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CONTENTS

CHAPTER	Page No.
HIGHLIGHTS OF ANNUAL REPORT 2012-2013	
I. AN OVERVIEW	1-15
1. Introduction	1
2. DSIR's 12th Five Year Plan Programme	2
2.1 Industrial R&D Promotion Programme	2
2.2 Technology Development and Demonstration Programme (TDDP)	3
2.3 Technopreneur Promotion Programme (TePP)	4
2.4 Technology Development Utilization Programme for Women (TDUPW)	4
3. Asian Pacific Centre for Transfer of Technology (APCTT)	4
4. Information Technology and e-Governance	5
5. RTI Act 2005	5
6. Autonomous Institutions	6
6.1 Council of Scientific and Industrial Research (CSIR)	6
6.2 Consultancy Development Centre (CDC)	14
7. Public Sector Enterprises	14
7.1 National Research Development Corporation (NRDC)	14
7.2 Central Electronics Limited (CEL)	15
8. Results Framework Document	15
II. DSIR'S 12TH FIVE YEAR PLAN PROGRAMME	16-20
1. Preamble	16
2. DSIR - 12 th Plan Schemes	16
2.1 Promoting Innovation in Individuals, Start-up and MSMEs (PRISM)	17
2.2 Patent Acquisition and Collaborative Research and Technology Development (PACE)	17



2.3	Building Industrial Research and Development (BIRD)	18
2.4	Access to Knowledge for Technology Development and Dissemination (A2K+)	19
2.5	XIth Plan on going programmes	20
A	INDUSTRIAL R&D PROMOTION PROGRAMME	21-30
1.	Objectives	21
2.	Areas of Coverage	21
3.	In-House R&D In Industry	21
3.1	Recognition of In-House R&D Units	21
3.2	Renewal of Recognition	23
3.3	Zonal Distribution of In-House R&D Units	23
3.4	R&D Expenditure	23
3.5	R&D Infrastructure	23
3.6	R&D Manpower	23
3.7	Sector-wise Break-Up of In-House R&D Units	24
3.8	Achievements of In-House R&D Units	24
3.9	Imports Made by In-House R&D Units	26
3.10	Other Benefits Availed by the Recognised R&D Units	26
4.	Scientific and Industrial Research Organisations (SIROs)	26
4.1	Recognition of Scientific and Industrial Research Organisations	26
5.	Fiscal Incentives for Scientific Research	27
5.1	Accelerated Depreciation Allowance on Plant and Machinery Setup Based on Indigenous Technology	28
5.2	Central Excise Duty Waiver for three years on patented products	28
5.3	Reference on expenditure on scientific research under Section 35 (3) of Income-Tax Act, 1961.	28
5.4	Approval of Commercial R&D Companies	28
5.5	Customs Duty Exemption to Recognised SIROs	29
5.6	Central Excise Duty Exemption to Recognised SIROs	29
5.7	Customs and central excise duty exemption to Recognised in-house R&D units	29
5.8	Registration of Public Funded Research Institutions, Universities, etc.	29
5.9	Approval of In-House R&D Centres u/s 35(2AB) of I.T. Act 1961	30
B	TECHNOLOGY DEVELOPMENT AND DEMONSTRATION PROGRAMME (TDDP)	31-48
1.	Preamble	31
2.	Objectives	31
3.	Activities	31

4.	Status of the Projects Supported During the Eleventh Plan	32
C	TECHNOPRENEUR PROMOTION PROGRAMME (TePP)	49-52
1.	Preamble	49
2.	Other Activities	51
D	TECHNOLOGY DEVELOPMENT AND UTILIZATION PROGRAMME FOR WOMEN (TDUPW)	53-54
1.	Preamble	53
2.	Activities	53
III	ASIAN AND PACIFIC CENTRE FOR TRANSFER OF TECHNOLOGY (APCTT)	55-66
1.	Preamble	55
2.	Activities of APCTT	55
IV.	INFORMATION TECHNOLOGY & e-GOVERNANCE (IT-eG)	67-75
1.	Introduction	67
2.	IT-Action Plan	67
3.	IT-eG Activities	67
4.	Achievements	68
5.	Various Applications Customised and USeD	74
6.	On Going Activities	75
V.	IMPLEMENTATION OF RTI ACT 2005	76-79
VI.	AUTONOMOUS BODIES	80-201
VI-A.	COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH (CSIR)	80-192
1.	Biological Sciences Cluster	80
2.	Chemical Sciences Cluster	117
3.	Engineering Sciences Cluster	139
4.	Information Sciences Cluster	168
5.	Physical Sciences Cluster	169
6.	CSIR 800	183

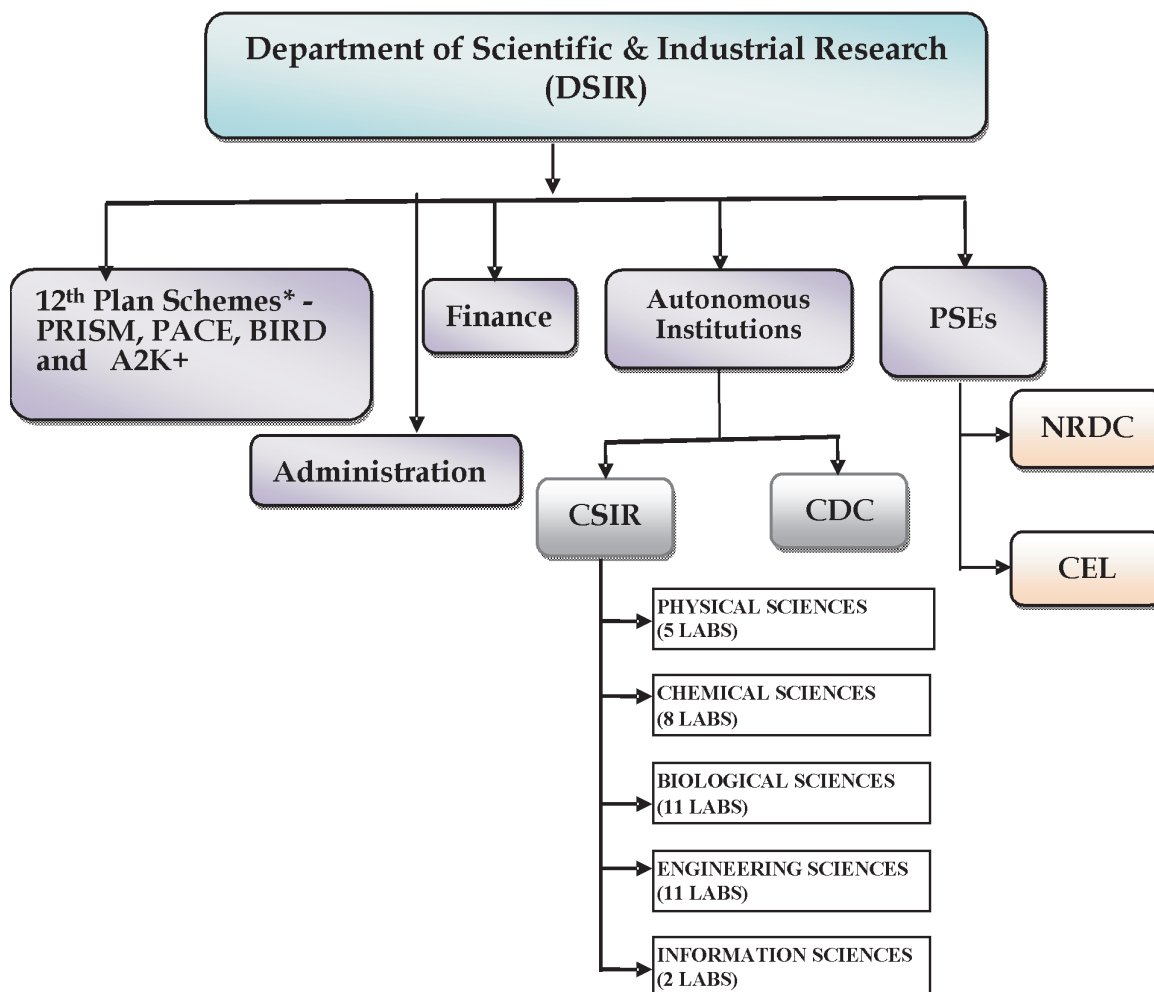


VI-B. CONSULTANCY DEVELOPMENT CENTRE (CDC)	193-201
1. Preamble	193
2. Activities/ Schemes undertaken	194
3. Funded Projects	199
4. Educational Programmes	200
5. Financial Performance	201
VII. PUBLIC SECTOR ENTERPRISES	202-214
VII-A. NATIONAL RESEARCH DEVELOPMENT CORPORATION (NRDC)	202-208
1. Introduction	202
2. Achievements	202
2.1 Processes Assigned	202
2.2 Major Technologies Licensed	203
2.3 Prize Award	203
2.4 Intellectual Property Consultancy and Management	203
2.5 Publications	204
2.6 Promotion of Rural and Household Technology (PRHT)	204
2.7 Rural Cluster	205
2.8 Exhibitions and Publicity	205
2.9 Technology and Project Export	205
2.10 Knowledge Management System (KMS) for Technology Promotion	205
2.11 Basic Engineering Design Package (BEDP)	206
2.12 Market Survey	206
2.13 Program for North-Eastern States	206
2.14 Women Entrepreneurship Development Program (WEDP)	207
2.15 Human Resource	207
2.16 Implementation of Official Language	207
VII-B. CENTRAL ELECTRONICS LIMITED (CEL)	209-214
1. Introduction	209
2. Operating Results (2011-12)	209
2.1 Exports	210
2.2 Major Achievements of CEL	210
3. Future Strategy	211
4. Research and Development	213
5. Foreign Exchange Receipts & Outgo	214

6.	Energy Conservation	214
7.	Particulars of Employees	214
8.	Implementation of Hindi, Industrial Relations & Human Relations	214
9.	Welfare of Reserved Categories	214
VIII.	ADMINISTRATION & FINANCE	215-219
1.	Administration	215
1.1	Staff Strength	215
1.2	Promotion of Hindi	216
2.	Finance	217
3.	Audit Observations by CAG	217
IX.	FINANCIAL SUMMARY	218
	ANNEXURES	220-297
1.	Statement on Recognition of In-house R&D Units	220
2.	Statement on Renewal of Recognition of In-house R&D Units whose Recognition was Valid upto 31-03-2012	221
3.	List of In-house R&D Units in Industry Reporting Annual Expenditure more than Rs.500 lakhs	222
4.	List of In-house R&D Units in Industry Reporting Annual Expenditure in the Range of Rs. 100 lakhs to Rs. 500 lakhs	229
5.	List of Scientific and Industrial Research Organizations (SIROs) Recognized During the year period January 2012 to December 2012	241
6.	Certificates for claiming Accelerated Depreciation Allowance issued by DSIR under Rule 5(2) of the IT Rules vide Notification No. 133/342/86-TPL dated 01-04-1987	244
7.	List of Commercial R&D Companies approved by DSIR u/s 80IB(8A) of IT Act 1961	245
8.	List of Companies approved u/s 35(2AB) of Income Tax Act, 1961	246
9.	List of TDDP/PATSER Projects Commercialized	250
10.	Details of Projects Supported under Technopreneur Promotion Programme	253
11.	DSIR Staff Strength as on 1 st December, 2012	262
12.	Extracts of Audit Observations by CAG	264
13.	Results Framework Document (RFD) for DSIR for year 2011-12.	266
14.	List of CSIR Institutes/Laboratories	292
15.	Abbreviations/Acronyms	294



FUNCTIONAL STRUCTURE



PRISM	Promoting Innovation in Individuals, Start-ups and MSMEs
PACE	Patent Acquisition and Collaborative Research and Technology Development
BIRD	Building Industrial Research and Development
A2K+	Access to Knowledge for Technology Development and Dissemination
CSIR	Council of Scientific and Industrial Research
CDC	Consultancy Development Centre
PSEs	Public Sector Enterprises
NRDC	National Research Development Corporation
CEL	Central Electronics Limited

* Awaits in-principle approval of the Planning Commission and approval of the Standing Finance Committee



Highlights of Annual Report 2012-13

- ◆ In-house R&D Centres recognized by DSIR increased to 1767 in December 2012 from 1618 in December 2011. 196 Centres incurred annual expenditure over Rs.500 Lakhs on R&D compared to 181 centres in the previous year. Scientific & Industrial Research Organisations (SIROs) recognized by DSIR increased to 603 during 2012 from 570 in previous year. Public Funded Research Institutes (PFRIs) registered by DSIR as on 31st December 2012 are 620.
- ◆ 149 new R&D centres were approved during the year 2012 as compared to 151 in the year 2011 for claiming weighted tax deduction u/s 35(2AB) of IT Act. Reports in Form 3 CL issued by DSIR to Director General of Income Tax (Exemptions) reported R&D expenditure of Rs.3341 crore by DSIR approved in-house R&D centres of industries during 2012 as compared to Rs.3707 crore during 2011.
- ◆ 66 Number of on-going projects continued under the Technology Development and Demonstration Programme (TDDP) during the year.
- ◆ 49 Projects completed and 173 projects are on-going during the year under Technopreneur Promotion Programme (TePP).
- ◆ Project on “Design, Development, Implementation of Enterprise Application and Maintenance Support Service’s for DSIR” was on-going during the year under Information Technology and e-Governance.
- ◆ The Academy of Scientific and Innovative Research (AcSIR) was established by an Act of Parliament, Academy of Scientific and Innovative Research (AcSIR) Act 2011. Subsequently the Act was notified in the Gazette of India. AcSIR was set by CSIR as an institution for awarding degrees in frontier areas of Science and Technology.
- ◆ CNM5, a 5-seater all-metal light utility aircraft designed to meet the latest global standards and has been designed and developed through a public-private partnership between CSIR-NAL and Mahindra Aerospace.
- ◆ CSIR-IGIB has developed a new diagnostic method for detecting airway diseases.
- ◆ CSIR-IIP is the first institute in India to produce 15 litres of high quality biojet fuel from *Jatropha curcus* oil. This fuel has been tested by both Indian Oil Corporation and HPCL and has been found to meet all specifications as per ASTM D 1655.
- ◆ G.N. Ramachandran Protein Centre was inaugurated in the CSIR-Institute of Microbial Technology, Chandigarh campus on 24th January, 2012. This Protein Centre is one-of-its-kind facility in India, solely focused on diverse forms of integrated activities on proteins.
- ◆ First Test run of vehicle with marine microalgal biodiesel : Late Shri Vilasrao Deshmukh and the then Minister of Science



& Technology and Earth Sciences, Vice President, CSIR on 30th March, 2012 flagged off test-run of Tavera SUV, running on microalgal biodiesel from CSIR Headquarters, New Delhi. The 'microalgal biodiesel' was produced from a marine microalgal strain cultivated in a solar pond. The endeavour is outcome of a joint effort put forth by CSIR and Ministry of Earth Sciences wherein scientists from nine partnering institutes made their contributions.

- ◆ CSIR-CGCRI has developed an alternate body mix for granito tiles production and thereby replaced the expensive imported Ukraine clay with indigenous clay.
- ◆ CSIR-NIIST has designed a bioethanol pilot plant with a capacity process 80 kg of biomass per batch .
- ◆ CSIR-IMMT studied and prepared flow sheets for beneficiation of low-grade irons to many industries.
- ◆ CSIR-IMMT developed a technology for reduction of hematite in the presence of pure hydrogen plasma.
- ◆ CSIR-CSMCRI had developed a knowhow for pharma grade synthetic anionic clay commonly known as synthetic hydrotalcite which is basically a magnesium aluminium hydroxyl carbonate. The Institute had standardised a process to convert hazardous effluents to value added product and the knowhow for the preparation of synthetic

hydrotalcite from effluent streams generated in the dye (copper phthalocyanine green) manufacturing plant of M/s Heubach Colour Pvt. Ltd., Ankleshwar.

- ◆ Consultancy Development Centre (CDC) trained more than 2000 Sr. Govt. officials of Central/State Govt./Ministries/ Departments on "Selection and Effective use of Consultants".
- ◆ A total 190 students were trained through CDC's educational Programmes-MS in Consulting Management, Certificate Programme in Technical Consulting and Certificate Programme in Management Consulting.
- ◆ National Research Development Corporation (NRDC) was assigned 32 new technologies / processes by various R&D institutions and signed 33 license agreements with various entrepreneurs and industries during 2011-2012.
- ◆ Central Electronics Limited (CEL) installed solar power plants in various locations in the country for various organizations like Sashastra Seema Bal (SSB) and Central Industrial Security Force (CISF) located at Ghaziabad, Rajayoga Ed Mount Abu, Tripura Industrial Development Corporation, Agartala, Guahati University, Assam Engineering College, Krishna Kanta Handique State Open University, Tripura University etc.





I. AN OVERVIEW

1. INTRODUCTION

The Department of Scientific and Industrial Research (DSIR), one of the departments of the Ministry of Science and Technology, was set up through a Presidential Notification, dated 4th January, 1985 (74/2/1/8 Cab.). The mandate of DSIR includes promotion of industrial research for indigenous technology promotion, development, utilization and transfer.

Shri Jaipal Sudini Reddy assumed as Union Minister for Science & Technology and Earth Sciences on 29th October, 2012. Prior to that Late Shri Vilasrao Deshmukh was holding the charge as Union Minister for Science & Technology and Earth Sciences.

The Allocation of Business for the Department is as follows:

- All matters concerning the Council of Scientific and Industrial Research.
- All matters relating to National Research Development Corporation.
- All matters relating to Central Electronics Limited.
- Registration and Recognition of R&D Units.
- Technical matters relating to UNCTAD and WIPO.
- National register for foreign collaborations. Matters relating to creation of a pool for temporary placement of Indian Scientists and Technologists.

The primary endeavour of DSIR is to promote R&D by the industries; support industrial units to develop state-of-the-art globally competitive technologies of high commercial potential; catalyze faster commercialization of laboratory-scale R&D; augment technology transfer capabilities; enhance the share of technology intensive exports in overall exports; strengthen industrial consultancy and establish a user-friendly information network to facilitate scientific and industrial research in the country. The DSIR has two public sector undertakings viz. National Research Development Corporation (NRDC) and Central Electronics Ltd (CEL) and two autonomous organizations viz. Council for Scientific and Industrial Research (CSIR) and Consultancy Development Centre (CDC). The Department also provides host facilities and assistance to Asian and Pacific Centre for Transfer of Technology (APCTT) as the focal point in the country.

The Technology Promotion, Development and Utilization (TPDU) Scheme of 11th five year plan was aimed at promoting technology development and industrial research in the country and encouraging its utilization by various sections of economy including industry, academic/research/scientific institutions and the society at large. In 12th five year plan TPDU scheme has been discontinued. The components of the erstwhile TPDU scheme were:



- Industrial R&D Promotion Programme (IRDPP)
- Technology Development and Demonstration Programme (TDDP)
- Technopreneur Promotion Programme (TePP)
- Technology Development Utilization Programme for Women (TDUPW)

2. DSIR'S 12th FIVE YEAR PLAN PROGRAMME

During the 12th five year plan, the DSIR has proposed following four schemes focusing on innovations after the recommendation of the Steering Committee on Science and Technology. These schemes await in-principle approval of the planning commission and approval of the Standing Finance Committee :

(i) Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM) - This scheme focuses on supporting individual innovators, start-up companies, incubatee companies in public funded technology business incubators and MSMEs besides supporting the approved 11th Plan projects related to Technopreneur Promotion Programme (TePP) spilling over from the 11th five year plan.

(ii) Patent Acquisition and Collaborative Research & Technology Development (PACE) - This is a new scheme focusing on technology acquisition and its development and demonstration for commercialization.

(iii) Building Industrial Research & Development (BIRD) - This is a new scheme which focuses on creation of common research facilities for micro and small enterprises and subsumes components of the 11th Plan scheme, viz., Industrial R&D Promotion Programme, Information Technology and e - Governance (ITeG) and Asian and Pacific Centre for Transfer of Technology (APCTT).

(iv) Access to Knowledge for Technology Development and Dissemination (A2K+) - This is a new scheme focusing on facilitating access to

scientific journals by in-house R&D units of industry and Scientific and Industrial research Organizations (SIROs). The scheme subsumes the 11th Plan component scheme on Technology Development and Utilization Programme for Women (TDUPW) and DSIR Building and Infrastructure. Besides, the scheme supports the approved 11th Plan projects related to Technology Development and Demonstration Programme (TDDP) spilling over from the 11th five year plan.

Present report includes only the committed liabilities of 11th Plan Technology Promotion, Development and Utilization (TPDU) Scheme. The major achievements of the various components of erstwhile TPDU Scheme of the Department during the period under report are as under:

2.1 Industrial R&D Promotion Programme

DSIR is the nodal Department for granting recognition to in-house Research and Development centres of industry. As on 31st December, 2012, there were 1767 in-house R&D centres of industries with DSIR recognition. Out of these, 196 Industries incurred an annual expenditure of over ₹ 5 crores each and 341 Industries incurred an annual expenditure in the range of ₹ 1 crore to ₹ 5 crores.

During the period under report, 212 in-house R&D centres were accorded fresh recognition and recognition of 490 centres was renewed.

Scientific research foundations in the areas of medicine; agriculture; natural and applied sciences; and social sciences seek DSIR recognition and registration as Scientific and Industrial Research Organisations (SIROs) under the programme granting recognition to SIROs. The registered SIROs are eligible for availing customs duty exemption on imports and central excise duty exemption on indigenous purchase of essential scientific and technical instruments, apparatus, equipment (including computers), accessories, spare parts thereof and consumables, required for

R&D activities. During the period under report, 51 SIROs have been accorded fresh recognition.

DSIR is the nodal Department for registration of public funded research institutions (PFRI), universities, IITs, IISc and NITs, for availing customs duty exemption and central excise duty exemptions under notifications 51/96-Customs and 10/97-Central Excise. During the period under report, 22 such institutions were newly registered with DSIR; and 65 institutions were granted renewal of registration.

Secretary, DSIR is designated as the Prescribed Authority under section 35(2AB) of Income-tax Act, 1961. Fresh approvals were accorded to 149 companies by the prescribed authority. The detailed R&D expenditure of the approved companies have also been examined by DSIR and 182 reports valued at ₹ 3341 crores have been forwarded to DGIT (E) in Form 3CL, as required under the IT Act.

Secretary, DSIR, is the Prescribed Authority to certify expenditures where higher rate of depreciation is to be allowed for the plant and machinery installed for the manufacturing of products using indigenous know-how as per the provisions of rule 5(2) of IT Rules. During the period under report, 3 certificates were issued by DSIR.

Central Excise Duty Exemption for a period of three years is available under Notification No. 13/99-CE dated 28th February, 1999 for specified goods. During the period under report one company has submitted application for issuing excise duty exemption under the notification No. 13/99-CE dated 28th February, 1999. The application is under process.

2.2 Technology Development and Demonstration Programme (TDDP)

The erstwhile Technology Development and Demonstration Programme (TDDP) aimed at catalyzing and supporting activities relating to

technology absorption, adaptation and demonstration including capital goods development, involving industry and R&D organizations. Under the programme, research, development, design and engineering projects for absorption and up-gradation of imported technology, as well as development and demonstration of new and improved technologies were supported. While the DSIR support was catalytic and partial, the bulk of the financial contribution in any project was from the industry.

The Department, under this programme, had so far supported about 280 R&D projects from industrial units. These projects cover products and processes in various important industries such as metallurgy, electrical, electronics, instrumentation, mechanical engineering, earth-moving and industrial machinery, chemicals and explosives and others. Around 60 technologies developed under the programme have been commercialized or are under commercialization. The scheme has been discontinued in the 12th Five Year Plan. Only ongoing projects are to be completed in the 12th Five Year Plan under the new scheme - Access to Knowledge for Technology Development and Dissemination (A2K+) of DSIR. The department has committed to support 66 on-going projects during the year.

Technology development projects had strengthened industry-institute linkages with more than 25 national research laboratories/institutions such as NAL, Bengaluru; IIIST, Thiruvananthapuram; IICT, Hyderabad; CIMFR, Dhanbad; IIP, Dehradun; C-DAC, Pune; Institute of Plasma Research, Ahmedabad; ER&DC, Thiruvananthapuram; Dalmia Centre for Biotechnology, Coimbatore and CMTI, Bengaluru. These laboratories/institutions had collaborated with industry in the specific research, design, development and engineering (RDDE) projects having high techno-socio-commercial impact. The programme had been successful in synergizing the R&D efforts of industry and national research organizations.



2.3 Technopreneur Promotion Programme (TePP)

The erstwhile Technopreneur Promotion Programme (TePP) was India's largest network program supporting independent innovators and start-up firms. The network spread out with 37 outreach centres and 100 innovation managers provided grants, pre-seed funds, technical guidance, incubation facilities and assistance to get a sound business plan. The support was provided in two distinct phases - innovation incubation in first phase where maximum support was ₹ 15.00 lakh and towards enterprise incubation in second phase where the cap was ₹ 45.00 lakh. Since the time of inception, 558 innovations of independent innovators had been supported. Out of these, 462 were supported by DSIR (rest by TIFAC). Some of the successfully completed TePP projects (recommended for approval during 2011-12) during the year are Innovation on Normal Scaife, i.e. GEM-polishing wheel for gem polishing application, Design and development of low cost u-controller based Digital CO₂ analyser, Crankshaft metrology system, Fabrication of low cost lab scale electro-spinning machine, Automated scan lock, Digital hot gold foil stamping/embossing machine, Developing novel photo catalysts for photo degradation on various dyes without pre-treatment, Multi-level Automatic Two-wheeler parking and so on.

The Technopreneur Promotion Programme (TePP) scheme has been discontinued in the 12th Five Year Plan. Ongoing projects are to be completed in the 12th Five Year Plan under the new scheme - Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM) of DSIR.

2.4 Technology Development Utilization Programme for Women

A Technology Development and Utilization Programme for Women (TDUPW) was continued during the year. The programme is aimed to meet specific needs of women and to enhance their contribution towards technology capability building. The objectives of the programme are:

- Promoting the adoption of new technologies by women.
- Awareness creation and training of women on technology related issues with regard to women.
- Promoting technological upgradation of tiny, small and medium enterprises run by women entrepreneur.
- Showcasing of appropriate technologies and organizing demonstration programmes for the benefit of women.
- Design and development of products, processes beneficial to women.

3. ASIAN PACIFIC CENTRE FOR TRANSFER OF TECHNOLOGY (APCTT)

Matters pertaining to the APCTT under UN-ESCAP are dealt with the cooperation of the Ministry of Commerce and Industry and the Ministry of External Affairs, DSIR also plays an active role in APCTT's functioning, particularly relating to its programmes and policies.

India, being the host country for APCTT, has been providing institutional support of US\$ 200,000 in Indian Rupees for meeting local costs. DSIR has extended programme support towards the APCTT project entitled, "Promotion of National Innovation Systems (NIS) in Countries of the Asia-Pacific Region - Phase II". Among other government support received by APCTT, the Ministry of New and Renewable Energy Sources has funded another APCTT project entitled, "Establishing an Institutional Cooperation Mechanism to Promote Renewable Energy" in Asia and the Pacific.

The revised Statute of APCTT, adopted by the Commission at its Sixty-first session in May 2005, through its resolution 61/4, stipulates among other things, that the Centre shall have a Technical Committee consisting of experts from members and associate members of ESCAP and from inter-governmental and non-governmental organizations. Members of Technical Committee shall be appointed by the Head of APCTT in

consultation with the Executive Secretary of ESCAP. The Technical Committee shall be responsible for advising on the formulation of the programme of work and on technical matters concerning the operations of APCTT. The 8th Technical Committee of APCTT held at Manila, Philippines during the year was attended by departmental representative. It is also stipulated that the Centre shall have a Governing Council consisting of a representative designated by the Government of India and no fewer than eight representatives nominated by other members and associate members of ESCAP elected by the Commission. The members and associate members elected by the Commission shall be elected for a period of three years, but shall be eligible for re-election. The members of APCTT's Governing Council for the period 2011-2014 are Bangladesh, China, Fiji, India, Indonesia, Islamic Republic of Iran, Malaysia, Nepal, Pakistan, Philippines, Samoa, Sri Lanka, Thailand and Viet Nam. The 8th Governing Council held at Bangkok during the year was attended by the departmental representative.

Co-ordination with other UN Organisations

The DSIR also maintains effective cooperation with other various international organizations such as UNCTAD, WIPO, UNIDO, UNESCAP and UNESCO at different levels and in association with other concerned Ministries on various issues related to Technology development and technology transfer.

4. INFORMATION TECHNOLOGY AND E-GOVERNANCE

IT-eG division implements e-Governance in the Department progressively that needs to be in conformance to the National eGovernance Action Plan. IT-eG Division operates on a separate IT Budget Head that came into effect in DSIR since FY 2004-05 for the implementation of an IT Action Plan.

Various applications like IntraDSIR, Instant Messaging System, ExtraDSIR, Public Grievance

Redress and Monitoring System, and Central Plan Scheme Monitoring System (CPSMS) remain operational during the period under report. The Departmental Website at <http://www.dsir.gov.in> is regularly updated. The proactive disclosures under Section 4 (1) (b) of the RTI Act 2005 enacted on June 15, 2005 are regularly updated and available on the DSIR Website at <http://dsir.gov.in/rti/rti-dsir.htm>.

Integrated Finance, DDO and Utilization Software (IFDUS) have been in use for DSIR for preparation and process of the bills for Salary, Contingency, TA/DA and LTC Advance and Other Advances. A Composite Pay Roll System has been in use in the department. The same system is used for calculation of Income Tax and Preparation of Form 16. The system also has an interface for sending transactions to the Bank.

A project entitled 'Design, Development, Implementation of Enterprise Application and Maintenance Support Services for DSIR' is ongoing. The project has two RFPs, ie. RFP1 includes Enterprise Integration, Program Implementation and eService Delivery and RFP2 includes Office Automation Solution, Workflow Management, Record Management, and Data Warehousing. Considerable progress has been made under the ERP project and is being reviewed regularly. Hands-on-Training is being imparted to the DSIR employees for use, various modules developed and gone live.

5. RTI ACT 2005

The Right to Information Act 2005, enacted on 15th June 2005, has been implemented successfully in the department. As per the provisions of the Act Nodal Officer, Appellate Authority, Transparency Officer, Central Public Information Officer and Central Assistant Public Information Officer are designated.

The proactive disclosures under Section 4 (1)(b) of the RTI Act 2005 enacted on June 15, 2005 are regularly updated and available on the DSIR



Website at <http://dsir.gov.in/rti/rti-dsir.htm> DSIR has complied with the directives received from Central Information Commission.

DSIR has received 52 Applications during Jan-Dec 2012 and all the Applications were registered and disposed off on RTI Request & Appeal Management Information System, <http://164.100.42.72/rrmis/>. During Jan-Dec 2012, 14 applications were registered as first appeal and 04 applications were registered as second appeal.

DSIR has been effectively using various IT applications like RTI-MIS Updation System at <http://164.100.42.72/rtiupd/>, RTI Request & Appeal Management Information System at <http://164.100.42.72/rrmis/> and RTI Annual Return Information System at <http://rtiar.nic.in>. The quarterly returns were uploaded on RTI Annual Return Information System at <http://rtiar.nic.in>.

6. AUTONOMOUS INSTITUTIONS

6.1 Council of Scientific and Industrial Research (CSIR)

Council of Scientific and Industrial Research (CSIR), established in 1942, is India's largest and most diverse S&T institution which comprises of 37 national laboratories/institutes, 39 outreach centres, three Innovation Complexes and six units spread across length and breadth of India. CSIR is an autonomous organization under administrative control of Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology, Government of India. It is headed by the Prime Minister of India as its President, Minister of Science and Technology and Earth Sciences as Vice President.

CSIR embarks on a renewed mission to define its vision for 2022 with a seamless connectivity from science to technology to innovation as its motivating inspiration. Its renewed mission has been the remarks made by the President of the CSIR Society to CSIR "... to build new CSIR that will fulfill the aspirations of modern India".

CSIR is working with a vision "Pursue Science which strives for global impact, technology that enables innovation-driven industry and nurture trans-disciplinary leadership thereby catalysing inclusive economic development for the people of India." The philosophy contained in the vision statement inspiring CSIR towards:

- Science & Engineering Leadership;
- Innovative Technology Solutions;
- Open Innovation and crowd sourcing;
- Nurturing talent in trans-disciplinary areas;
- Science based entrepreneurship; and
- Socio-economic transformation through S&T intervention.

Today, CSIR is playing a centroidal role in partnering and strengthening Indian Industry in various fields such as aerospace, agrochemicals, petroleum, & petro-chemicals, chemical intermediates, polymers, glass and ceramics, mining, minerals and metals, coal, building materials, surface engineering, food processing, aromatic plants and healthcare products. Further CSIR is the true technology leader, in the areas of generic drugs, industrial catalysts and leather technology. It plays a decisive role in the Indian strategic sector in handling their challenge of technology denial by providing products including radiation shielding glass, microwave tube, head up display, advanced carbon composites etc. CSIR provides S&T based services to industry and other stakeholders for Environmental Impact assessment and mitigation; testing of structures; urban and rural road etc. Since its inception, CSIR is a proud custodian of primary standards of measurements, bio-resources, and traditional knowledge. Since the days of winning patent right of 'Haldi' in the United States of America it becomes nation's flag bearer in Intellectual Property generation and protection. Last but not least, CSIR builds the country's largest S&T human resources through research grants, fellowship, post-graduate in niche areas and doctoral degree in Science and Engineering through newly constituted Academy of Scientific & Innovative Research.

CSIR during the year evinces some of the significant efforts made by the organization along with its constituent laboratories comprising of approximately 16000 workforce in marching ahead to realize its vision. It is evident from the fact that it has filed 196 patent applications in India, 286 patent applications abroad, and generated 38 copyrights during the year. It is maintaining its upward trend in the field of scientific output i.e. 4716 research publications with average impact factor per paper as 2.56 (highest being 38.28 of 'Lancet') that constitutes around 9.43% of India's total research output.

Further, CSIR has marked a number of cogent S&T achievements. The most remarkable is the design and development of a 5-seater all metal aircraft by CSIR in Public-Private partnership mode with M/s Mahindra Aerospace. It had a number of successful flights till date.

Another apt achievement of CSIR was to get the Bill of 'Academy of Scientific & Innovative Research (AcSIR)' passed by the Lok Sabha during the Monsoon Session, 2011 and by the Rajya Sabha during the Winter Session, 2011. Subsequently the Act was notified in the Gazette of India.

A few sententious achievements are:

(i) CSIR Technologies for National Capacity Building

(a) Granito tiles: Alternative to Ukraine Clay

CSIR-CGCRI has developed an alternate body mix for granito tiles production and thereby replaced the expensive imported Ukraine clay with indigenous clay that has immensely benefitted the tile industries of Morbi, Wankaner and Himatnagar regions in Gujarat.

(b) Bio-jet fuels

CSIR-IIP is the first institute in India to produce 15 liters of high quality biojet fuel from *Jatropha curcus* oil. This fuel has been tested by both Indian Oil Corporation and HPCL and has been found to

meet all specifications as per ASTM D 1655. The large pilot plant has been built with a capacity of 20 litre per day and is in operation, which is expected to produce enough fuel for testing in engine of Pratt & Whitney, Canada.

(c) Bio-fuel Pilot Plant

A bioethanol pilot plant with a capacity process 80 kg of biomass per batch was designed by CSIR-NIIST based on the data obtained for the process for conversion of different selected biomass types to bioethanol.

(d) Flow Sheets for beneficiation of low-grade iron ores

CSIR-IMMT studied and prepared flow sheets for beneficiation of low-grade irons to many industries including: M/s Rawmet Commodities Pvt. Ltd., Bhubaneswar; M/s Jayaswal Neco Industries Ltd., Raipur; M/s Sandur Manganese and Iron Ores Limited, Bengaluru; M/s Shri Bajrang Power and Ispat Ltd., Raipur; M/s Kalawati Ispat & Power Pvt. Ltd., Vandana Group, Raipur; M/s Earthstone Group, Jakarta, Selatan; M/s Pacific Iron Ore Manufacturing Ltd., Mumbai; and M/s V.M. Salgaocar & Bro. Pvt. Limited, Goa.

(e) First Test run of vehicle with marine microalgal biodiesel

Late Shri Vilasrao Deshmukh and the then Minister of Science & Technology and Earth Sciences, Vice President, CSIR on 30th March, 2012 flagged off test-run of Tavera SUV, running on microalgal biodiesel from CSIR Headquarters, New Delhi. The 'microalgal biodiesel' was produced from a marine microalgal strain cultivated in a solar pond. The endeavour is outcome of a joint effort put forth by CSIR and Ministry of Earth Sciences wherein scientists from nine partnering institutes made their contributions.

(ii) CSIR-800 S&T Interventions for the people at the base of the Economic Pyramid

(a) Multi-institutional demonstration trials showing efficacy of liquid seaweed sap from



Kappaphycus alvarezii and Gracilaria edulis on different crops

Kappaphycus and Gracilaria saps were tested by CSIR-CSMCRI at different centres of 22 Agricultural Universities and ICAR Institutes in India belonging to different agro-ecological regions and different soil types to demonstrate their efficacies towards improvement in production and nutritional qualities of different crops viz., rice, maize, sesame, soybean, green-gram, black-gram, sugarcane, fodder/grass and potato. Marked improvement in productivity of different crops was observed by application of Kappaphycus and Gracilaria sap over control (water spray + recommended dose of fertilizers). Application of Kappaphycus sap recorded yield improvement in almost all varieties of crops.

(b) Safe Drinking Water

CSIR is continuously providing safe drinking water options to various parts of country. It ranges from arsenic and fluoride free water to parts of West Bengal and North Eastern states to Solar-based Electrolytic Defluoridation water purification plants in Maharashtra to coal mine water reclamation procedures etc.

(c) North east ethnic material and leather combination products

The people of north east India make lot of products but, they are unable to reach the market and earn profit in large scale because of the lack of Aesthetic appeal and Standardisation. There is a need to transform this knowledge into wealth by increasing the value of the products without losing its real essence. CSIR-CLRI in collaboration with CSIR-NEIST carried out a comprehensive survey in the north eastern region. Based on the inputs from the survey, designers at CLAD Design Studio developed new range of products. The handbags are crafted and designed with the ethnic materials of the northeast and the inspirations are derived from Ornaments, Dresses & Artifacts adorned by tribal folks of the northeast India The products were

displayed in various national/ international fairs and attracted many enquiries.

(d) Anti-tarnishing lacquer coating for brasswares: Moradabad brass cluster

A cost effective but efficient anti tarnishing lacquer has been developed by CSIR-NML. Field tests (outdoor and indoor exposure) of the partly coated brass panels reveal that the developed lacquer is very efficient to prevent tarnishing for long durations (AAC_4). Accelerated tarnishing test using ASTM B 809 procedure confirms that the developed lacquer is comparable or more efficient than INCRALAC, the internationally available lacquer. The lacquer was produced in bulk scale (10 Litres) and supplied to the brass artisans of Moradabad Brass Cluster, Uttar Pradesh for their use in collaboration with National Innovation Council of India.

(iii) Value Generation through Intellectual Property

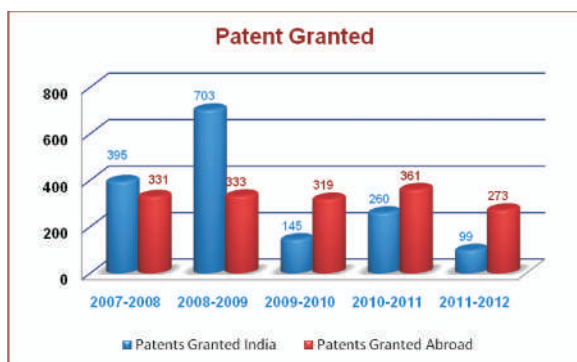
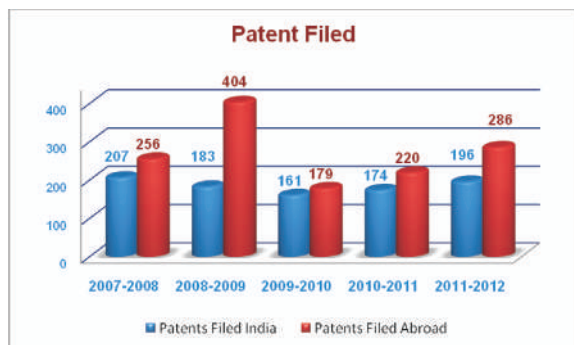
CSIR has been spearheading the IP movement in the country for quite some time which is evident from the fact that CSIR's patents granted by USPTO and PCT is comparable to some of the World's top ranking institutes. Continuing the effort it has filed 286 patents abroad and 196 patents in India. It is maintaining a portfolio of 3250 patents abroad and 2350 patents in India. The following graph gives an impression about CSIR's patent filing and patents granted data during the last five years.

(iv) Scientific Excellence

(a) Research Papers

During the year CSIR published 4716 research papers with an average impact factor per paper as 2.56 in SCI journals of national and international repute contributing to 9.43% of Indian R&D literature.

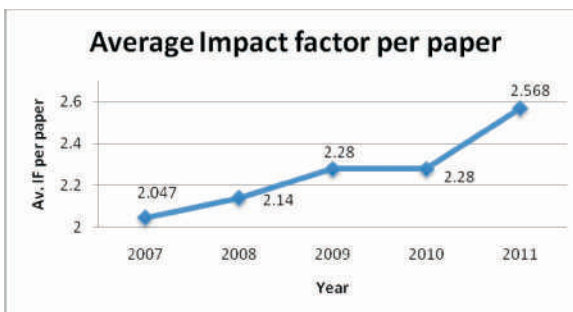
CSIR published many research publications in high impact factor (IF) journals like 'Lancet' (IF 38.278),



'Nature' (IF 36.28), 'Science' (IF 31.20), 'Chemical Society Reviews' (IF 28.76) etc. Following Graph shows rising trend of the research publications by CSIR with improved average Impact Factor per Paper.

(b) CSIR Scientists in Frontier of Science

CSIR scientists are being awarded prestigious fellowship and conferring academic awards regularly. Following table gives some of the most prestigious awards conferred to CSIR scientists during the year.



Fellowship/Award	Number
Fellows of Indian National Science Academy (2012)	2
Fellows of Indian Academy of Engineers (2011)	3
Fellows of Indian Academy of Sciences (2011)	7
Fellows of National Academy of Sciences (2011)	11
Shanti Swarup Bhatnagar Awardees (2011)	3
National Geoscience Awardees (2010)	9
INSA Medal for Young Scientist (2012)	5
CSIR Young Scientist Awardees (2011)	7

(c) CSIR's Research on cover pages of the Journals

CSIR research publications has been given importance by many journals by providing the contributions a place on its cover page. These journals include Chemical Engineering Journal, Organic & Biomolecules Chemistry, Chemistry: A European Journals

(v) Creating and Nurturing S&T Human Resource

CSIR is known for its contribution towards the creation and nurturing highly qualified workforce for S&T endeavours of the country. CSIR is, during



the year, supported 8876 Research fellows, 172 Emeritus Scientists, 173 Senior Research Associates and 1092 research schemes awarded to faculties of various universities.

(vi) G.N. Ramachandran Protein Centre: A unique new facility

G.N. Ramachandran Protein Centre was inaugurated in the CSIR-Institute of Microbial Technology, Chandigarh campus on 24th January, 2012 by Prof. Balam, Director, Indian Institute of Science, Bengaluru. This Protein Centre is one-of-its-kind facility in India, solely focused on diverse forms of integrated activities on proteins. It houses groups involved in Research & Development involving using basic building blocks of proteins i.e. amino acids to supramolecular assemblies. In-silico as well as experimental science research is also being carried out for better understanding of functioning of proteins. This unique Protein Centre has all requisites to translate findings from basic research into applications for societal good.

(vii) Some Cluster-wise S & T Contributions

(a) Biological Sciences Cluster

The Tuberculosis Drug Streptomycin as a Potential Cancer Therapeutic

CSIR-IGIB reported microRNAs (miRNAs) fine-tune gene expression, deregulation which has been causally associated with a number of debilitating conditions. Streptomycin, a well-known aminoglycoside drug, binds to RNA secondary structures and is shown to inhibit miR-21 function by direct binding to its precursor, thus presumably interfering with the processing by the Dicer enzyme.

New diagnostic method for detecting airway diseases

CSIR-IGIB has developed a new diagnostic method for detecting airway diseases. More than hundred patients with asthma or COPD have already been studied using this technique. It holds potential for early detection of bronchiolitis

obliterans in post-transplant patients, a life threatening disease that can be suppressed if detected early.

Ankle foot orthosis for patients with Diabetic foot ulcer

The accepted etiology of diabetic plantar wounds is excessive pressure on the insensitive foot that leads to callus formation, skin breakdown and infection. Thus off-loading of peak plantar pressures (PPPs) reduces the risk for skin breakdown and allows healing of open wounds. One of the effective offloading devices is Ankle Foot Orthosis (AFO). Among the pressure offloading techniques, AFO offers lot of advantages for physicians and patients. But the current design and materials used for fabrication of AFO make the treatment expensive which is not affordable by the patients in India. Therefore a new design of AFO for patients with diabetes having diabetic foot ulcer has been developed by CSIR-CLRI.

Genomes of mango, pomegranate pathogens decoded

CSIR-IMTECH analyzed and reported the fully annotated genome of the *Xanthomonas* pathogens that cause serious diseases in high value fruit crops like mangoes, pomegranates and grapes. Interestingly the team found that the genomes of these bacterial pathogens, are highly identical suggesting their recent origin. Further the set of unique genes and markers present in their genomes will be valuable in epidemiological and evolutionary studies of these fruit pathogens. These are the first plant pathogen genomes published from India. The study has also been covered as a featured article in *Nature India*.(doi:10.1038/nindia.2012.70).

Demonstration of Process Know-how of CDR-134-D123 (antihyperglycemic)

CDR134D123 is a standardized fraction isolated from a marine source. The product has shown promising antihyperglycemic activity. CSIR-CDRI

has licensed the product to M/s TVC Skyshop Ltd., Mumbai for further development and commercialization. Phase I single and multiple dose study have been completed. Efforts are in place to avail marketing permission for the product in herbal mode. The process Know-how for preparation of CDR134D123 has been successfully demonstrated to the M/s TVC Skyshop Ltd during year.

Easy and low-cost Test for Visceral Leishmaniasis and Post-Kala-azar Dermal Leishmaniasis

CSIR-IICB scientists have developed a dipstick assay for the serodiagnosis of visceral leishmaniasis (VL) and post-kala-azar dermal leishmaniasis (PKDL). The dipstick can even be used at primary health centers. For detection of the circulating anti-leishmanial IgG in the patient sera, leishmanial antigens prepared from the cultured promastigote membranes (LAg) is used as test antigen. The whole process takes about 2 hours. When stored at room temperature without desiccation, dipsticks performs consistently for 12 months. CSIR-IICB dipsticks appeared equally sensitive and specific (100%) for VL from India and Brazil and for Indian PKDL. LAg dipsticks perform better than rK39 strip test for diagnosing VL patients from Brazil. This indigenously developed dipsticks strip test is approximately ten times more economical than rK39 strip test.

(b) Chemical Sciences Cluster

Hollow fibre ultrafiltration membranes

Process of preparation of hollow fiber ultrafiltration membranes using polysulphone / polyacrylonitrile was licensed to M/s Uniqflux Membranes LLP, Pune. A commercial unit has been set-up and they have started commercial production of hollow fibre membrane modules.

Pharma Grade Synthetic Anionic Clay

CSIR-CSMCRI had developed a knowhow for pharma grade synthetic anionic clay commonly



known as synthetic hydrotalcite which is basically a magnesium aluminium hydroxyl carbonate. Magnesium aluminium hydroxide octahedral forms positively charged layers and balancing anionic carbonate ions are located between the layers as interlayer anions. The Institute had standardised a process to convert hazardous effluents to value added product and the knowhow for the preparation of synthetic hydrotalcite from effluent streams generated in the dye (copper phthalocyanine green) manufacturing plant of M/s Heubach Colour Pvt. Ltd., Ankleshwar was successfully transferred.

Process for fluoroelastomer Kel-F-800

Fluoroelastomer Kel-F-800 is a fluoropolymer used in defence as a coating material over ammunition in order to improve the shelf life in terms of moisture resistant, weatherability and plasticity. CSIR-IICT designed and developed a process for both the monomers and their copolymerisation to obtain Kel-F-800. The process for. The uniqueness of process development for both the monomers is by using a specific catalyst, and indigenous process is available for Indian industries. The developed process was demonstrated to Terminal Ballistic Research Laboratory (TBRL), Chandigarh, a DRDO Laboratory.

Process for FEP-Resin

Fluorinated Ethylene Propylene (FEP-Resin) has application space research as coating material for cryogenic polyamide pipelines, rockets and missiles. Besides coating FEP-Resin also finds applications in, melt extrusion and impregnation. FEP-Resins are known for their excellent chemical resistance, superior electrical properties and high service temperatures of upto 200°C. Presently, there is no techno economically feasible process for hexafluoropropene available anywhere. CSIR-IICT developed a process for FEP-Resin by copolymerization of HFP and TFE under specific conditions in collaboration with M/s Hindustan Fluorocarbons Limited (HFCL), Hyderabad. The

process was successfully demonstrated to ISRO/ Vikram Sarabhai Space Centre (VSSC), Thiruvananthapuram.

(c) Engineering Sciences Cluster

Five Seat General Civil Aviation aircraft (CNM-5)- the country's first public-private partnership in the development of civil aircraft

CNM-5, the five seat aircraft has the distinction of being the country's first public-private partnership (PPP) for development of civil transport aircraft. It has been developed by CSIR-NAL in collaboration with M/s Mahindra Aerospace Pvt. Ltd (MAPL), Bangaluru. CNM-5 had its first test flight on the 1st September, 2011 in Australia. CNM-5 is powered by a 300HP piston engine driving a 3-blade propeller cruising at a speed of 160 knots with a maximum AUW (All Up Weight) of 1525 kg. It is an ideal aircraft for air taxi, air ambulance, training, tourism and cargo. It is proposed to be certified first under the Australian Authority CASA. With the MAPL as a partner organization, there are ample opportunities to capture the global market.

Tejas Flight Simulation

The encounter of modern combat fly-by-wire aircraft with the wake of another aircraft during combat, formation flying or refueling is fraught with hazards. A simulation model of the fighter aircraft has been developed by CSIR-NAL incorporating the rigid body dynamics air data system and flight control laws to clear Tejas for wake penetration trials. The flight model was also incorporated into the ELS to enable the pilots to practice the wake penetration flight test profiles. The ELS simulator was used for evaluation of the auto-throttle mode, and for the Autopilot design and high-Angle-of-Attack studies.

Green Technology for producing iron using hydrogen plasma

CSIR-IMMT developed a technology for reduction of hematite in the presence of pure hydrogen

plasma. The involvement of highly energetic atomic and ionic states of hydrogen provides a very high driving force for reduction of ore into metal. The process is completely carbon free and hydrogen plasma alone acts as a reducing as well as heating source.

Ferromagnetic Shape Memory Alloys by Rapid Solidification Route using Melt Spinning Technique

CSIR-NML developed ferromagnetic shape memory alloys (FSMAs) in the form of ribbons by rapid solidification route and optimised heat treatment schedules to modify magnetic and structural properties. A series of $\text{Ni}_{55}\text{Mn}_{22}\text{Ga}_{23-x}\text{Al}_x$ ($x=0, 0.5, 1, 2, 3, 5$) alloys have been prepared in the form of ribbons by melt spinning. The ribbons were found to be in martensitic state at room temperature.

Book based on the report of CSIR-SERC-NDMA Project 'Development of Seismic Hazard Map of India'

CSIR-SERC in association with National Disaster Management Authority (NDMA) has been developing and refining the basic scientific and technological tools to assist the administration at the national and other levels to manage disasters, aided by appropriate technology. One of the important activities identified as an urgent need in the National Disaster Management Guidelines: Management of Earthquakes, brought out by NDMA is the development of a more realistic and scientific seismic zonation map of India.

(d) Physical Sciences Cluster

42 GHz, 200 kW Gyrotron

CSIR-CEERI developed indigenous design technology of low power and high power Gyrotron and further implemented in the other high frequency gyrotrons like 95 GHz, 120 GHz, 170 GHz Gyrotron.

System for detection of synthetic adulteration in raw milk

CSIR-CEERI developed system for detection of adulteration in raw milk (KSHEER-SCANNER) for on-line testing of the spurious milk. The system far excels than the presently available products and equipment available in the dairy industry or the Indian market. The system has capability to detect urea, salt, detergent, liquid soap, caustic soda, boric acid, hydrogen peroxide and sodium bicarbonate. On-line detection and checking has become necessary in the recent times because of the serious problem of adulteration. With the deployment of the system at village milk collection centers across the country would impact that the quality check of the milk becomes easier thereby improving the health standards of the people.

Quantum dots based molecular sensing

CSIR-CSIO developed Biocompatible quantum dots based fluorescent bionanoconjugate for protein sensing. Successful bioconjugation was characterized with the absorption and emission spectra showing blue shifts of around 40 and 30 nm, respectively. Gel electrophoresis and particle size distribution studies further confirmed the mass increment of QDs after their functionalization with anti-BSA. Surface plasmon resonance spectrometry has been used to study the affinity of QD-(anti-BSA) probes for bovine serum albumin (BSA). Photoluminescence quenching of the developed probe is observed in the presence of BSA. The proposed approach may be useful for realizing *in-vivo* applications of the quantum dots for disease diagnosis and cargo transport.

Autonomous profiling device to monitor remote water bodies

In tropical climates, most freshwater reservoirs, dams and lakes are prone to annual summer stratification during which bottom water layers near the bed become hypoxic (<2 ml/l) with very low concentrations of dissolved oxygen (DO). This has serious implications to human health, and



requires frequent and effective monitoring, particularly during summer months when water consumption is highest. These water bodies are frequently located in remote areas away from human habitation, making it logistically difficult to access and monitor their water column properties on a regular basis. The need for monitoring temporal changes in freshwater ecosystems is addressed CSIR-NIO for use in both coastal and freshwater bodies. The AVP was used in experiments to satellite transmit complete time and location referenced high-resolution profiles of temperature, phytoplankton concentration, turbidity and DO from the remote Tillari Dam - a freshwater reservoir near Dodamarg, Maharashtra, India. The profiles were received without errors at the CSIR-NIO. The benefits of in situ time-series profiling with AVP captured the onset of developing hypoxia in early April 2011 over a 9-day unsupervised profiling experiment. A similar 5-day experiment tracked diurnal changes in phytoplankton concentrations through night and day, suggesting a possible interplay between recycled production and photoinhibition.

Geogenic Contamination through Arsenic in Groundwater in Western Bihar: A Sustainable Solution with the Application of Aquifer Modelling

CSIR-NGRI provided a sustainable solution using aquifer modelling to mitigate the arsenic contamination in groundwater of Western Bihar. A four layered numerical model has been built with the first layer as an unsaturated zone, 2nd layer as the first and shallow aquifer, 3rd layer as aquitard consisting of clay and the 4th layer as the second and deeper aquifer consisting of medium to coarse sands. The model domain is bound by River Ganga, Son and Thora (taken as a River Boundary) on its northern, eastern and south western side respectively. South eastern side is bounded by a road. The model after calibration for a period of ten years was used for predicting the multi-layer groundwater levels for a further period of 10 to 20 years i.e. up to 2031 for a number of expected scenarios. The principal indicator for the safe withdrawal of Arsenic free groundwater has been the reversal of leakage between the two aquifers.

Hydraulic head of the second aquifer (Arsenic free confined aquifer) is higher than the groundwater table in the first (Arsenic contaminated) aquifer in the entire region and an upward leakage exists wherever the intervening clay layer is thin. However, heavy and indiscriminate pumping from the second aquifer will create reversal in the leakage and will contaminate the second aquifer also.

6.2 Consultancy Development Centre (CDC)

CDC has made significant strides in emphasizing the need for effective use of consultancy services in various Central/State Govt. Ministries/ Departments. Consolidating its position as a Centre for promoting and developing consultancy, CDC offers a vast range of services to Clients and Consultants.

During the year 2011-12, CDC carried out both developmental and revenue generating activities. CDC undertook various activities keeping in view its mandate of promotion and development of Consulting Profession, Capacity Building, Creating trained human resources in the consulting domain and facilitating Client Organizations in the selection of right Consultants for their projects. Some of the new initiatives undertaken during the year are MSME operations & Lean ERP, National Knowledge Repository, Knowledge Management Partner Institutions (KMPIs), Building capacities for Use of Green Technologies Configurations, Architectures & solutions for Habitat Eco-Systems etc.

7. PUBLIC SECTOR ENTERPRISES

7.1 National Research Development Corporation (NRDC)

The National Research Development Corporation (NRDC) is a premier organization, under Department of Scientific & Industrial Research (DSIR), Ministry of Science & Technology, engaged in the development, promotion and commercialization of the R&D results/ technologies emanating from Research Institutes/

Universities/Industries, etc. The Corporation provides comprehensive technology transfer services and acts as a catalyst for transforming innovative research into marketable industrial products. The Corporation is a unique organization entrusted with the mandate of both promotional function of development/up-scaling of lab-scale technologies, promotion and inculcating the spirit of inventivity and commercial function of transferring/licensing these technologies to industry and making them commercially successful. During the operation for nearly six decades since its inception, the Corporation has developed strong links and network with various R&D organizations in the country as well as abroad for transfer of technologies. Its operations cover the entire spectrum of industrial technologies ranging from Agriculture to Agro processing, Chemicals to Metallurgy, Mechanical engineering, Electrical engineering, Electronics, Biotechnology and so on.

During the year 2011-12, the Corporation's total income was ₹ 1073.32 lakhs as compared to ₹ 959.46 lakhs in the previous year and the principal source of revenue i.e. Lumpsum Premium and Royalty on the licensing of technologies to industry was ₹ 566.78 lakhs as compared to ₹ 782.58 lakhs, in the previous year.

During the year 2011-12, the Corporation incurred Loss to the tune of ₹ 84.54 lakhs (before tax) as compared to Loss of ₹ 158.23 lakhs in the previous year. The Department of Public Enterprises's rating to the Corporation for the year 2011-12 is likely to be 'Good'.

7.2 Central Electronics Limited (CEL)

Central Electronics Limited is the other Public Sector Undertaking of DSIR engaged in the field of Solar Photovoltaic cells (SPV). CEL's objectives are as follows:

Solar Photovoltaics: To be a major global and domestic player in the area of Solar Photovoltaic cells and Modules by capacity enhancement and by manufacturing higher wattage modules with special emphasis on use of thinner wafers to become price competitive in the domestic and international markets.

Railway Equipment: To maintain leadership in the development, manufacturing, supply and commissioning of signaling and safety equipment for the Indian Railways to meet their existing and emerging modernization needs in line with their future strategies.

Defence: To expand the product portfolio using state-of-the-art technology for supply of strategic components such as PCM to be used by DRDO laboratories; PZT and di-electric material for use by BEL, NPOL and BARC; and heat fuse to be used by ordinance factories.

Safety and Security: To diversify into security systems and equipment used to counter terrorist threats in India by commercializing the latest state-of-the-art technology from abroad.

8. RESULTS-FRAMEWORK DOCUMENT

Government of India has approved the outline of a "Performance Monitoring and Evaluation System (PMES) for Government Departments" to measure the performance of the Government by preparing Results-Framework Documents (RFD) of all the Ministries/Departments every year, which provides a summary of the most important results that a Department/Ministry expects to achieve during the financial year.

Results-Framework Document (RFD) for Department of Scientific & Industrial Research for year 2011-12, corresponding achievements and composite score (93.90) for 2011-12 is given in Annexure-13.





II. DSIR's 12th FIVE YEAR PLAN PROGRAMME

1. PREAMBLE

DSIR has been supporting innovative projects directed towards improving the technological and industrial competitiveness of the industry during the tenth and eleventh five year plans. The department's eleventh plan Technology Promotion, Development and Utilization (TPDU) Scheme has been discontinued in 12th Five Year Plan. DSIR aspires to be - an agency that influences policy formulation leading to industrial competitiveness; a one-stop agency in the country for all matters related to industrial research and development; and an agency that is looked at by anybody in the country as one that nurtures and supports innovations having industrial applications. The DSIR programmes in the 12th five year plan shall focus on building an innovation ecosystem in the country. The DSIR Programmes shall be concerned with transformation of an innovation from mind to market, in line with the Vision and Mission of the department, given below:

Vision:

Enabling India to emerge as global industrial research and innovation hub.

Mission:

- Attracting industrial research in the country through industry and institution centric motivational measures and incentives;

- Creating an enabling environment for development and utilization of new innovations.
- Enhance innovations through its resources and channelize benefits thereof to the people.

New and innovative schemes have been proposed in the 12th five year plan that would contribute towards creating an innovative ecosystem in the country, raising industrial R&D's share in the national R&D expenditure, creating indigenous capacities to attract and absorb FDI, raising manufacturing industry's contribution in GDP and raising technology and value added exports from the country. Focus shall be on nurturing and supporting innovations in micro, small and medium enterprises and MSME clusters and bring them into the mainstream, so as to make them feel that their contributions matter in the overall development and growth process of the country.

2. DSIR 12TH PLAN SCHEMES

During the 12th five year plan, the DSIR has proposed following four schemes focusing on innovations, after the recommendation of the Steering Committee on Science and Technology. These schemes await in-principle approval of the planning commission and approval of the Standing Finance Committee:

2.1 Promoting Innovations in Individuals, Start-ups and MSMEs (PRISM) –

This scheme focuses on supporting individual innovators, start-up companies, incubatee companies in public funded technology business incubators and MSMEs besides supporting the approved 11th Plan projects related to Technopreneur Promotion Programme (TePP) spilling over from the 11th five year plan.

Broad Objectives:

- To support individuals for converting innovative ideas into demonstrable working models / prototypes / processes that may take the form of new or improved products, processes, or services and assist them to become incubatees / techno-entrepreneurs;
- Enabling incubatee companies in public funded technology and business incubators for up-scaling their proof of concept work;
- To deliver technological solutions for MSMEs Clusters units;
- To identify incubatees, start-ups for scaling up their proof-of-concept ideas into scalable ventures;
- To strengthen linkage of TOCICs with knowledge partners, e.g. the institution hosting the TOCICs or any other institutions or CSIR or any other public funded R&D laboratories;
- To support and complete the TePP projects that were approved in the 11th five year plan and have spilled over in the 12th plan period.

Focus Areas:

The proposal shall be preferably be in the following focus sectors:

- Green technology
- Clean energy

- Industrially utilizable smart materials
- Waste to Wealth
- Affordable Healthcare
- Water & Sewage Management
- Any other technology or knowledge intensive area

Eligibility Criteria:

- i. Any Indian citizen having innovative idea or an invention;
- ii. Any incubatee company (for the projects initiated during the first year of incubation) in a public funded technology or business incubator;
- iii. Any knowledge based start-up or MSME;
- iv. Any Institution/R&D organization/Industry association/Chamber of Commerce & Industry or any other legally approved agency involved in promotional activities related to innovation/ entrepreneurship/small scale industry (SSI)/ science & technology/R&D etc. for establishment of TePP Outreach cum Cluster Innovation Centres (TOCICs).

2.2 Patent Acquisition and Collaborative Research & Technology Development (PACE) –

This is a new scheme focusing on technology acquisition and its development and demonstration for commercialization.

Objectives:

- To support Indian industries to acquire patented technology at an early stage from within the country or overseas on an exclusive as well as non-exclusive basis, add value to the acquired technology for exploitation in Indian/foreign markets and develop “Made in India” innovative and socially relevant products for public consumption in India and abroad;



- To encourage and accelerate development and demonstration of indigenous product / process technologies by in-house R&D centres of the industry for commercialization;
- To create enabling environment for collaborative research between Indian Industry and R&D / academic institutions/ universities in India or abroad and formulate collaborative projects for development and demonstration of lab scale technologies aimed at commercialization of new products and processes;
- To develop a dynamic database on existing expertise and IPs available in the R&D organizations/academic institutions/ universities in India or abroad to facilitate PPP and tie-ups with Indian industry for collaborative projects.

2.3 Building Industrial Research & Development (BIRD)

This is a new scheme which focuses on creation of common research facilities for micro and small enterprises and subsumes components of the 11th Plan scheme, viz., Industrial R&D Promotion Programme, Information Technology and e - Governance (ITeG) and Asian and Pacific Centre of Transfer of Technology (APCTT).

Broad Objectives:

- Common Research and Technology Development Centers (CRTDC) -

To support creation of eight common facilities for industrial R&D with partial Government support dedicated for Micro & Small Industries for development of new & innovative products & technologies with special focus on areas such as energy efficient, clean & green technologies; affordable health; testing and R&D on solar/thermal/other non-conventional energy sectors, waste to wealth etc.

- Industrial R&D Promotion Programme (IRDP)-

To strengthen R&D infrastructure in industrial R&D centres and Scientific and Industrial Research Organisations (SIROs); Promote R&D initiatives of the industry and SIROs; Ensure that the contributions made by the in-house R&D centres and SIROs dovetail adequately in the overall context of technological and industrial development.

- Asian and Pacific Centre of Transfer of Technology (APCTT)-

To extend Government of India's support to the Asia Pacific Centre for Transfer of Technology (APCTT) of the UNESCAP with a view to promoting international cooperation in the areas of industrial R&D, innovations and technology development and transfer.

- Information Technology and e-Governance (IT-eG) –

To create IT enabled work environment in the Department through accelerated usage of various Information Technology opportunities and convert existing procedures and processes into *citizen centered*. Implement e-Governance in the Department progressively that need be in conformance to the National e-Governance Action Plan.

Eligibility Criteria (CRTDC):

- National laboratories, public funded research institutes (PFRI) or PSUs can establish the centres wherein micro & small industries will have access to carry out their R&D.
- Having R&D focus areas pertaining to key and allied sectors of MSE.
- Only capital cost excluding land & building will be supported. Consumables and recurring cost etc. will not be supported.
- Proposal to be submitted along with Detailed Project Report (DPR).
- Viability of the project to be established technically and financially through expert

comments and Technical Advisory Committee (TAC) approval.

- Cost estimate proposed shall be certified by chartered engineers

Focus Areas:

The proposal for establishing Common Research and Technology Development Centers (CRTDC) shall preferably be in the following sectors:

- Energy efficient, clean & green technologies
- Affordable Health
- Research & Development and Testing for Solar and other non-conventional energy sectors
- Waste to wealth

2.4 Access to Knowledge for Technology Development and Dissemination (A2K+)

This is a new scheme focusing on facilitating access to scientific journals by in-house R&D units of industry and Scientific and Industrial research Organizations (SIROs). The scheme subsumes the 11th Plan component scheme on Technology Development and Utilization Programme for Women (TDUPW) and DSIR Building and Infrastructure. Besides, the scheme supports the approved 11th Plan projects related to Technology Development and Demonstration Programme (TDDP) spilling over from the 11th five year plan.

It's a conglomeration of new programme components, some on-going programme components and miscellaneous activities not included elsewhere. List of components of the scheme:

New Programme component Units:

- A2K for in-house R&D Industries and SIROs
- Industrial Technology related studies
- National and International conferences, exhibitions

On-going Programme components:

- Technology Development and Utilization Programme for Women(TDUPW)
- Technology Development and Demonstration Programme (TDDP)
- DSIR Building and Infrastructure

Miscellaneous Programme component:

Miscellaneous activities includes leftover TPDU projects, specialized studies such as RFD Studies, etc.

Broad Objectives:

- To subscribe science, technology and innovation related National/international journals and making them accessible to in-house R&D units of industry & SIROs;
- To sponsor industrial technology related studies and disseminate them widely;
- To organize, support and participate in national and international conferences, seminars & workshops, exhibitions etc. to share the knowledge and success stories with stakeholders and end-users;
- To promote Technological up-gradation of tiny, small and medium enterprises run by women entrepreneurs, support proposals for design and development of products, processes beneficial to women and complete the Technology Development and utilization Programme for Women (TDUPW) projects that were approved in the 11th five year plan;
- To support and complete the Technology Development and Demonstration Programme (TDDP) projects that were approved in the 11th five year plan or earlier and have spilled over in the 12th plan period;
- To support creation of a building space and infrastructure facilities for DSIR



Eligibility Criteria:

Component	Applicant
A2K for in-house R&D Industries and SIROs	- Any in-house R&D units of industry and SIROs recognized by Department of Scientific and Industrial Research is allowed to access A2K facility - Publishers/vendors of scientific journals are eligible to compete in the selection of journals to be subscribed.
Industrial Technology	Any agency/consultant/institution/University/Industrial associations related studies etc. is allowed to apply for preparation of Industrial technology report.
National and International conferences, exhibitions	Any agency/consultant/institution/University/Industrial association etc. is allowed to apply/submit for financial assistance to organize/seek participation of DSIR in workshop/exhibition/seminar etc. of relevant area/interest of DSIR.
Technology Development and Utilization Programme for Women(TDUPW)	Any NGO/Institutions/University etc. is eligible to submit projects for Technology Development and Utilization Programme for Women.
DSIR Building and Infrastructure	DSIR will attempt to get land from Government/DDA etc. or may hire office space from Ministry of Urban Development.

2.5 XIth Plan on-going Programmes

The following chapters report approved XIth Plan TPDU Scheme on-going programmes. Respective details are available in Chapters :

A. INDUSTRIAL R&D PROMOTION PROGRAMME	C. TECHNOPRENEUR PROMOTION PROGRAMME (TePP)
B. TECHNOLOGY DEVELOPMENT AND DEMONSTRATION PROGRAMME (TDDP)	D. TECHNOLOGY DEVELOPMENT AND UTILIZATION PROGRAMME FOR WOMEN (TDUPW)





A. INDUSTRIAL R&D PROMOTION PROGRAMME

1. OBJECTIVES

The broad objectives of the Industrial Research and Development Promotion Programme are to:

- Bring in-house R&D into sharper focus;
- Strengthen R&D infrastructure in industry and Scientific and Industrial Research Organisations (SIROs);
- Promote R&D initiatives of the industry and SIROs;
- Ensure that the contributions made by the in-house R&D centres and SIROs dovetail adequately in the overall context of technological and industrial development.

2. AREAS OF COVERAGE

The specific areas covered under the component scheme are:

- In-house R&D in Industry,
- Scientific and Industrial Research Organisations (SIROs), and
- Fiscal Incentives for Scientific Research.

Activities and achievements in each of above areas are presented below:

3. IN-HOUSE R&D IN INDUSTRY

3.1 Recognition of In-house R&D Units

A strong S&T infrastructure has been created in the country. This covers a chain of national

laboratories, specialised R&D centres, various academic institutions and training centres, which continuously provide expertise, technically trained manpower and technological support to the industry. Various policy measures have been introduced from time to time, to meet the changing industrial and technological requirements of the industry. The Government has been giving special attention to promotion and support to industrial research in industry. Several tax incentives have also been provided which encourage and make it financially attractive for industrial units to establish their own in-house R&D units.

A scheme for granting recognition to in-house R&D units in industry is operated by the DSIR. A number of incentives and support measures are made available to in-house R&D units. Ministry of Finance has issued notification amending the basic notifications under customs and excise. As per the amendments, all DSIR recognized in-house R&D units other than hospitals can avail customs and central excise duty exemption on their procurements for research purposes.

The in-house R&D units qualifying for recognition are expected to be engaged in research and development activities related to the line of business of the firm, such as, development of new technologies, design and engineering, process/product/design improvements, developing new methods of analysis and testing; research for



increased efficiency in use of resources such as capital equipment, materials and energy; pollution control, effluent treatment and recycling of waste products.

The R&D activities are expected to be separate from routine activities of the firm, such as production and quality control. The in-house R&D units should have staff exclusively engaged in R&D and headed by a full-time R&D manager who would have direct access to the chief executive or to the board of directors depending upon the size of the unit. The in-house R&D units are also expected to maintain separate identifiable infrastructure and R&D accounts.

Number of in-house R&D units recognised by DSIR increased steadily from about 100 in 1973 to about 275 by 1975, to over 700 by 1980, around 925 by 1985, over 1,100 in 1990 over 1,200 in 1995 and thereafter is hovering between 1,200 to 1,250; 1,361 in March 2010; 1618 in December 2011 and 1767 in December 2012. Of these nearly 1,680 are in the private sector and the remaining units are in public/joint sector. The last updated 'Directory of Recognised in-house R&D Units' was brought out as on 30th November, 2010. This Directory lists 1,378 recognised in-house R&D units, giving registration number, name and mailing address of the company, location of the in-house R&D unit(s) and validity of DSIR recognition. The Directory for 2012 is being brought out shortly. The data on these R&D units is being computerised and updated.

For the purpose of recognition, the R&D units have to apply to DSIR as per a prescribed proforma. The proforma and other details about the scheme are provided to the interested companies on request. The proforma and details of the scheme are also available at DSIR website (<http://www.dsir.gov.in>). The applications received are scrutinised for their completeness in the DSIR and are then circulated for comments to various other departments/agencies such as concerned administrative ministries, MSME, CSIR, ICAR, ICMR, CCRAS, DBT, DC & PC, DoT, DRDO, DIT, DoP and NRDC. The units seeking

recognition are visited, if need be, by expert teams comprising of representatives of DSIR, as well as outside agencies, like, administrative ministries, CSIR, NRDC, DBT, ICAR, ICMR, DRDO, DIT, DOT, IITs and local educational and Research Institutions before they are taken up for consideration to verify their separation from the commercial activities like production and quality control and services. In order to obtain first hand information on R&D activities of the applicant firms, discussions with the chiefs of the R&D unit and executives of the firm are also held in DSIR in many cases. During the discussions outside experts are invited and their comments are sought. The applications along with comments from outside agencies, visit reports, and the Department's own evaluation are considered by an Inter-Departmental Screening Committee constituted by the Secretary, DSIR. The Committee meets every month to consider the applications and makes recommendations to the Secretary, DSIR based on its evaluation of the R&D infrastructure and R&D activities of the applicant firms.

R&D recognition is considered on the basic requirement to avail fiscal incentives focused towards R&D and separation of R&D activities from commercial production/service activities of the company is considered important.

During the Calendar year under report, the Screening Committee met 10 times. Of the 417 applications received for recognition, the screening committee considered 393 applications. 212 R&D units were granted fresh recognition based on their satisfactory R&D Infrastructure, Qualified Manpower and Programmes; 67 applications were rejected and 95 applications are under process at the end of 31st December, 2012. A statement giving month-wise receipt, disposal and pendency of applications for recognition of in-house R&D units is given at Annexure 1.

During the period under report, more than 500 discussions/meetings were held with heads/representatives of in-house R&D units. Also, expert teams visited a number of in-house R&D units.

3.2 Renewal of Recognition

Recognition to R&D units is granted for a period ranging from 2 to 5 years. The R&D units are advised to apply for renewal of recognition well in advance (3 months prior to the date of expiry of the recognition). The department has for the first time made arrangements for online submission of applications for renewal of recognition beyond 31.03.2012. Applications received for renewal of recognition are circulated to CSIR, NRDC and/or the concerned administrative departments of Government of India for comments depending on requirement. The applications are examined in DSIR taking into account the inputs received from other agencies for taking suitable decision on their renewal. As of 1st April 2012, 544 in-house R&D units were due for renewal of recognition out of which 490 applications were received. Based on the evaluation of the performance of the R&D units, renewal of recognition was granted to 490 R&D units. Recognition granted to 54 companies could not be renewed because of the reason that either their application is not received or the R&D performance was not up to the mark. A statement showing month-wise receipt, disposal and pendency of the cases of renewal of recognition of the R&D units is given in Annexure 2.

3.3 Zonal Distribution of In-house R&D Units

The in-house R&D units are distributed throughout the country. There are around 259 units in the Northern Zone (Delhi, Haryana, Punjab, Uttar Pradesh, Jammu & Kashmir), around 225 units in Western Zone (Rajasthan and Gujarat), around 540 units in the Central Zone (Maharashtra, Madhya Pradesh and Orissa), around 584 units in the Southern Zone (Andhra Pradesh, Karnataka, Kerala and Tamil Nadu) and around 107 units in the Eastern Zone covering Bihar, West Bengal, Assam and other North-Eastern states and remaining 30 in other places.

3.4 R&D Expenditure

The expenditure incurred by in-house R&D units in industry has steadily increased. During 1980-81

it was of the order of ₹300 crores. In 1985-86, it was of the order of ₹500 crores. It is estimated that the present R&D expenditure of the 1767 recognised R&D units is of the order of more than ₹10,000 crores per annum. The share of public and joint sector is about 20 per cent and that of private sector about 80 per cent. Of these 1767 recognized in-house R&D units, 196 spent over ₹500 lakhs each on R&D while 341 spent between ₹100 lakhs to ₹500 lakhs each per annum on R&D. The list of these R&D units is given in Annexure 3 and 4 respectively.

3.5 R&D Infrastructure

The in-house R&D centres have created impressive infrastructural facilities for R&D including sophisticated testing facilities, laboratory equipment and pilot plant facilities. Analytical facilities such as HPLCs, HPTLC, FTIR, GCMS, Polymerase Chain Reaction (PCR) equipment, Hydrogenator, Stability Chamber, Aflatoxin analyzer, X-ray diffractometer, Salt Spray test chamber, Vickers hardness tester, IR/UV-VIS spectrophotometers, NMR spectrometers, electron microscopes, particle size analyzers, portable particle counting systems; vibration test equipment, calorimeter, ultra filtration equipment, sonicator, spectro fluorimeter, protein purification set up, digital viscometer, high temperature test and evaluation facilities, CAD-CAM facilities, rapid prototype building machines, greenhouse and tissue culture laboratory facilities are available with many in-house R&D units.

3.6 R&D Manpower

There has been a steady increase in R&D manpower employed by the in-house R&D units. By 1975-76, about 12,000 R&D personnel were employed by recognised in-house units, and by 1981-82, the figure was over 30,000. The present estimated manpower for the 1,745 in-house R&D units is around 91,500 out of which around 28,000 R&D personnel are employed in public sector in-house R&D units and around 63,500 R&D personnel are employed in the private sector in-house R&D units.



3.7 Sectorwise Break-Up of In-house R&D Units

A broad sector-wise break-up of the recognised in-house R&D units is as below:

Chemical and Allied industries including Drugs, Pharmaceuticals and Biotechnology	671
Electrical and Electronics industries	422
Mechanical Engineering industries	278
Processing industries (Metallurgical, Refractories, Paper, Cement, Ceramics, Leather and others)	212
Agro including Biotechnology and food processing industries and others	162

3.8 Achievements of In-house R&D Units

Some of the R&D achievements reported by the recognised in-house R&D units are listed below:

Biological Sciences

1. Development of Herbal fairness cream, herbal shampoo - new cold rub and new mridul cough syrup.
2. Development of generic recombinant therapeutic proteins, Filgrastim (G-CSF, Moolgramostim (GM-CSF) and Aldesleukin (Interleukin-2 ,IL-2) for use in oncology.
3. Development of boosting yeast improving yields of Serratiapeptidase.
4. Development of BG II Cotton hybrid KCHH 2739, KCHH 2108, KCHH 2505 and KCHB 2250.
5. Development of big boll, medium tall open type with light hairiness in hybrid cotton.
6. Development of RSCL Triacontanol-plant growth promoter, RSCL AZOS-Nitrogen fixing liquid bio fertilizer, RSCL PHOSPHO-Phosphate solubilizing liquid bio-fertilizer, Decomposition of different agro industrial wastes by using sugar industry spent wash and microbial decomposition culture.

7. Development of recombinant Trypsin using yeast and treatment of industrial effluent using enzymes

Chemical Sciences

1. Development of In-line siliconized film (release film), Co-polyester for Peelable-sealable film, Heavy metal free high shrink film 4) Matte film for electronic applicaiton, Film with enhanced adhesion to various inks, In-line coated base film for extrusion coated thermal lamination film.
2. Development of one BOPET line, modification of drying system for polyester granules.
3. Development of additives in polymer plant system for Making proper additive distribution in polymer matrix.
4. Development of Insulation brick based on calcium silicate having thermal conductivity more than 0.14 w/m degree k and bulk density 600 Kg/Cu.M.
5. Development of Enzyme based product for treatment of industrial effluent, Enzyme based product for enhancing shelf life of distillers dried grain and soluble and Product for boosting yeast growth and metabolism during alcoholic fermentation.

6. Development of Phenylephrine Hydrochloride, 1,3-Benzenedisulfonamide, 4-amino-6-chloro (CADS), 2,3-Pyrazine dicarboxylic acid, N-Formyl – N-Methyl-4 amino benzoic acid; Fenoverine: Simplified process was developed with better yield; Glibenclamide: Process was modified by reducing raw material consumption.
7. Development of L-valine benzyl ester PTSA (For Valsartan) One step synthesis and N-3 intermediate L-Valine methyl ester HCl (For Valsartan) One step synthesis and N-3 intermediate Diazaspiro HCl (For Irbesartan) Three step synthesis and N-3 intermediate Chemsol-HS (For sun screen) Two step synthesis for active ingredient L-Acid (For antihypertensive Lercanidipine) Two step synthesis and N-1 intermediate.
8. Development of Auto primary valve heat sealing SPM, Automatic tumbler disc assembly, Productivity improvement through combining two Processes (Laser Marking & Sticker Pasting), Automatic Key Decoding, Centralized Material Feeding in Molding Machines. Semi automatic motorcycle ignition switch end of line test (Final test) rig., Fully automatic Tata Nano ignition switch end of line test (Final test) rig, Fully automatic M&M Flyte ignition switch end of line test (Final test) rig, Endurance test rig for Motorcycle/Scooter lock sets, Fully automatic Front & Rear Door Handle end of line test (Final test) rig, Detection of wrong fitment of Spring in Bracket Seat Lock, Automatic Welding SPM for Motorcycle Frame tube assembly, SPM for fuel filler cap assembly, Automatic Batch marking in Tata Ignition lock, Automatic Spring Force checking in Plate Terminal Assembly of Ignition Lock-Tata Nano.

Engineering Industries

1. Development of Magnetic Shutter Lock for CBZ Extreme, HMCL.
2. Development of Ignition Switch & Door Lock for Tata Nano.
3. Development of Front & Rear Door Handle Genetal Motor Beat model.
4. Development of Lock Set Duro for Mahindra Two Wheeler, Lock Set Flyte for Mahindra Two Wheeler, and Magnetic Shutter Lock for Maestro, HMCL.
5. Development of Fuel Cock Set Passion Pro HMCL, Combi Brake Switch Maestro, HMCL and Inner Door Handle of ARIA. (VISTION).
6. Development of Kit Set of Ignitor HMCL., Kit Set of Impulse HMC and Kit Set of CD Dawn HMCL.
7. Development of Kit Set of Glamour FI HMCL, Kit Set of hunk HMCL. 1 and Kit Set of Karizma ZMR HMCL.
9. Development of Light weight wheels by using high strength material (HR60/DP600); Flow formed Rim for Truck; Development of 20 spare wheel for Audi with 8 point welding & using HSS material etc.
10. Development of Impact energy absorber for steering wheel (123/CHE/2012); Height adjuster performance improvement; Assembly Error proofing; ELR line pokayoke.
11. Development of all ultra slim models star rating low cost low ultra slim entry model and amlogical internet board development new SXL platform development.
12. Development of colored acrylic galvalume product and pre treated galvalume product and Galvanized plain skin passed for A/C base tray.
13. Development of 42 hp tractor suitable for paddy cultivation Project completed



Development of 60 hp tractor with outsourced transmission.

14. Development of Coastal/Desert Special tractor improvement in fuel efficiency on engines through in-house efforts.
15. Development of quick lift arrangement for hydraulic lift of tractor Project, improved hydraulic rockshaft sealing Project, 60 hp Swaraj transmission suitable for Combine Harvesting & CE application New development taken up for 58 hp transmission.

Information and Communication Technology (ICT)

1. Development of BioMedical Sensing and Processing - ECG Monitoring Device with mobility and Remote data access capability
Wireless Sensor Networks - Wireless Communication Platform for Agriculture
Sensor networking - Upper Audio Band Communication Modem.
2. Development of GPS-Glonass receiver, NextGen Correlator for high sensitivity indoor GPS receiver, Assisted GPS receivers, GPS timing modules, NAV 2400 High Sensitivity GPS receiver.
3. Development of Primary Mux • ANANDA MARK II Encryptor • E3 Cell relay Encryptor • MIL PCM Secrecy • L VSAT Phase II Encryptors • Field Auto Telephone • Telephone Set 5C.
4. Development of Central Monitoring System for V-sat Terminal, Aerial Imagery Work Station
5. Development of test benches of Residual Current Circuit breaker, Data acquisition, software of Short circuit lab.
6. Development of analytics for Ubiquitous Computing including applications of machine learning, planning and continuous event processing and statistical analysis.

7. Development of Intelligent Infrastructure applications on Mobile and Devices - Building several use cases based on intelligent infrastructure to validate RIPSAC platform and its SDK so that latter can be used as PaaS.

3.9 Imports Made by In-house R&D Units

The recognised in-house R&D units have imported a variety of equipment, raw materials and samples for their R&D activities. These include: HPTLC, FTIR, GCMS, Polymerase Chain Reaction(PCR) equipment, Hydrogenator, Stability Chamber, Aflatoxin analyzer, X-ray diffractometer, Salt Spray test chamber, Vickers hardness tester, Microplate reader, Medical photography equipment, Nitrogen generator, Abrasion loss testing machine, viscosity testing machine, Load cell, Universal testing machine, 30 ton capacity pulley block, Ginning machine, Spares for Rota vapor chiller and extraction system, Polymer microscope, Oscillation granulator, Automatic potentiometric titrator, DSC (PerkinElmer), etc.

3.10 Other Benefits Availed by the Recognised R&D Units

The Department provides assistance to recognised in-house R&D units in a number of ways, such as cases of industrial R&D units requiring allotment of special controlled materials for R&D, permission to export of specialised products reserved for small scale industries by medium scale industries for test marketing in other countries and disposal of imported R&D equipment/instruments and pilot plant produce are examined for making suitable recommendations to concerned agencies.

4. SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS

4.1 Recognition of Scientific and Industrial Research Organisations (SIROs)

The DSIR had launched a scheme of granting recognition to SIROs in 1988. SIROs recognised by DSIR are eligible for Customs Duty Exemption

and Excise Duty Waiver in terms of notification Nos. 51/96-Customs dated 23.7.1996 and 10/97-Central Excise dated 1.3.1997 respectively.

The DSIR has brought out Guidelines for Recognition of SIROs, which give procedural details and application proforma for seeking recognition under the SIRO Scheme. Functional SIROs having broad based governing council, research advisory committee, research personnel, infrastructural facilities for research, well defined, time bound research programmes and clearly stated objectives of undertaking scientific research, are considered eligible for recognition by DSIR. The investments of surplus funds not needed for immediate research should be in accordance with the Income-tax Act, 1961.

Applications for seeking recognition under the SIRO scheme are considered in DSIR by an Inter-departmental Screening Committee with members from Council of Scientific and Industrial Research (CSIR), Indian Council of Medical Research (ICMR), Indian Council of Agricultural Research (ICAR), Indian Council of Social Sciences Research (ICSSR) and University Grants Commission (UGC). The recommendations of the Screening Committee are put up for approval of Secretary, DSIR. Retrospective approval is not granted.

During the period January 2012 to November 2012, the Screening Committee met 8 times and recommended 51 cases for recognition as SIROs. These include cases in the natural and applied sciences, agricultural, medical sciences and social sciences. List of these SIROs is furnished at Annexure-5.

Recognition granted to SIROs is for duration ranging from 1 to 3 years. The SIROs are advised to apply for renewal of recognition well in advance (3 months prior to the date of expiry of recognition). The department has for the first time made arrangements for online submission of applications for renewal of recognition for SIROs beyond 31.03.2012. Such applications received for renewal of recognition are

examined by Research Review Groups by involving representatives from ICAR, ICMR, CSIR and ICSSR depending on the area. Based on the evaluation made by the Research Review Groups, renewal of recognition is granted to SIROs.

At present there are 603 SIROs duly recognised by DSIR; of these, 235 are in the area of natural and applied sciences, 245 are in the area of medical sciences, 38 are in the area of agricultural sciences, 85 are in the area of social sciences.

The SIROs have employed qualified scientists and researchers and have also established good infrastructural facilities for research. They have developed new processes, procedures, techniques and technologies and also filed several patents. They have also organised seminars/symposiums/workshops and published research papers/reports/books.

5. FISCAL INCENTIVES FOR SCIENTIFIC RESEARCH

Government has evolved, from time to time, fiscal incentives and support measures to encourage R&D in industry and increased utilisation of locally available R&D options for industrial development. New incentives to encourage investments in R&D by industry are announced in the Union Budget.

Fiscal incentives and support measures presently available include:

- Income-tax relief on R&D expenditure;
- Weighted tax deduction U/s 35 (2AA) of IT Act 1961 for sponsored research programs in approved national laboratories, universities and IITs;
- Weighted tax deduction u/s 35(2AB) of IT Act, 1961 on in-house R&D expenditure for any company engaged in the business of biotechnology or in any business of manufacture or production of any article or



thing not being an article or thing specified in the list of the eleventh schedule of IT Act having R&D facility approved by Secretary, DSIR.

- Customs duty exemption on capital equipment, spares, accessories and consumables imported for R&D by approved institutions/SIROs;
- Customs duty exemption on specified goods (comprising of analytical and specialty equipment) for use in pharmaceutical and biotechnology sector;
- Excise duty waiver on indigenous items purchased by approved institutions/SIROs for R&D;
- Ten year tax holiday for commercial R&D companies approved upto 31.03.2007
- Excise duty waiver for 3 years on goods produced based on indigenously developed technologies and duly patented in any two of the countries out of India, European Union (one country), USA and Japan;
- Accelerated depreciation allowance on plant and machinery set-up based on indigenous technology;
- Customs duty exemption on imports for R&D projects supported by Government.

Information on some of these fiscal incentives is given in the following paragraph.

5.1 Depreciation Allowance on Plant and Machinery Setup Based on Indigenous Technology

Secretary, DSIR, is the Prescribed Authority to certify expenditures where higher rate of depreciation is to be allowed for the plant and machinery installed for the manufacturing of products using indigenous know-how as per the provisions of rule 5(2) of IT Rules. Certificates are issued for eligible expenditure after a detailed examination in the department.

During the period under report, three certificates were issued by DSIR. (Annexure-6).

5.2 Central Excise Duty Waiver for three years on patented products

Central Excise Duty Exemption for a period of three years is available under Notification No. 13/99-CE dated 28th February, 1999 for specified goods provided the products are patented in any two countries from amongst India, United States of America, Japan and any one country of the European Union provided the products are designed, developed, patented and manufactured by a wholly Indian owned company, national laboratory, public funded research institution, or university.

During the year, one company M/s Rishabh Instruments Pvt Ltd, Nashik has submitted application for issuing Excise duty exemption certificate under the notification. The application is under process.

5.3 Reference on expenditure on scientific research under Section 35 (3) of Income-Tax Act, 1961.

Section 35 (3) of Income-tax Act, 1961 provides that if a question arises as to whether and, if so, to what extent any activity constitutes or constituted or any asset is or was being used for scientific research, the Central Board of Direct Taxes would refer the question to the Prescribed Authority. Director General Income-tax (Exemptions) in concurrence with Secretary, DSIR is the Prescribed Authority for deciding such cases.

5.4 Approval of Commercial R&D Companies

In order to promote research and development activities in the commercial research and development companies, the Finance Act, 2000 provided for a ten-year tax exemption from income-tax under section 80-IB(8A) of the Income-tax Act, 1961, to approved companies, whose main objective is scientific and industrial research, Secretary, DSIR is the Prescribed Authority vide Gazette notification no. S.O. 85(E) dated 31 January, 2001, issued by Department of Revenue, Ministry of Finance for granting

approval under section 80-IB(8A) of the IT Act. The notification was valid upto 31st March, 2007 and this scheme was not extended further by the Government.

The approval to commercial R&D companies is given initially for a period of 3 years, which can be extended up to 10 years based on evaluation of its performance. The tax exemption is available to a company, which is accorded approval by the Prescribed Authority at any time after the 31st day of March 2000 but before the 1st day of April 2007.

Out of 45 companies approved till 31st March 2007, twenty five companies are not availing benefit under the section at present. The list of 20 companies is given at Annexure 7.

5.5 Customs Duty Exemption to Recognised SIROs

All SIROs recognised by DSIR other than hospitals are eligible for Customs Duty Exemption on the import of scientific equipment, instruments, spares, accessories as well as consumables for research and development activities and programmes.

The department was issuing the essentiality certificates to SIROs for obtaining the customs duty exemptions. As per the notification No. 24 /2007 dated 1st March, 2007 the Director or Head of the institute/organization is empowered to sign the essentiality certificate.

5.6 Central Excise Duty Exemption to Recognised SIROs

All SIROs recognised by DSIR other than hospitals are eligible for Excise Duty Exemption on purchase of scientific and technical instruments, apparatus, equipment (including computers); accessories and spare parts thereof and consumables; computer software, Compact Disc - Read Only Memory (CD-ROM), recorded magnetic tapes, micro films, microfiches; and prototypes for research and development activities and programmes.

This provision was introduced by Ministry of Finance (Department of Revenue) vide notification No. 10/ 97-Central Excise dated 1st March, 1997. The department was issuing the essentiality certificates to SIROs for obtaining the central excise duty exemptions. As per the notification No.10/ 2007 dated 1st March, 2007 the Director or Head of the institute/ organization is empowered to sign the essentiality certificate.

5.7 Customs and central excise duty exemption to Recognised in-house R&D units

Ministry of Finance has issued notification no. 24/ 2007 – Customs dated 01/03/2007 and 16/2007 – Central Excise dated 01/03/2007 amending the basic notifications under customs and excise. As per the above amendments all DSIR recognized in-house R&D units other than hospitals can avail customs and central excise duty exemption on their procurements for research purposes. All the eligible in-house R&D units recognized by DSIR have been issued the certificates of registration.

5.8 Registration of Public Funded Research Institutions, Universities etc.

Public funded research institutions, universities, IITs, IISc., Bangalore; Regional Engineering Colleges (other than a hospital) are eligible for availing customs duty exemption on import of equipment, spares and accessories and consumables for research purposes through a simple registration with the DSIR. The heads of the public funded research institutions/ organisations duly registered with DSIR can certify the R&D goods for duty free import as per the notification No. 51/96-Customs dated 23 July 1996. As per the Government notification No. 10/97-Central Excise dated 1.3.1997, the above Public Funded Research Institutions registered with DSIR are also eligible for Central Excise Duty Waiver on purchase of indigenously manufactured items for scientific research purposes.

Coinciding with the presentation of Union Budget for the year 2004, Ministry of Finance amended the notification No. 51/96-customs vide notification No. 28/2003-Customs dt. 1.3.2003. As per the amendment, departments & laboratories of central



government and state governments (other than a hospital) are not required to register with DSIR for availing the customs duty exemption. They can clear the consignments by producing a certificate from the Head of the institution certifying that the said goods are required for research purposes only. Another significant change in the notification is that Regional Cancer Centres have been included in the list of institutions eligible for DSIR registration for importing goods for research purposes at a concessional rate of customs duty.

For the purpose of registration, the PFRI/ Universities etc have to apply to DSIR as per prescribed proforma. The proforma and other details about registration scheme are available at DSIR website (www.dsir.gov.in) The applications received are scrutinized for their completeness in DSIR by a Sub-Committee constituted by the competent authority. The complete applications are then considered by an Inter-departmental Screening Committee constituted by the department for considering the requests from various institutions. Presently the committee is chaired by a former Secretary of DSIR.

The Screening Committee met 1 time during the year 2012 and considered 24 applications received from various public funded research institutions.

During the year 2012, 22 registration certificates were issued to such public funded research institutions for availing customs duty exemption on import of scientific equipment, spares and accessories, consumable items and Central Excise Duty exemption on indigenous purchases for Scientific Research Purposes.

The registration to public funded research and other institutions mentioned in the notification is granted for maximum period of five years / ten years. The registered institutions are advised to apply for renewal of registration well in advance of the date of expiry of the registration.

During the year 2012, 92 institutions were due for renewal of registration. The department received 70 renewal applications. The department has for the first time made arrangements for online submission of applications for renewal of

registration for PFRI's beyond 31.08.2012. These were processed on individual files and approval of Competent Authority was obtained and 65 renewal certificates were issued. The remaining 5 applications are under process. There are about 620 PFRI's registered with DSIR.

5.9 Approval of In-house R&D Centres under Section 35(2AB) of I.T. Act 1961

In order to encourage R&D initiatives of industry, the finance bill 1997 introduced a sub section (2AB) in section 35 of the IT Act, 1961. The provision introduced initially was for select sectors of industry i.e. drugs, pharmaceuticals, electronic equipment, computers, telecommunication equipment, chemicals and provided weighted deduction of 125 per cent on expenditure on in-house research and development facility as approved by the prescribed authority i.e. Secretary, DSIR. Subsequently, a number of other sectors were added to the list of eligible sectors. From the year 2009 the benefits have been extended to all sectors of industry with a select list of non-priority items. Rate of weighted tax deduction was raised from 125 per cent to 150 per cent subsequent to the year ending March, 2000. The rate of weighted tax deduction was further enhanced to 200% from 1st April 2010. Initially the provision was introduced up to 31st March, 2000. The provision was extended from time to time initially till 31st March, 2005 and then upto 31st March, 2007, further up to 31st March 2012. In the Union Budget 2012, the provision has been extended up to 31st March 2017.

During the period under report, 229 new applications were received for approval under the provision. New approvals were accorded to 149 companies in Income Tax prescribed Form 3CM in addition to renewals to the 423 companies already approved. Further, the detailed R&D expenditure of the approved companies were also examined and 182 reports valued at Rs.3341 crores forwarded to DGIT (E) in Form 3CL as prescribed in IT Act. A list of companies approved under Section 35(2AB) of IT Act, during the year 2012 is furnished in Annexure-8.



B. TECHNOLOGY DEVELOPMENT AND DEMONSTRATION PROGRAMME

1. PREAMBLE

Erstwhile Technology Development and Demonstration Programme (TDDP) was a component of 11th Plan scheme 'Technology Promotion Development and Utilization (TPDU)'. The genesis of erstwhile TDDP was PATSER Scheme, which commenced in VIII Five Year Plan in 1992. The PATSER Scheme continued in the VIII and IX Plan and was designated as TDDP in the X Plan. The erstwhile TDDP aimed to support technology development efforts of industrial R&D system. The scheme has been discontinued in the XII Five Year Plan. The on-going projects approved during XI Plan will be completed in the XII Five Year Plan under the new scheme - Access to Knowledge for Technology Development and Dissemination (A2K+) of DSIR. DSIR has committed to support Rs.20.00 Crores in the FY 2012-13 for the 66 on-going projects of TDDP/DSIR.

2. OBJECTIVES

The programme aimed at strengthening the interface between industry, R&D establishments and academic institutions and provided catalytic support for development and demonstration of innovative product and process technologies, traversing the journey from proof of concept or laboratory stage to pilot stage, rendering them fit for commercialization in all sectors leading to

industrially useful applications. The objectives of the programme were:

- (a) Development and demonstration of innovative need-based technologies for making industry competitive, and
- (b) Strengthening the interface between industry, R&D establishments and academic institutions

3. ACTIVITIES

The Department provided, on a selective basis, partial financial support to research, development, design and engineering (RDDE) projects proposed by industry in the following areas:

- (a) Development of a new or improved product resulting in prototype development and ending with demonstration in commercial environment.
- (b) Development of a new or improved process resulting in establishment of process know-how, development of process equipment and demonstration of yield, efficacy etc in a pilot plant.
- (c) Absorption and up-gradation of imported technology.
- (d) Priority technology development projects of PSUs in consultation with and co-financing from economic ministries. Under this,



consortium projects for development of technologies of common interests for group of industries or associations to be undertaken by industrial units, national laboratories, user industries in important focused areas such as Electronics and Communications, Railways, Drugs, Chemicals and Fertilizers etc.

- (e) Development and demonstration of technologies for common use by industry clusters.
- (f) Development and demonstration of technologies for government's flagship and mission mode projects.

The partial financial support by DSIR in the above areas primarily covered prototype development and pilot plant work, testing and evaluation of products from such R&D, user trials, etc. Bulk of the cost of the project was met from the industry's resources.

The Department, under this programme has so far supported about 280 R&D projects of Industrial units. These projects cover products and processes in various important industries such as metallurgy, electrical, electronics, instrumentation, mechanical engineering, earth moving and industrial machinery, chemicals and explosives, etc. Around 60 technologies developed under the scheme have been commercialized or are under commercialization. The details of TDDP projects commercialized are given in Annexure-9.

4. STATUS OF THE PROJECTS SUPPORTED DURING THE ELEVENTH PLAN

Development of 90 KW Brushless Eddy Current Clutch Gear Unit for Radiator Cooling Fans in Diesel Electric Locomotives of Indian Railways by M/s Eddy Current Controls (I) Ltd., Chalakudy, Kerala

The Radiator Fan is used in Diesel Electric Locomotives to bring down the temperature of the Diesel Engine cooling water to the desired level. Drive between the Engine and Radiator Fan consists of an Eddy Current Clutch (ECC) which is capable of providing variable speed and a

suitable Gear Box which provides mechanical coupling between the Clutch and the Fan. Eddy Current Clutch Gear units presently being used by Diesel Locomotive Works (DLW), Varanasi for Indian Railways, are brush type couplings with rotating winding and copper coated drums and are inherently prone to frequent breakdowns. Brushless Eddy Current Clutch Gear Units for Radiator Cooling Fans, due to non-contact type technology, have relatively lower maintenance costs and longer life.

In the present project, M/s Eddy Current Controls (I) Ltd. have undertaken the design and development of 90 KW Brushless Eddy Current Clutch Gear Unit for Radiator Cooling Fans with the additional constraints imposed by the limited space available and high ambient temperature environment prevailing in the engine space where presently ECC is housed. The company, improving upon the initial prototype could overcome the problem of excessive heating of drum, clutch voltage saturation etc. and has developed 90 KW Brushless Eddy Current Clutch Gear Unit. The testing of the prototype as per the specifications and field requirements is under trial.

The project activities completed.

Development and Demonstration of process for manufacture of Hydrogel at Pilot Plant Scale by M/s Earth International Pvt. Ltd., New Delhi

Hydrogels also known as Super Absorbent Polymers (SAP), are substances that have a unique 40,000 to 50,000 per cent water absorption capacity. This property can be a boon for agriculture since absorbed water along with nutrition and other desirable substances can continuously provide all requirements of the plants. Hydrogel is a cross-linked polymer, which when put in water traps the water and forms swollen networked structures, forming a gel like substance. The hydrogels developed in Indian Agriculture Research Institute (IARI), in its dry form are capable of absorbing 400-500 times its weight of

water, can withstand up to 50°C temperature, have repetitive gelling character, biodegradable with a shelf life of 2 years. These hydrogels besides meeting water demands of the plant improves germination and minimizes soil erosion. These hydrogels in combination with drip irrigation can transform the barren land to a productive one.

The performance trials and test runs on various crops in different climates are in progress by the company. The company is scaling up the lab process up to pilot scale (initially in a batch of 5 kg with the maximum of 25 kg) and developing field trials data for commercialization of the lab scale technology on use of Hydrogels.

The project is nearing completion.

Development of Indigenous Radiotherapy Simulator (RTS) for Radiation Treatment of Cancer by M/s Elim Meditech Pvt. Ltd., Kanyakumari, Tamil Nadu.

Radiotherapy (Radiation treatment) plays a major role in multidisciplinary cancer treatment. Delivering accurate radiation dose conforming to the tumour is one of the most important needs in Radiotherapy. To achieve this radiation conformal treatment for all types of cancer, Radiotherapy Simulator (RTS) is the basic hardware equipment. RTS is basically a Radiological Imaging System, mimicking all the mechanical functions of a Teletherapy treatment machine (telecobalt Machine or Linear Accelerator), which is used for radiation treatment of cancer. With Radiotherapy Simulator it is possible to create all types of image reconstruction, storage, networking and result output.

The project of M/s Elim Meditech Pvt. Ltd. made progress in assembling all the hard ware mechanical sub-system of the old RTS system and developed new electronics sub systems and software controls for the design, development and demonstration of Indigenous Radiotherapy Simulator for Radiation cancer treatment

The project is under progress.

Process Up-scaling & Clinical Evaluation- PBL 1427 – A Novel Long Acting DPP IV Inhibitor for the Treatment of Type 2 Diabetes by M/s Panacea Biotec Ltd., New Delhi

PBL1427 has exhibited potent, reversible competitive inhibition in human DPP IV enzyme activity with an IC₅₀ of 12 nM. It has > 15000 fold selectivity for DPP IV over DPP8 / 9. PBL 1427 binds more strongly to the DPPIV enzyme as compared to Sitagliptin and Vildagliptin as suggested by a better K_{off}. PBL 1427 showed a good *in vivo* efficacy in lean mice and rats in terms of improvement in oral glucose tolerance test suggesting a better glycemic control. Further it results in an increase in active GLP-1 which leads to glucose dependent secretion of Insulin. PBL 1427 also improves the oral glucose tolerance in various animal models of diabetes like db/db and ob/ob mice. In addition it exhibits a body weight reduction in leptin receptor deficient db/db mice. PBL 1427 appears to be metabolically stable in in-vitro metabolism studies performed in pooled liver microsomes from various species such as mice, rats and humans. It exhibits a favorable pharmacokinetic profile in mice and rats with an oral bio-availability of 50-70 %. PBL 1427 did not show any accumulation of drug in any of the organs studied. PBL 1427 did not show any mutagenicity or cytotoxicity in AMES assay even upto a concentration of 3000 g/plate. 14 days repeat dose probe toxicity in SD rats with oral formulation did not show any adverse event suggesting a NOAEL of >100 mpk. In summary, PBL 1427 is a novel long acting DPPIV inhibitor with an attractive profile that meets the need for promoting safer drugs to treat T2DM in growing patient population. The company is in the process of filing foreign patent application on this product.

The present project is to develop a commercially viable process for up scaling PBL 1427 and to build a capability of a cGMP compliant API manufacturing facility in five years duration.

The project is under progress.



Development of Large Size CNC Rotary Table 2500 x 2500 with Translation Movement – Model URH – SQ 2500 – X by Uday Computer Aided Manufacturing (P) Ltd., Bangalore

Large size CNC rotary tables, a highly specialized machine tool, are imported in the country and these not being built by Indian industries. Uday Computer Aided Manufacturing Ltd is a leading manufacturer and exporter of small size CNC Rotary Tables and diversified products for various industry sectors and Machine Tool Builders. They have established capability for CNC Rotary Tables of sizes, viz. of 100 mm - 1600 mm dia. Under this proposal, development of a Large Size CNC Rotary Table of size 2500 x 2500 with Translation Movement will be demonstrated for application in the domestic as well as global market. The project has been supported by DSIR for duration of 18 months.

The project is under progress.

Indigenous Development of FTIR Spectrophotometer by M/s ELICO Limited, Hyderabad

The objective of the project involves indigenous development of FTIR in the Price band less than 5 Lakhs Rupees to make it affordable to academic & research institutions and Industry Sector. The targeted FTIR Instrument would come with configurable optics, application specific accessories, in-built PC Processing capabilities, and advanced Human/Machine Interfaces like Touch Screen, USB Mass Driver storage, USB Printing, and TCP/IP for networking. The project has been supported by DSIR for duration of 30 months.

The project is under progress.

Development and commercialization of Aliskiren and its Intermediates by M/s. Penn Bio-Chemicals (India) Pvt Ltd.

The overall objective of this proposal is to produce Aliskiren and its intermediates. The Aliskiren

compound is complex molecule with four stereo centers in the structure. For the sake of convenience, the company is targeting to synthesize three fragments and market all these three synthons. Design and synthesis of novel approach for the three fragments (AK1, AK2 and AK3), the work will be carried out in-house R&D centre and the scale up will be done by using pilot scale. The long term goal is to develop the most efficient operating conditions for large scale synthesis of the Aliskiren and its intermediates to market the finished product in the India as well as in the world markets. The project has been supported by DSIR for duration of 3 Years.

The project is under progress.

Liquid Coolant Recovery System by Pure Tech India, Trichy

The objective of the proposal is to enhance the Research and Development activities of the product Liquid Coolant Recovery System and



Liquid Coolant Recovery System by M/s Pure Tech India, Tiruchirapalli, Tamilnadu

customize it to suit all types of working environments with an aim to make the equipment economical & tradition. The project has been supported by DSIR for duration of three years.

The project is under progress.

Development of Magnesium alloy Pressure Die Castings for Automotive applications by M/s. Sundaram-Clayton Limited

The objective of the project is to develop environment friendly, cover gas technology (in lieu of SF₆ currently being used) for processing magnesium pressure die castings, to further extend it to the stage of putting-up an automated pre-commercial production plant and finally converting it into a commercially viable production plant for manufacturing magnesium alloys die castings for transport applications. The project has been supported by DSIR for duration of three years.

The project is under progress.

Design & Development of Capacitance Type Fuel Level Sensor for Flexi Fuels by M/s. Pricol Ltd., Coimbatore

The objective of the project is to design and develop a reliable automotive fuel level sensor with capacitance principle compatible for all types of fuels (Flexi fuels) such as RME (Rapeseed Methyl Ester), PME (Palm Methyl Ester), FAME (Fatty Acid Methyl Ester), Ethanol blended fuels -Grade E10, E15, E20 & E85 at optimum cost. The project has been supported by DSIR for duration of two years.

The project is under progress.

Optimization of an innovative process and its cost effective manufacturing of a fast acting anti diabetic recombinant drug product insulin Lispro, a rapid acting insulin analogue, and testing its clinical comparability (safety and efficacy) with the innovator's product by Biocon Limited, Bangalore

The objective of the project is development of Biosimilar Insulin Lispro process, a fast acting Insulin analogue and its commercialization in Indian market. Eli Lilly had the first insulin analogue with "lispro" as a rapid acting insulin analogue. It is marketed under the trade name Humalog. The cost of 3ml Humalog cartridge is ₹ 450, which is almost 10times higher than the cost of regular Insulin. Biocon's vision is to provide the affordable as well as good quality drug product to the Indian and world Diabetic patient population. Biocon is confident about achieving the target and meeting the deliverables with the cost effective proposed process plan. The project has been supported by DSIR for duration of three years.

The project is under progress.

Development of Long acting hormonal intra-uterine contraceptive device by M/s Famy Care Ltd., Mumbai

The project is to make a substitution of MIRENA. The innovative product is very expensive (About ₹ 8000/- per piece) and cannot be afforded by the masses of our country. LNG-IUS is imported in India from the innovator by Cadilla healthcare. There is no manufacturer in India or for that matter anywhere in the world other than the innovator who can provide the product at an affordable cost. An import substitution is the need of the hour. The objective in this endeavour is to manufacture LNG containing long acting intrauterine contraceptive devices which is generically equivalent to Mirena®. Due to the cost of the existing IUS product, most of the NGO's use a copper based device for contraception as opposed to safer and more effective LNG-IUS. The copper containing device has many problems during its insertion regimen like excessive bleeding, pain during insertion, irregular menses, etc. LNG-IUS overcomes all the problems of copper based IUD's and provides a safe and highly effective means of contraception. The project has been supported by DSIR for duration of three years.

The project is under progress.



E-waste Recycling & Precious Metal Recovery by Eco Recycling Ltd., Mumbai

E-waste is a growing concern and will continue to rise with the socio-economic developments; the present generation of 500,000 tons per annum will shortly reach to a million ton. This 'waste' is resource rich and also very hazardous too and therefore can't be ignored. Presently 'Kabadies' are dismantling end of life electrical & electronic equipments in their own style and leaving behind polluted air, water and soil for us to inhale, drink and eat toxic mixed eatables. The present proposal will provide complete solution to address all the relevant concerns and will help in recovering the precious metals from Printed Circuit Boards. The project has been supported by DSIR for duration of two years.

The project is nearing completion.

Manufacture of Magnesium & Calcium Metal Powder by M/s Ardee Business Services Pvt. Ltd.

The objective of the project is to manufacture of Magnesium and Calcium Metal Powder through Pidgeon process for use in steel industries. The project is aimed at manufacturing a total quantity of 10 MT of Magnesium and Calcium Metal Powder through various batches with varied operating conditions and the test the product in laboratory as well as industrial trial for their purity, performance and steel industry acceptability. For De-sulphurisation the use of Magnesium powder when indigenously developed will result in cost savings to the extent of around Rupees 3 to 4 thousand per Tonne of hot metal. So also Calcium metal will result in saving of around Rupees 2 to 3 thousand per Tonne of Steel. Traditional methods generates a huge amount of carbon di-oxide by burning Coal for heating the retorts. The present proposal will reduce energy requirement substantially. The project has been supported by DSIR for duration of eighteen months.

The project is nearing completion.

DSP based high-end active professional audio speakers by DSP based high-end active professional audio speakers by M/s Sonodyne Technologies Pvt. Ltd., Kolkata.

The project will produce the following range of high quality DSP based active professional speakers for application in studio, live and installed sound applications, converting core research into products by way of advanced testing and measurement, and creation of tools, and dies and fixtures to make production ready. The products have a world market. Importantly, there is also a large requirement in India. Primarily since these products are linked with development (FM, Bollywood performances, corporate presentations, product launches, entertainment venues, airport, railway stations). These are mushrooming all over a developing India. The project has been supported by DSIR for duration of two years.

The project is under progress.

Development of Coal dry beneficiation system -X-Ray based Sorting system for Indian Coals of size range 13-50mm (ArdeeSort) by Ardee Hi-Tech Pvt Ltd, Vishakhapatnam

The project is for development of field scale X-ray based sorting system to provide complete solution for coal dry beneficiation for particle size, in the range of 13-50 mm. This technology will yield similar results as compared to the existing technologies without using water as a beneficiating media but with lower water consumption, thus, leading to lesser effluent generation. The system electronics, removal technology, logic of separation is totally different than its competitors and there is no conflict on technology issues. The project has been supported by DSIR for duration of one year.

The project is under progress.

NLT 40% L-Dopa from Mucuna Prurius Seeds by BACFO Pharmaceuticals (I) Ltd., New Delhi

The objective of this project is to develop a process for Commercial Manufacturing of Standardized

Extract NLT 40 % L- Dopa from *Mucuna pruriens* (Kaunch) seeds. *Mucuna pruriens* (Kaunch) seeds have L-Dopa with hundreds of compounds, of different chemical groups. The potential ingredients from the seeds have been separated by the company with pH selective extraction, as combination of synergistic ingredients, with L-Dopa, highly useful in treatment of Parkinson's disease. Laboratory Experiments of 1.0 Kg. batch size have been successfully completed to produce free flowing yellow brown powder having NLT 40 % L-Dopa with 61 gm yield. Now the company will develop Commercial Manufacturing of Standardized Extract NLT 40 % L-Dopa from *Mucuna pruriens* (Kaunch) seeds at 500 Kg. batch size pilot plants. The project has been supported by DSIR for duration of two years.

The project is under progress.

Development of Indigenous Technology of Materials for Nano Photofunctional Applications by IICT, Hyderabad, and Sapala Organics (P) Ltd., Hyderabad

The project is to develop the pilot scale process to manufacture two ruthenium polypyridyl complexes based materials for Nano Photofunctional Applications used in Dye sensitised solar cells (DSC) dyes. The technology at bench scale level (2 grams) has been developed at IICT, Hyderabad. The proposal aims to develop the technology at 500 grams to 1 Kg level in pilot plant. Dye sensitised solar cells (DSC) have emerged as a very promising source of energy at considerably lower costs. The functioning of DSC mimics natural photosynthesis in that the photoreceptor and charge carriers are different elements unlike a PV cell where the semiconductor assumes both the functions. This separation of functions reduces the stringent purity requirements of the raw materials and consequently makes DSC a cheaper alternative. The advantages of DSC, apart from being a low cost alternative, include Good performance under standard reporting conditions, Stable performance under non-standard conditions of temperature, incidence angle etc., Semi-transparency and multi-colour range possibilities. The dye in the DSC needs to fulfil several requirements,

the most notable ones being a broad absorption spectrum, adequate ground and excitation states, long stability, no toxicity and good adherence. The most successful dyes to date belong to the family of ruthenium complexes. Other alternatives are still being pursued due to the scarcity of ruthenium. There are no manufacturers of DSC or the dyes for DSC in India. The project is supported by DSIR for duration of 24 months.

The project is under progress.

Purification of Gas Gangrene Clostridium Toxins & Development of Monovalent and Polyvalent Antitoxins by VINS Bioproducts Ltd., Hyderabad.

The objective of this project is production of gas gangrene causing toxins from three different *Clostridium* strains namely *C. perfringens*, *C. septicum* and *C. novyi*, purification of toxins from the culture media by chromatography based methods, development of strategic immunization schedule for obtaining high titre antitoxin from equines, standardization of F (ab')₂ purification from equine plasma and testing the efficacy of the purified antitoxin by animal assays and user trials. The project has been supported by DSIR for duration of forty two months.

The project is under progress.

Development of Small size pistons for Two Stroke Engines by high pressure die casting process by Abilities India Pistons & Rings Ltd., Delhi

There is current trend to revive the 2 stroke version of the engines for the smaller versions of the engines for applications like Chain saws, Brush cutters, Hedge trimmers and agricultural sprayers basically from the point of view of utilizing the inherent advantages of the 2 stroke engines with upgraded technology in the manufacture of the components with lesser weight, lower inertia masses with added cost advantage coupled with high productivity. One of the upgraded technologies currently being tried out internationally is to produce the most vital component like the



Pistons for the Engines in High pressure die casting process which offers the possibility of producing the components with intricate shapes and contours with thin walled sections with "Near Final Shape" without any additional machining for achieving these shapes which render the engine more efficient in terms of improved fuel economy and reduced emissions.

Under the project the company proposes to develop small size Pistons (size 44mm for 50cc Engines and size 37.08mm for 33cc engines) with high silicon content for two stroke engines employed in specialized applications like chainsaw, brush cutter, trimmer etc. adopting the high pressure die casting process, which is being attempted for the first time in India. The project has been supported by DSIR for duration of 24 months.

The project is under progress.

New Process Development for Special Elastomer Compound by M/s. Som Shiva (Impex) Limited, Ahmedabad

The objective of the project is regenerating Polymer which has gone through certain heat cycles there by imparting specific end-use properties. However the challenge is processing the Elastomer and granulating it. It is essential to Incorporate Low melting temperatures of Elastomer and High melting temperatures of Polymers while compounding in the Polymer Matrix and in order to do so, metered feeding is necessary to make it a commercially viable proposition.

The project has been supported by DSIR with a grant of ₹ 270.00 lakhs out of the total project cost of ₹ 774.25 lakhs for duration of 24 months. The Project is under progress.

Development of Biofertilizers (Emulsifiable Concentrate) for Nutrient Management of Agricultural Crops by M/s T. Stanes and Company Ltd., Coimbatore

The objective of the project is to improve the existing technology for liquid formulation of Bio-

fertilizer, to have greater shelf-life, to improve the efficiency of the microbes and faster regeneration of the microbes when applied to the soil to enhance the growth, avoiding contamination during storage and keeping the shelf-life for a minimum of 2 years.

The project has been supported by DSIR with a grant of ₹ 260.00 lakhs out of the total project cost of ₹ 654.00 lakhs for duration of 12 months. The project is in progress.

Smarter Material Handling Automated Guided Vehicles (AGVs) by M/s Hi-Tech Robotic Systemz Ltd., Gurgaon

The objective is to develop an AGV Pallet Truck, which combines an autonomous navigation system with a pallet handling system with a new generation of AGV controller, a new power pack and guidance system. The two-fold goal of this project is to: (a) Develop an indigenous vehicle as a substitute for vehicles that currently must be imported into India & (b) Gather essential know how on the processes required to create the specifications for and to install a system comprising the above type of AGV.

The project has been supported by DSIR with a grant of ₹ 40.00 lakhs out of the total project cost of ₹ 150.70 lakhs for duration of 24 months. The Project is under progress.

Development & demonstration of technology to manufacture a new dosage form namely Oral Thin Films by M/s ZIM Laboratories Ltd., Nagpur

The project involves developing of an innovative product i.e. oral thin film producing machine and its process thereof. The method comprises formulation of solution/dispersion/ emulsion required for solvent casting and its characterization. Clinical design and fabrication of machine with larger capacity for film formation of polythene sheets, film rolls, transdermal patches, paper lamination etc. is the uniqueness of this proposal for making oral thin film over the

medicines. These machines would achieve the affordability of final product substituting the foreign machine with higher cost. The proposed product and process will help in drug delivery in general and for paediatric and geriatric use in specific.

The project has been supported by DSIR with a grant of ₹ 70.00 lakhs out of the total project cost of ₹ 352.50 lakhs for duration of 36 months. The Project is under progress.

Integrated energy efficient system with automated control facility for varied climatic conditions by M/s Saveer Biotech Ltd., New Delhi

The objective of the project is to develop, integrate and standardize energy efficient automation system for the development of HI-Tech controlled production facility for varied climatic conditions, innovation in Structural Aspect of Green Houses, flexibility in Ventilation for saving energy, automation for optimum utilization of Ambient conditions, integration of abiotic factors.

The aim is to develop innovative solution for greenhouse technology coupled with effective product development whilst ensuring safety, manufacturability and cost effectiveness. The technology developed in this project will make it possible to control the system in such a way that the temperature can be drastically reduced upto 8-10°C which in itself is a revolutionary innovation. This project will be a highly energy efficient in turn to reduce the cost of various operations in the greenhouse thereby increase the acceptability of the greenhouse technology in the areas where energy supply is either very insufficient or even not available and will help in horizontal spread of the technology with justified economical and ecological concerns.

In this project the integration of the different abiotic factors like temperature, humidity, light, CO₂ will be done which is a very novel concept as no such technology has been developed till date

which integrates the abiotic factors in the greenhouse. With the technology developed in this project the factors can be integrated in such a way so that they will complement each other for providing zed conditions for the crop production in the greenhouse.

The project has been supported by DSIR with a grant of ₹ 200.00 lakhs out of the total project cost of ₹ 447.50 lakhs for duration of 24 months. The Project is under progress.

Application of Layered Manufacturing technique for development of new light weight drive chain for two-wheelers with modified work material and optimized processes by M/s Rockman Industries Ltd., Ludhiana

The project aims at development of a new light weight drive chain with layered manufacturing method. The objectives of this new product development are:

- Rapid proto development using incremental forming process and layered manufacturing.
 - Experimental trials with new variety of Medium Carbon Steel for achieving weight reduction (Target at least 15%).
 - Process qualification for heat treatment and tempering process for the new material proposed to be used.
 - Optimize the fits and tolerance of mating parts to improve Delayed fracture test.
 - Develop new test procedures to evaluate the vibrations and noise from the new chains.
- i) The company proposes to design and develop a light weight chain with 15% reduction in weight compared to our existing chain for two wheelers. The innovation involves selection of new raw material for Pin, Bush and plates with respect to existing chain model. SAE 1050 for plate being used for the existing chain will be replaced by SAE 1045 in the new chain. For Pin the existing model is in 15B25 where



as in new model, it is proposed to use SCM420. For Bush, the existing model is in 16MnCr5 where as new one will be in SAE8620. This will increase the endurance and fatigue strength of the drive chain.

- ii) The other major change is proposed to be made in the Heat treatment process. The new process will be designed and qualified as per the requirement of the chemical and mechanical properties of the proposed raw materials. This is expected to increase the endurance and fatigue strength.
- iii) Rapid development of parts for the new chain as a prototype is proposed by using the principles of layered manufacturing, sculptured surface machining called incremental sheet metal forming. These processes enable three-dimensional generation of freeform surfaces without using a component specific tooling and therefore have the potential to significantly reduce the cost of rapid manufacturing. One of the important requirements for commercializing is the capability to form components with desired accuracy and surface finish. The major steps in this process are:
 - Creating the geometry/ solid model of the component,
 - Saving it in .STL or .STEP format,
 - Developing the code to detect the coordinates and triangulation/tessellation using the .STL or .STEP file,
 - Selection of incremental depth,
 - Finding the sectional points along the profile at the constant depth and doing the same moving incrementally.
- iv) It is also proposed to introduce Shot Peening of plates which will be a first time for a chain in India. They are not using this method in our existing chain models. This process is expected to help improve the fatigue strength.
- v) In the design of parts and assembly of chain, it is proposed to change the fits and tolerance

of mating parts up to the optimum level to enhance the duration of Delayed fracture test.

The project has been supported by DSIR with a grant of ₹ 295.00 lakhs out of the total project cost of ₹ 696.70 lakhs for duration of 36 months. The Project is under progress.

BLDC Motor and control for hybrid car on transmission shaft by M/s. S K Dynamic Pvt. Ltd., Roorkee

The objective of the project is to develop, fabricate, test and commercialize the Brushless DC motor (BLDC) and control for hybrid car.

Company has found an innovative concept in their design for HEV application. It is essential to operate motor at high torque in low speed range while it should be able to sustain high speed. The unique innovative design handles this issue by rotating two bodies of motor and thus reduces Back EMF at high speed. Company has also filed the patent application.

The project has been supported by DSIR with a grant of ₹ 360.00 lakhs out of the total project cost of ₹ 1093.00 lakhs for duration of 24 months.

Development and Demonstration of Innovative Technology for the automation of Firework Manufacturing by M/s Sri Kaliswari Fireworks Private Ltd., Sivakasi, Tamil Nadu.

The objective of the project is to develop machinery for automation of weighing, mixing, filling, drying and packing of cracker manufacture. The introduction of automation in fireworks manufacturing process will lead to achieve:

- Upgradation of technology in fireworks industry which is at present carried on manually
- Finding out a solution for the acute shortage of labour

- Reducing the cost of manufacturing so that the Indian firework manufacturers can compete with the foreign competitor-earning of foreign exchange
- Reduction of energy consumption by introducing solar energy in some of the production process like drying
- Controlling the wastage of raw materials by the introduction of automatic weighing system, electronically controlled manufacturing process like mixing and filling through machineries.
- Improving the working conditions of workers and reducing the occupational hazards
- Production of quality fireworks free from manufacturing defects and malfunction by improved process control and strengthening the testing and evaluation facilities
- Application of computer hardware and customized software packages for the improved and safe process control, inventory management and integration of different processes of the fireworks manufacturing through online monitoring.

This proposed project aims to automate most of the production process in order to achieve elimination of human touch of toxic chemicals, improving the occupational hazards, improving the productivity and elimination of environmental pollution. The increased productivity after incorporating the above innovations will achieve the cost reduction particularly after completion of the pilot test and starting the regular scaled up commercial production.

The project has been supported by DSIR with a grant of ₹ 83.00 lakhs out of the total project cost of ₹ 225.84 lakhs for duration of 36 months.

Development of Uni-Density Insulator for Vehicles by M/s Uniproducts (India) Ltd., Noida

The need for a uniform density insulation part is to cater to the future requirements of the

automobile industry. The lamination with the current technology using fibre is the non linear density of the insulation material which necessitates usage of higher GSM in areas of the dash because the clearance of the lowest thickness of the dash insulator determines the uniform weight area of the felt in the part. The proposed activity intends to make an improvement in process and product during the manufacture of NVH components (mainly UNI-density dash) that will enable production of parts having superior insulation quality along with lower weight and having uniform density across the entire area of the part.

The challenge to pre-commercialization would entail injecting fibre in moulding process with the mould being able to take the contours and shape of the final product. The designing of the shape would inter alia depend on the shrinkage of the fibres during the moulding stage. Detailed study would need to be taken to establish the shrinkage of the fibre so that the tolerance can be given to the cage where fibre will be injected for moulding.

The project has been supported by DSIR with a grant of ₹ 150.00 lakhs out of the total project cost of ₹ 328.04 lakhs for duration of 15 months. The Project is under progress.

Innovative Product Development and manufacturing Process for three important oncology therapeutic recombinant proteins- GCSF, IFN alpha 2b and L-asparaginase by M/s A.R.A. Healthcare Pvt. Ltd., Gurgaon

To develop the process for the commercial scale production of pharmacopoeial grade of three biosimilar molecules namely Granulocyte Colony Stimulating Factor (GCSF), Interferon alpha-2b (IFN α 2b), and L- Asparaginase.

The company has constructed over expressed clone with strong promoter optimized codon bias for protein expression in *E.coli* system. Optimized high cell density fed batch fermentation condition at lab level to produce 4-5 gm per liter protein.



Develop simplified process for the folding and refolding of over expressed solubilised protein. Two steps simplified and scalable protein purification process has been optimized at lab scale level for these proteins.

The project has been supported by DSIR with a grant of ₹ 305.00 lakhs out of the total project cost of ₹ 864.75 lakhs for duration of 24 months. The Project is under progress.

Rapid Diagnosis of Malaria by Multiplex Fast-PCR Assay by M/s Chromous Biotech Pvt. Ltd., Bangalore

The proposal envisages the development of Fast-PCR (FasTaq™ polymerase-based) and multiplexed primer sets that facilitate diagnosis of malaria (consensus primers) as well as discrimination of *P. falciparum* from other *Plasmodium spp.* (amplification of specific genes). Both PCR products will be detected using VeriPCR™ and if found positive, visualized on agarose gel using GreenView™ to discriminate *P. falciparum* from other species of Plasmodium. It has a huge potential in India and abroad with great social impact.

The project has been supported by DSIR with a grant of ₹ 118.00 lakhs out of the total project cost of ₹ 397.30 lakhs for duration of 36 months. The Project is under progress.

Development & commercialization of Rapid cast Technology for manufacturing of stainless/steel castings of weight 5000 Kgs single piece by M/s PTC Industries Limited, Lucknow.

Main objective of the project is to reduce the cumbersome process of making dies and mould of the product which requires lot of time and investment and not only makes the product/ part costly but also increase the production lead time. The rapid cast would be the most innovative and revolutionary Casting Technology. With Rapid Cast “Near Net Shape” castings of highly complex geometrics, in a variety of difficult metallurgies,

can be produced weighing up to 5,000 Kgs single piece. Further, all this can be done while keeping the environment in mind and keeping the emissions to the minimum. The casting of 5000 kgs single piece is new in India. M/s. PTC is the first company who will develop rapid cast technology for manufacturing of stainless/steel castings in India.

The project has been supported by DSIR with a grant of ₹ 500.00 lakhs out of the total project cost of ₹ 1800.00 lakhs for duration of 24 months. The Project is under progress.

3-Dimensional Mixer by M/s. Hexagon Product Development Pvt. Ltd., Vadodara

The objective of this project proposal is to design and development of 3-Dimensional mixer of 500 litres capacity and bringing in Indian market for pharmaceuticals, paints, construction and finishing industry.

The project envisages the design and development of 3-Dimensional Mixer which will be used for efficient mixing of powder and liquid materials. As proof of concept, the company has already developed a prototype of 20 litre capacity which the company wants to scale up to 500 litres capacity.

The project has been supported by DSIR with a grant of ₹ 60.00 lakhs out of the total project cost of ₹ 182.00 lakhs for duration of 36 months. The Project is under progress.

Development of novel Biopesticides from Antagonistic Microbes Bacillus subtilis and Trichoderma viride using Dextrose as a carrier by M/s. Nirmal Seeds Pvt. Ltd. Jalgaon

The objective of the project is to develop novel, eco-friendly dextrose base Biopesticides, Reactor Design and process optimization, to develop economic control method for formulation, its bioassay, field trials, product validation etc. and implementation and publicity of classical biological control strategy.

The project envisages development of novel bio-pesticides from antagonistic microbes *Bacillus subtilis* and *Trichoderma viride* using Dextrose as a Carrier. The company has formulated these bio-pesticides in the lab and want to scale up these bio-pesticides. *Trichoderma Viride* is a green coloured, fast growing beneficial fungal species. It has multiple uses in crop protection, as a bio control and decomposing agent.

The project has been supported by DSIR with a grant of ₹ 46.00 lakhs out of the total project cost of ₹ 127.59 lakhs for duration of 24 months. The Project is under progress.

Design and Development of Biological Toilet System by M/s. Stone India Ltd., Kolkata

The objective of the project is to eliminate open defecation fully and to prevent human wastes from being dumped on the ground this is a major cause of disease in the country, to convert human waste and other bio degradable substances into water and gas through biological digestion using bio media, to make further purify of resultant water & recycle for flushing, discharged on the ground or used for agriculture satisfying environmental limits.

Stone India Ltd has been working on the Biological Toilet Project development for the last three years. The concept of bio digester tank has been jointly developed by Stone India Limited along with its technical collaborators both in India and overseas. Stone India Limited has designed and installed Bio Toilet Modules which have been running successfully in the Indian Railways for over a year now. Regular monitoring of the Bio Toilets is done so that the effluents discharged can be collected and tested to be within the specified limits laid down by the railways and to collect passenger feedback for improvements in the system. Now, the main challenge is to incorporate these bio digesters in the stationary toilets so that they can function efficiently and the effluent discharged lie within the accepted environmental standards.

The project has been supported by DSIR with a grant of ₹ 288.00 lakhs out of the total project cost of ₹ 611.80 lakhs for duration of 12 months. The Project is under progress.



Biological Toilet System M/s Stone Indian Ltd., Kolkata

Development and Commercialization on Low Temperature Polymer Exchange Membrane Fuel Cell and Stack by Elpro Energy Dimensions Pvt. Ltd., Bangalore

The objective of the project is Development of Polymer Exchange Membrane fuel cell stacks for stationary applications in the temperature ranges in room temperature.

The development of fuel cells is very critical in view of the energy and environmental considerations. The work on low temperature and high temperature fuel cells for stationery applications is being carried out at IIT Mumbai and upon successful development the company shall manufacture the same commercially. The fuel cells developed at proof of concept level at IIT Mumbai delivered the power of 0.2 watts per cm² with air as an oxidant. However, further development work needs to be carried out, initially



at IIT and subsequently upto pilot scale at the company before commercialization.

The project has been supported by DSIR with a grant of ₹ 326.90 lakhs out of the total project cost of ₹ 957.62 lakhs for duration of 30 months. The Project is under progress.

Smart Closed Loop Energy Management Solution by M/s. Genus Power Infrastructures Ltd, Jaipur

The main objective of the project is to reduce transmission, distribution and commercial losses in LT distribution system through smart closed Loop Energy management system. This solution leverages the potential of Power management with IT and Telecommunication technologies to help utilities realize the hitherto unrecoverable revenues; to monitor and control losses in an LT distribution network. It encompasses Automatic and Remote meter reading for a group of 1ph and 3ph LT/HT consumers mapped to a distribution transformer which in turn is mapped to a feeder; to provide closed loop metering rendering the abnormalities immediately on the GPS map, enabling specific and concentrated counter-measures; to establish a management server to monitor and control the billed and unbilled electricity consumption etc.

The project has been supported by DSIR with a grant of ₹ 290.00 lakhs out of the total project cost of ₹ 182.00 lakhs for duration of 30 months. The Project is under progress.

Biogas Plant using Dry Digestion of Biomass water for Power, Heat and Fertilizer by M/s Mojj Engineering Systems Ltd., Pune.

The main objective of the project is to design, develop and demonstrate of 100 KWh biogas pilot plant based on dry digestion technology using wet biomass residue from vegetable market as well as agricultural wet biomass waste.

The project has been supported by DSIR with a grant of ₹ 260.00 lakhs out of the total project cost

of ₹ 5786.20 lakhs for duration of 24 months. The Project is under progress.

Development of Process Know How for the Manufacture of Vinflunine, and anti cancer Molecule in API Form by M/s Vinkem Labs Ltd. Kakkalur Thiruvallur, Dist. Tamilnadu.

The objective of this R&D work is to evolve the process know how for the manufacture of the chemical Vinflunine Tartrate.

The project has been supported by DSIR with a grant of ₹ 38.50 lakhs out of the total project cost of ₹ 100.00 lakhs for duration of 12 months. The Project is under progress.

Bench an Pilot Scale Process Development for UV Reflective Security Inks & Pigments (UVRIP) by M/s Aron Universal Ltd., Bangalore.

The main objective of the project is to develop security inks and pigments with improved performance characteristics in terms of glow intensity under UV exposure, solvent resistance, reduced particle size and acid/ alkali resistance; to commercialize such state of the art novel UV-reflective security inks and pigments and thereby enhance the country's capability for its industrial as well as defense and security applications and thus improve their security, confidentiality and quick detection of their violations on the strengths of the self reliant indigenous technology.

The project has been supported by DSIR with a grant of ₹ 65.00 lakhs out of the total project cost of ₹ 169.58 lakhs for duration of 24 months. The Project is under progress.

Solid Handling Fluid transfer Pumps by M/s. Oriental Engineering Works Pvt. Ltd., Yamuna Nagar.

The objectives of the project is to design and develop the prototypes of solid handling fluid

transfer pumps and associated accessories (Vacuum Pumps, NRV's, Swimmer Box, Fabricated Open Structure, canopies etc.) as per the need of customers preferably European and UK market and test these pumps in house as well as in field for different application e.g. Viscous Liquids, Site Drainage, Raw/Process Water, Storm/Flood Water, Emergency Pumping, Sewage, Sludge, Slurry and Bentonite.

The project has been supported by DSIR with a grant of ₹ 100.00 lakhs out of the total project cost of ₹ 256.09 lakhs for duration of 36 months. The Project is under progress.

Development of Process Know How for the Manufacture of Vinflunine, an anti cancer Molecule in API Form by M/s TEJAS Networks LTD., Bangalore.

The objective of the proposal is to design, develop, manufacture and sell TD-LTE Macro eNodeB Base stations.

The project has been supported by DSIR with a grant of ₹ 550.00 lakhs out of the total project cost of ₹ 1814.90 lakhs for duration of 10 months. The Project is under progress.

Manufacture of Corey's Lactone and Prostanoids: Iloprost, Lubiprostone and Travoprost by M/s Sai Advantium Pharma Ltd., Hyderabad.

The main objective of the project is to synthesize Corey's lactone, a key intermediate required for the syntheses of several prostanoids; to synthesize Iloprost, Lubiprostone and Travoprost from Corey's lactone; to match purity of Corey's lactone with samples supplied by Cayman (US); to develop analytical methods for synthesized prostanoids.

The project has been supported by DSIR with a grant of ₹ 210.00 lakhs out of the total project cost of ₹ 528.00 lakhs for duration of 36 months. The Project is under progress.

Development of Chiral APIs by M/s Sharon Bio-Medicine Ltd. Mumbai.

The main objective of the project is to develop fermentation and downstream processes for Chiral Immobilized Enzymes for Target Molecules/Target Transformations) by:

- Screening of libraries for specific biocatalysts Isolation and production of identified variants
- Improvement of selected enzymes (biocatalysts) by means of directed-evolution
- Continued search and operation of new libraries
- Developing Fermentation capabilities in order to provide Enzymes for various Transformations
- Optimizing the enzyme/s, fermentation optimization followed down-stream process optimization to prepare the target molecule/s including use of immobilized enzymes and also using Walden inversions via enzymatic-switch routes.

The project has been supported by DSIR with a grant of ₹ 690.00 lakhs out of the total project cost of ₹ 1828.70 lakhs for duration of 36 months. The Project is under progress.

Development and Validation of a novel computer aided drug design (CADD) technology for drug discovery by M/s. Rational Labs Pvt Limited , Hyderabad.

The main objective of the project is to develop and marketing of an integrated CADD technology for drug discovery. Through this project the company will develop an integrated CADD technology for drug discovery, validation for Relative Solvation Free Energies of Small Molecules and Validation for a Diverse Set of Small Molecules and Drug Targets.

The project has been supported by DSIR with a grant of ₹ 260.00 lakhs out of the total project cost



of ₹ 574.00 lakhs for duration of 36 months. The Project is under progress.

Integrated energy efficient system with automated control facility for varied climatic conditions by M/s. Saveer Biotech Ltd., New Delhi.

The main objective of the project is to develop, integrate and standardize energy efficient automation system for the development of HI-Tech controlled production facility for varied climatic conditions; Innovation in Structural Aspect of Green Houses; Flexibility in Ventilation for saving energy; Automation for optimum utilization of Ambient conditions; Integration of abiotic factors.

The project has been supported by DSIR with a grant of ₹ 200.00 lakhs out of the total project cost of ₹ 447.50 lakhs for duration of 24 months. The Project is under progress.

Conversion of steel/iron forged/cast under chassis auto-components e.g. steering knuckles & suspension links to lighter weight aluminium equivalents by deploying advanced LPDC process by M/s. Synergies Castings Limited, Visakhapatnam.

The main objective of the project is:

Conversion of steel forged /cast under chassis auto-components to lighter weight Aluminum equivalents by deploying **advanced LPDC process**. e.g. Steering Knuckles & Suspension Links.

Conversion identified pilot components such as 'Suspension Links', 'Steering Knuckles' from cast/forged steel/iron components for commercial production with LPDC Aluminum equivalents.

Optimization of LPDC Equipment with temperature and flow rate dependent process controls.

Methodology of casting simulation, flow analysis & die design for LPDC.

The project has been supported by DSIR with a grant of ₹ 300.00 lakhs out of the total project cost of ₹ 613.00 lakhs for duration of 30 months. The Project is under progress.

Development of a novel, Cost effective liquid and stable Adsorbed Rabies Vaccine based on Vero Cell Platform by M/s. Pochiraju Industries Limited, Hyderabad.

The main objective of the project is to develop a safe and effective rabies vaccine technology superior to the existing ones which does not need ultra Centrifuge. The Vaccine formulation will be liquid stable and storable at 4°C with a shelf life of 2-3 years and a process that is highly reproducible and with complete removal of host cell DNA contamination.

The project has been supported by DSIR with a grant of ₹ 150.00 lakhs out of the total project cost of ₹ 380.00 lakhs for duration of 15 months. The Project is under progress.

Development of Endoxifen as a new efficacious and safe therapeutic agent for the treatment of breast cancer by M/s. Intas Pharmaceuticals Ltd, Ahmedabad.

The main objective of the project is the Development of a delayed release and scaleable Endoxifen formulation safer than the parent Tamoxifen as a selective estrogen receptor modulator.

The project has been supported by DSIR with a grant of ₹ 800.00 lakhs out of the total project cost of ₹ 1760.00 lakhs for duration of 36 months. The Project is under progress.

Development of Non-infringing processes for API's in pilot scale by M/s. Ogene Systems (I) Pvt. Ltd., Hyderabad.

Development of 17 Active Pharmaceutical Ingredients (APIs) (viz Telmisartan, Zolmitriptan, Levetiracetam, Irbesartan, Lacidipine, Valsartan,

Olmesartan Medoxomil, Manidipine Hydrochloride, Fosamprenavir, Montelukast, Linezolid, Nifedipine, Felodipine, Florfenicol, Bifonazole, Tamsulosin Candesartan) by non-infringing processes at in-house R&D from gms scale to Kgs scale in the pilot plant.

The project has been supported by DSIR with a grant of ₹ 600.00 lakhs out of the total project cost of ₹ 1509.28 lakhs for duration of 36 months. The Project is under progress.

Process development for Dibenzamido-diphenyldisulfide (DBD), dithidianiline (DTDA) and dithiodicapro lactam (DTDC) by M/s. Merchem Limited, Kerala.

The main objective of the project is to scale-up the process for making and commercialization of Dithiodianiline(DTDA) and Dibenzamido-diphenyldisulfide(DBD) based Peptizer and Reclaiming Agents starting from Benzothiazole and to scale-up the process for making and Commercialization of Dithiocaprolactam (DTDC) starting from Caprolactam.

The project has been supported by DSIR with a grant of ₹ 57.00 lakhs out of the total project cost of ₹ 114.00 lakhs for duration of 12 months. The Project is under progress.

Optimization and Pilot Plant trials towards commercialization of Standardized Colocynthin extract from the medicinal plant "Citruillus Colocynthis by M/s. SAMI Labs Ltd., Bangalore.

The main objective of the project is:

To optimize the extraction process of Colosynthin at several scale-up levels from 50 kg per batch to 500 kg per batch in the Pilot plant. And also to source quality raw materials from different parts of India and identify good sources.

To standardize the extraction process to be consistent, batch after batch, with respect to yield, assay and other product specification with optimized cost of production.

To confirm the safety of the product by in vitro methodologies available in Sami Labs Biology Research Laboratory.

To make samples of the standardized products as commercial samples for developing the markets globally.

The project has been supported by DSIR with a grant of ₹ 49.00 lakhs out of the total project cost of ₹ 103.40 lakhs for duration of 12 months. The Project is under progress.

Innovative Electronic Control System for PNG (Pipeline Natural Gas) fueled stationary engine by M/s. Minda Industries Ltd., New Delhi.

The main objective of the project is to develop an Engine management system consisting of electronic control units and sensors for Pipeline Natural Gas fueled Stationary Engines like Genset System at a significant lower cost, with an innovative self diagnostic feature and fully integrated system.

The project has been supported by DSIR with a grant of ₹ 50.00 lakhs out of the total project cost of ₹ 130.00 lakhs for duration of 24 months. The Project is under progress.

A New Approach for Synthesis of an Import Substitute 3-Methyl-N-Nitroiminoperhydro-1,3,5-Oxadiazine (MNIO), an intermediate for the Manufacture of Thiamethoxam by M/s. Insecticides (India) Ltd., Bhiwadi, Rajasthan.

Synthesis of an Import substitute 3-methyl-N-nitroimino perhydro-1,3,5-oxadiazine (MNIO), an intermediate used for manufacture of Thiamethoxam.

The project has been supported by DSIR with a grant of ₹ 127.00 lakhs out of the total project cost of ₹ 317.65 lakhs for duration of 24 months. The Project is under progress.

Innovative Rear View Mirrors for Automobile by M/s. SMR Automotive Systems India Ltd., Noida.



The main objective of the project is to develop innovative mirror which is smaller in size, but meets all legal regulations.

The project has been supported by DSIR with a grant of ₹ 200.00 lakhs out of the total project cost of ₹ 925.00 lakhs for duration of 30 months. The Project is under progress.

Design and development of ultra high pressure (6000 bar) pump by M/s. Water Jet Germany Pvt Ltd, Tamil Nadu.

Indigenous design and development of a pump which can build up pressures beyond 6000 bar for increasing cutting speeds, thereby improving productivity of the water jet cutting machine.

The project has been supported by DSIR with a grant of ₹ 100.00 lakhs out of the total project cost of ₹ 42.00 lakhs for duration of 24 months. The Project is under progress.

Innovative Process Development for the Manufacture of Peptide APIs by Neuland Laboratories Ltd., Hyderabad.

The main objective of the project is Process Development for commercial manufacturing of Peptide APIs' using three types of H-bond disrupters viz. Pseudoprolines dipeptides, Isoacyl dipeptides and Dmb-amino acids/dipeptides and further improvement on the current manufacturing processes for these H-bond disrupters.

The project has been supported by DSIR with a grant of ₹ 250.00 lakhs out of the total project cost of ₹ 734.76 lakhs for duration of 24 months. The Project is under progress.

Fuel Cell Bus development Programme by Tata Motors Ltd, Mumbai.

The main objective of the project is to Design, Develop and demonstrate Fuel Cell Bus and continue efforts to bring down cost to affordable level with a view to commercialization of Fuel Cell Bus.

The project has been supported by DSIR with a grant of ₹ 33 crores out of the total project cost of ₹ 61.62 crores for duration of 35 months. The Project is under progress.

New Product Development (Nitroscanate) by P.I. Drugs & Pharmaceuticals Ltd., Thane.

Synthesis of nitroscanate (1-isothiocyanato -4- (4-nitrophenoxy) benzene ($C_{13}H_8N_2O_3S$))

Nitroscanate is an anthelmintic of the diphenyloxy group. Nitroscanate is known to interfere with and inhibit the synthesis of ATP in *Fasciola hepatica* while A.M.P. levels are increased. The alterations in A.T.P. levels are shown to be irreversible and continuous with time. An initial increase in end-product formation, namely acetate and lactate is observed, possibly due to increased levels of the enzyme phosphofructokinase resulting from depletion of A.T.P. levels, but this increase is later abolished. In the nematode *Haemonchus contortus* adenine nucleotide pools are depressed by nitroscanate. Efficacy of nitroscanate is increased approximately four-fold if given with food due to slower passage of the drug through the gastrointestinal tract, with increased contact time with the parasite.

The project has been supported by DSIR with a grant of ₹ 80 lakhs out of the total project cost of ₹ 227.12 lakhs for duration of 18 months. The Project is under progress.

Process Development and Manufacture of Two APIs (Tapentadol and Lacosamide) targeted at specialized applications/ diseases by Indoco Remedies Ltd., Mumbai.

The main objective of the project is to develop a commercially viable process for synthesis and manufacture of APIs viz. Tapentadol Hydrochloride & Lacosamide.

The project has been supported by DSIR with a grant of ₹ 1100.00 lakhs out of the total project cost of ₹ 2200.00 lakhs for duration of 36 months. The Project is under progress.



C. TECHNOPRENEUR PROMOTION PROGRAMME (TePP)

1. PREAMBLE

Department of Scientific and Industrial Research (DSIR) under its Technology Development and Innovation Programme of erstwhile XI Plan TPDU Scheme had operated the “Technopreneur Promotion Programme (TePP)” from January, 2012 to March, 2012. The programme has been discontinued during XII Five Year Plan, hence new activities were not undertaken. The activities related to on-going projects were continued. TePP along with its network partners had provided grants support to individual innovators having original ideas to convert them into working models, prototypes etc. till March, 2012. The department has supported thirty-two (32) new projects (recommended for approval during the year 2011-12) during the period. The details of the completed, on-going and projects (recommended for approval during the year 2011-12) supported under TePP during the current year under report are given in Annexure 10. The programme has been discontinued during 12th five year plan in the current form. The details of some of the completed projects are given below:

Digital Hot Gold Foil Stamping/Stamping Machine

Gold foil embossing/stamping is widely used by academicians for printing title for their reports such as project reports, thesis, marketing reports, survey reports etc. The traditional process involves high

degree of labour, heavy machinery, time & design related investment such as die making etc. Shri Chopade of Mumbai has developed a Digital Gold Foil Embossing Machine, which aims to reduce all problems of traditional gold foiling/stamping. The jobs are performed digitally reducing time & manpower along with other advantages like ease in composing the material in different languages, fonts, sketches etc.

Crankshaft Metrology System

Shri Nicky D. Joshi of Vadodara has developed a Crankshaft Metrology System, now known as MetroForm & MetroLab, is a measurement tool used to evaluate the geometry of crankshafts. This a 3-axis, fully CNC system with a dedicated PC controller, with hardware for high speed data acquisition, and software for test set up, data acquisition and analysis. MetroForm at its concept stage was displayed at IMTEX 2011 at Bangalore. It has received the FIE Foundation Award for indigenous, innovative technology.

Multi-level Automatic Two –Wheeler Parking

Shri S. Venkataraman of Chennai has developed and designed a multi-level automated two wheeler parking system. It allows two wheelers to be stored and retrieved automatically from parking lots, available at multiple levels, in a safe, reliable and efficient manner offering effective space management. The invention is patented in India.



Multi-level Automatic Two Wheeler Parking

It has been designed for wide range of configurations—perpendicular and parallel parking.

Low Specific Cost Solar Parabolic Dish Concentrator System by Madan Mohan Reddy, TUC, CSIR-CMERI, Durgapur.

The Innovator Shri Madan Mohan Reddy is executing his innovative work at CSIR-CMERI Durgapur. The novelty of the product resides in the use of thin reflector and a lighter supporting structure which leads to drastic reduction in the cost, achieved basically by dividing the whole dish into several concentric sets and by providing height/level differences in between which creates vents for the wind to escape. In this configuration, the wind load acting on each set of reflectors does not add up but escapes right from the place where the wind is incident.



Multi-layer scannable voice output communication aid and special access switches



Multi-layer, Scannable, Voice Output Communication Aid and Special Access Switches by Er. Shamit Patra, TUC, IIT, Kharagpur

Shri Samit Patra B.Tech. from IIT Kharagpur and self-employed has developed a portable communication device for the spastic children. A rough survey indicates that about 60% people affected with cerebral palsy are speech impaired. Gifted with all other faculties, they feel severely impaired to express. Voice output communication aids (VOCA) available abroad costs around US\$400-\$1000. Considering the prohibitive costs, Shri Patra has developed a product which provides high quality playback solutions for 8-16 minutes messaging applications. Some of the utility features of the device are : Easy to operate, Auto-scanning of backlit icons, around 16 messages stored per layer, corresponding to the icons, 4-layer device with layer selection switch, Portable device, which runs on rechargeable batteries/AC mains with adapter, low cost and so on.

2. OTHER ACTIVITIES

2.1 To expand the reach of TePP among common mass, thirty-seven (37) TePP Outreach Centres have been set up by DSIR. These are located at Sponsored Research and Industrial Consultancy

(SRIC), IIT Kharagpur (W.B.); Society for Innovation and Entrepreneurship (SINE), IIT Bombay; ERDC-Hartron, Ambala Cantt. (Haryana); Acharya Nagarjuna University, Guntur (A.P.); Technopark, Trivandrum (Kerala); Foundation for Innovation & Technology Transfer (FITT), IIT Delhi; Shri Siddhartha Institute of Technology (SSIT), Tumkur (Karnataka); Science & Technology Entrepreneurs' Park (STEP)-National Institute of Technology (NIT), Surathkal (Karnataka); TREC-STEP, Trichy (T.N.); JSSATE-STEP, NOIDA (U.P.); PSG-STEP, Coimbatore (T.N.); Vellore Institute of Technology-Technology Business Incubator (VIT-TBI), Vellore (T.N.); Central Glass Ceramics Research Institute (CGCRI), Kolkata (W.B.); Institute Industry Partnership (IIP) Cell, IT-BHU, Varanasi (U.P.); SIDBI Innovation & Incubation Centre (SIIC), IIT Kanpur, Kanpur (U.P.); Intellectual Property Rights (IPR) Cell, IIT Roorkee (Uttarakhand); College of Technology & Engineering, Udaipur (Rajasthan); National Institute of Technology (NIT), Silchar (Assam); Institute of Himalayan Bio-resources Technology (IHBT), Palampur (H.P.); Central Mechanical



Engineering Research Institute (CMERI), Durgapur (W.B.); Central Scientific Instruments Organisation (CSIO), Chandigarh; National Environmental Engineering Research Institute (NEERI), Nagpur (Maharashtra); Shri Padmavati Mahila Vishwavidyalayam (SPMVV), Tirupati (A.P.); International Crop Research Institute for Semi-Arid Tropics (ICRISAT), Hyderabad (A.P.), Central Electronics Engineering Research Institute (CEERI), Pilani (Rajasthan); NEIST, Jorhat; e-Health-TBI, Bangalore (Karnataka); Chhattisgarh Swami Vivekanand Technical University (CSVТУ), Bhilai (Chhattisgarh); Technology Business Incubator- University of Madras (TBI-UoM), Chennai; University Science Instrumentation Centre(USIC), University of Kashmir, Srinagar; Venture Centre (Entrepreneurship Development Centre), NCL, Pune; National Design Business Incubator(NDBI), National Institute of Design (NID), Ahmedabad; ICICI Knowledge Park, Hyderabad; Uttarakhand State Council for Science & Technology(UCOST), Dehradun; KIIT (Kalinga Institute of Industrial Technology)-TBI, KIIT University, Bhubaneswar; Confederation of Ayurvedic Renaissance Keralam Ltd. CARE-KERALAM), Thrissur; Amity University , NOIDA(U.P.)and so on.

2.2 A number of other activities organised/ participated by TePP during the year to sensitize academia, disseminate information on TePP to the larger mass of the populace network partners and impact generation among common masses:

- TePP innovators participated in Pride of India Science Exhibition (99th Session of ISC-2012) at KIIT University, Bhubaneswar (3rd–7th January, 2012).
- Participation of TePP with Techkriti 2012, IIT Kanpur [January 27-30, 2012].
- Review meeting of TUCs in association with CSIR-CMERI, Durgapur during February 26-27, 2012 at Durgapur.
- Workshop on Intellectual Property Rights, Drafting, Interpretation of Patent Specification and Claims at TUC, Udaipur (March 16-17, 2012).
- Participation of TePP innovators in R@W:Exhibition 2012 during ISBA – 2012 conference at Science and Technology Park, University of Pune [March 17-19, 2012].
- TUC network has further been expanded. During the current year two new TUCs being created at Confederation fo Ayurvedic Renaissance Keralam Ltd., Kerala (CARE-KERALAM), Thrissur and Krishma Cluster Development Society, Krishnagiri(T.N.)
- To diffuse the activities of TePP to a larger mass, an Annual Calendar consisting of profiles of TePP Outreach Centres were brought out.



D. TECHNOLOGY DEVELOPMENT AND UTILIZATION PROGRAMME FOR WOMEN

1. PREAMBLE

The Gender Cell has initiated action as per the guidelines/circulars issued by the Ministry of Finance for promoting gender budgeting. Steps have been taken to enhance the share of women in respect of beneficiary oriented schemes and a Technology Development and Utilization Programme for Women (TDUPW) has been launched. The programme is aimed to meet specific needs of women and to enhance their contribution towards technology capability building. The objectives of the programme are:

- Promoting the adoption of new technologies by women.
- Awareness creation and training of women on technology related issues with regard to women.
- Promoting technological upgradation of tiny, small and medium enterprises run by women entrepreneurs.
- Showcasing of appropriate technologies and organizing demonstration programmes for the benefit of women.
- Design and development of products, processes beneficial to women.

2. ACTIVITIES

Some of the projects taken up and currently under progress under the programme during the period under report are listed below:

Development of women entrepreneurs in advanced pottery technologies in Vilavancode taluk of Kanyakumari district

The main objectives of the proposal received from Centre for Social Development, Ammandivilai, Kanyakumari are to upgrade the skill of the women in pottery production technologies in scientific procurement, testing and processing of raw materials to suit the production activities, to introduce affordable and efficient mechanical devices for quantity and quality products fabrication and elimination of production drudgery, to introduce new designs in the products development and producing diversified value added products, to create effective marketing channels and outlets and to train the beneficiaries as entrepreneurs in collective/individual production system and run the units sustainably.

Empowerment of women through mushroom cultivation and value addition of mushrooms

The main objectives of the proposal received from Agricultural College and Research Institute,



Empowerment of landless SC/ST women through mushroom cultivation and value addition of mushrooms, TNAU, Madurai

TNAU, Madurai are creating awareness among women regarding cultivation and post harvest technology of mushrooms, motivation of women groups by training, demonstration on mushroom production and post harvest technology of mushrooms and empowerment of women and entrepreneurship development through Hands-on-training on mushroom cultivation and value addition.

To educate and train rural women of western Uttar Pradesh in the cultivation and processing of medicinal plants for the preparation of

nutraceuticals/ functional foods and health care products

The main objectives of the proposal received from Amity Institute of Herbal Research and Studies, Amity University, NOIDA are to educate and train women of the weaker section of the society in the identification and uses of locally available medicinal and aromatic plants and to educate and train them in the cultivation of medicinal plants at home stead and on community land and processing for the preparation of nutraceuticals/ functional foods and health care products for personal use and gainful employment.



III. ASIAN PACIFIC CENTRE FOR TRANSFER OF TECHNOLOGY (APCTT)

1. PREAMBLE

The Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology has been the national focal point of APCTT since its inception in 1977. Matters pertaining to the APCTT and UN-ESCAP are dealt with in cooperation with the Ministry of Commerce and Industry and the Ministry of External Affairs, Government of India. (DSIR) also plays an active role in APCTT's functioning, particularly relating to its programmes and policies. India being the host country for APCTT, has been providing institutional support of US\$ 200,000 in Indian Rupees for meeting local costs. In addition, funding for building repairs, renovation work, and municipal taxes was also provided. DSIR has also extended programme support towards the APCTT project entitled, "Promotion of National Innovation Systems (NIS) in Countries of the Asia-Pacific Region – Phase II". Among other Government of India support received by APCTT, the Ministry of New and Renewable Energy (MNRE) has funded another project entitled, "Establishing an Institutional Cooperation Mechanism to Promote Renewable Energy" in Asia and the Pacific.

The revised Statute of APCTT, adopted by the Commission at its Sixty-first session in May 2005, through its resolution 61/4, stipulates among other things, that the Centre shall have a Technical Committee consisting of experts from members and associate members of ESCAP and from inter-governmental and non-governmental organizations.

Members of Technical Committee shall be appointed by the Head of APCTT in consultation with the Executive Secretary of ESCAP. The Technical Committee shall be responsible for advising on the formulation of the programme of work and on technical matters concerning the operations of APCTT. The 8th Technical Committee of APCTT held at Manila, Philippines was attended by departmental representative. It is also stipulated that the Centre shall have a Governing Council consisting of a representative designated by the Government of India and no fewer than eight representatives nominated by other members and associate members of ESCAP elected by the Commission. The members and associate members elected by the Commission shall be elected for a period of three years, but shall be eligible for re-election. The members of APCTT's Governing Council for the period 2011-2014 are Bangladesh, China, Fiji islands, India, Indonesia, Islamic Republic of Iran, Malaysia, Nepal, Pakistan, Philippines, Samoa, Sri Lanka, Thailand and Viet Nam. The 8th Governing Council held at Bangkok during the year was attended by the departmental representative.

2. ACTIVITIES OF APCTT

During the period under report, the Centre has continued to assist the countries by focusing on the promotion of national innovation systems, technology transfer support services for SMEs, the promotion of critical emerging technologies such as renewable energy technologies, biotechnology, and nano-



technology, and the provision of information, networking and the sharing of experiences relating to the management of technology. Under these thrust areas, the Centre has undertaken a range of programmes of immediate relevance to the region in 2012 and following are the activities that have been implemented during the current year:

TECHNOLOGY TRANSFER THROUGH REGIONAL AND SUB-REGIONAL NETWORKING

Web-based Technology Transfer Services

APCTT continued to facilitate technology transfer in the Asia-Pacific region through its comprehensive and popular web-based regional technology transfer portal called Technology4sme (www.technology4sme.net) that was developed in consultation with its member countries. A companion website called Business Asia (www.business-asia.net) continued to serve as a network to bring together ideas, information and resources concerning technology-based businesses, particularly for SMEs. *The Asia-Pacific Technology Information Tracking and Unified Data Extraction search engine (APTITUDE)*, developed by APCTT during 2008 has been acting as an enabling platform for buyers and sellers of technology to have access not only to the APCTT database but also related databases from member countries that are in the public domain. APTITUDE is currently linked with about 20 public domain technology databases from APCTT member countries and beyond.

Asia-Pacific Traditional Medicine and Herbal Technology Network

The Asia-Pacific Traditional Medicine and Herbal Technology Network was initiated by APCTT and its member countries to disseminate information and promote industrial and technical cooperation on traditional medicine in the Asian and Pacific region. The Network (see www.apctt-tm.net) links 14 countries in the region (Bangladesh, China, India, Indonesia, Islamic Republic of Iran, Malaysia, Mongolia, Nepal, Pakistan, Philippines, Republic of

Korea, Sri Lanka, Thailand and Viet Nam) in the area of traditional and herbal medicine technology. APCTT has initiated several efforts to identify potential partner organizations for mobilizing resources and partnerships to revitalize the activities of the network. APCTT organized a Consultative Forum entitled, "Establishment of a Subhealth Intervention Technology Consortium in the Asia-Pacific Region" in Changsha, China during 24-25 September 2012 in partnership with the Ministry of Science and Technology, China and Hunan Agricultural University, Changsha, China with funding support from MOST, China. This Consultative Forum attracted the participation of representatives from several research institutions involved in the traditional medicine related research in 11 countries namely, China, India, Indonesia, Mongolia, Nepal, Pakistan, Philippines, Republic of Korea, Sri Lanka, Thailand and Viet Nam. This Consultative Forum provided a unique opportunity to deliberate on the possibilities for initiating new collaborative efforts for revitalizing APTMNET with a new and holistic approach for promoting regional cooperation among member countries in the form of establishment of an Asia-Pacific Consortium for Subhealth Intervention Technology (APCSIT) with the active involvement of APTMNET member countries.

Renewable Energy Cooperation Network for Asia and the Pacific

In accordance with Commission resolution 64/3 of 30 April 2008 on promoting renewables for energy security and sustainable development in Asia and the Pacific, APCTT implemented a project funded by ESCAP in 2009 that focused on supporting the development of an institutional cooperation mechanism for strengthening the capacity of member countries to adopt multiple approaches for promoting the utilization of renewable energy resources to meet their energy needs and foster sustainable development. The mechanism, in the form of a network of participating member countries was aimed to perform four major functions, namely:

- (a) Collection and dissemination of information on renewable energy technologies (RET) available globally;

- (b) Sharing of best practices on renewable energy promotion and utilization;
- (c) Development of the capacity to plan and implement RET transfer projects;
- (d) Promotion of research and development (R&D) collaboration in renewable energy technologies.

In July 2010, APCTT was able to obtain US\$250,000 from the Ministry of New and Renewable Energy (MNRE) of the Government of India for consolidating the progress made in developing the institutional cooperation mechanism under the project entitled, “Establishing an Institutional Cooperation Mechanism to Promote Renewable Energy” for the period July 2010 – June 2012. While the main objective of the first stage in 2009 was the creation of an information infrastructure to support the institutional cooperation mechanism, this project aimed at establishing the institutional cooperation mechanism. During the past two years, APCTT implemented several programmes at the regional level with the active involvement of the member countries of the Renewable Energy Cooperation-Network for the Asia Pacific (RECAP). The following activities were undertaken during the current year:

(a) Consultative Meeting for the “Establishment of a Renewable Energy Technology Bank (RET-Bank)”, 14 – 15 May 2012, Bangkok, Thailand. APCTT organized this Consultative Meeting in partnership with the Ministry of Science and Technology of the Royal Thai Government. It brought together representatives from 12 countries in the region namely, Fiji Islands, India, Indonesia, Mongolia, Malaysia, Nepal, Pakistan, Philippines, Republic of Korea, Sri Lanka, Thailand and Viet Nam. The primary aim of the Consultative Meeting was to discuss with the representatives from ESCAP member countries participating in the Renewable Energy Cooperation-Network for the Asia-Pacific (RECAP) Network of APCTT and deliberate on the establishment of a Renewable Energy Technology Bank (RET-Bank) with readily

available, commercially tested and proven renewable energy micro-systems developed by member countries, especially those that have potential “pro-poor” and rural applications. For implementing the recommendations of the Consultative Meeting, APCTT has entered into partnership agreements with selected institutions in the following member countries: China, Fiji Islands, India, Indonesia, Nepal, Pakistan, Philippines, Sri Lanka, and Viet Nam. The partner institution in India for this activity is the Centre for Wind Energy Technology (C-WET), Chennai, an autonomous organization under the Ministry of New and Renewable Energy, Government of India.

(b) Policy-Makers Forum on “Policy Analysis, Formulation and Development of Policy Instruments for Promoting Renewable Energy Technology Transfer and Adoption”, 23– 24 July 2012, Manila, Philippines. APCTT organized this Policy-Makers Forum in partnership with the Department of Science and Technology of the Republic of Philippines. This Forum was aimed to provide hands-on training for renewable energy policy-makers from member countries on tools and techniques available for analyzing the strengths and weaknesses of the current RET promotion policies at the national level; adopting and adapting best practices in renewable energy policy making; developing suitable policy instruments; and putting in place measures to ensure effective implementation of renewable energy policies. The Forum brought together policy-makers and senior experts from 10 countries namely China, Fiji Islands, India, Indonesia, Malaysia, Mongolia, Nepal, Pakistan, Sri Lanka and Thailand. One of the key recommendations of this Policy-Makers Forum was to organize a Regional Dialogue facilitated by APCTT to deliberate on ways and means to enhance energy security of RECAP member countries through cross-border cooperation in Off-grid renewable energy applications.

APCTT’s project on Renewable Energy was to end on 31 July 2012 as per the Trust Fund Agreement



entered between Government of India and ESCAP. However, the proposal to establish a Renewable Energy Technology Bank (RET-Bank) was a new additional activity proposed by the member countries that was not envisaged at the planning stage of this project. Hence, APCTT extended the duration of this project to 31 October 2012 with the concurrence of the Ministry of New and Renewable Energy, Government of India.

(c) Regional Dialogue on “Promoting Off-grid Renewable Energy Technologies for Enhancing Energy Security in the Asia-Pacific Region”, 4-5 October 2012, Chennai, India. Based on the recommendations of the Policy-Makers Forum organized in Manila, APCTT organised this Regional Dialogue in partnership with the Centre for Wind Energy Technology (C-WET), Ministry of New and Renewable Energy, Government of India. This Regional Dialogue was aimed to explore possible ways for enhancing regional cooperation among member countries of APCTT in the promotion of technology transfer and adoption of renewable energy technologies that have off-grid applications. Renewable energy experts and officials from 10 member countries of the RECAP mechanism namely China, India, Indonesia, Malaysia, Mongolia, Nepal, Pakistan, Philippines, Sri Lanka and Vietnam as well as from international organizations such as International Renewable Energy Agency participated in the Regional Dialogue and provided inputs and suggestions on how APCTT’s RECAP mechanism could accelerate the transfer and diffusion of renewable energy technologies in the Asia-Pacific region.

TECHNOLOGY CAPACITY-BUILDING AND PROMOTION AND MANAGEMENT OF INNOVATION

Promotion of national innovation systems in the Asia-Pacific region

Assisting members and associate members of ESCAP through strengthening their capabilities to develop and manage national innovation systems

is one of the primary mandates of the Centre, as stated in its statute.¹ In accordance with this mandate, APCTT has been promoting and strengthening the National Innovation Systems (NIS) in countries of the Asia-Pacific region since 2005. The Centre is currently implementing a second phase of the project (2010-2013) with funds received from the Department of Scientific and Industrial Research (DSIR), of the Ministry of Science and Technology, Government of India. This project aims to assist the participating countries in strengthening specific key component/s of NIS identified by each country and organize capacity building activities for policymakers, industries, universities/academia and R&D institutions (NIS key actors) to formulate, implement and manage strategic policies and programmes for developing effective working linkages/partnerships with other relevant key actors to transform technology innovation into products or services. A key feature of the second phase is the involvement of several countries with special needs (CSN) including Afghanistan, Bangladesh, Bhutan, Cambodia, Laos People’s Democratic Republic, Myanmar and Nepal.

The following activities were undertaken during the current year under this project:

(a) Study Visit to Nepal, 17-19 April 2012. APCTT and the Science and Technology Policy Institute (STEPI) of the Republic of Korea carried out a joint study in April 2012 on the current strengths and challenges of the national innovation systems of Nepal and to identify specific components of NIS that require interventions from the Government to strengthen the governance and performance of NIS. During this visit, the study team held meetings with 16 key actors of NIS that included the Minister of Science and Technology and senior officials from the various ministries of the Government of Nepal, senior executives of industries, heads of R&D organizations, faculty members of the universities and academia, industries and industry associations.

The findings of the study visit and diagnosis of the Nepal national innovation system were

presented at the workshop held in Kathmandu during July 2012.

(b) Workshop on “Linkages and Partnerships among Enterprises, R&D Institutions, Academia/ Universities to Foster Innovation and Transfer of Technology”, 17-18 July 2012, Kathmandu, Nepal and training on NIS On-line Resource Centre, 19 July 2012, Kathmandu, Nepal. Strengthening linkages and partnerships among NIS key actors was identified by Nepal as the key component of its NIS. APCTT and STEPI jointly organized this workshop in cooperation with Research Centre for Applied Science and Technology (RECAST), Tribhuvan University, Nepal and support from the Ministry of Science & Technology, Government of Nepal. This workshop, attracted the participation of policy makers, R&D institutions, academia and industries, experts from APCTT, STEPI and Nepal presented their views and deliberated on the following topics: structuring an NIS to foster linkages and partnerships among R&D institutions; academia and SMEs, key components of NIS; linking science and industry. In order to assist Nepal to design and develop its NIS On-line Resource Centre, a training programme was organized by APCTT after the conclusion of the workshop. The APCTT developed Asia-Pacific NIS On-line Resource Centre with the example of India case study was used to demonstrate the salient design elements and content aspects of the Resource Centre. RECAST has expressed their interest to develop such a Resource Center in cooperation with and support from the Centre. In this regard, APCTT is developing a Letter of Agreement (LoA) defining the technical assistance and financial support from the Centre and the role and responsibilities of the partner institution in Nepal.

(c) Workshop on “Incubatee Selection and Mentoring Strategy of Technology Business Incubator Management”, 9-10 July 2012, Jakarta, Indonesia and Training on NIS On-line Resource Centre in Indonesia, 11 July 2012, Jakarta, Indonesia. Technology Business

Incubator (TBI) has become an effective instrument in nurturing the growth of newly technology-based firms (NTBFs) both in developed and developing countries. As a follow up to the workshop on management of technology business incubator, organized in November 2011, selection and mentoring of incubate being a most important element of the TBI management strategy, APCTT organized this workshop in cooperation with the Centre for Innovation, Indonesia Institute of Sciences (LIPI) and the Association of Indonesia Business Incubators.. The objectives of the workshop were to enhance the practical knowledge of managers and senior staff of technology business incubators in Indonesia in the areas of incubatee selection and related mentoring processes and strategies; provide an opportunity for TBI managers and key stakeholders to develop a network to exchange experiences, best practices, and discuss expectations; and to highlight major issues and strategies needed to boost the growth of NTBFs and innovative SMEs in Indonesia and the Asia-Pacific region. A training programme on NIS On-line Resource Centre was also organized by APCTT after the conclusion of the two-day workshop at the Centre for Innovation. The APCTT developed Asia-Pacific NIS On-line Resource Centre with the example of India case study was used to demonstrate the salient design elements and content aspects of the Resource Centre. The Centre of Innovation, LIPI has expressed their interest to develop such a Resource Center in cooperation with and support from the Centre. In this regard, APCTT is developing a Letter of Agreement (LoA) defining the technical assistance and financial support from the Centre and the role and responsibilities of the partner institution in Indonesia.

(d) Workshop on “National Financing of Technology Innovation”, 30-31 October 2012, Hanoi, Viet Nam. Technology innovation entails different forms of financing at various stages of its transformation to commercial product/services. A workshop was organized by APCTT in cooperation with and as requested by the State



Agency for Technology Innovation (SATI) of the Ministry of Science and Technology, Government of Vietnam on 30 and 31 October 2012 in Hanoi, Viet Nam with the following objectives: (a) strengthen understanding of the importance of national technology innovation policy framework to promote innovation by key-actors (academia, R&D institutions and industries) of Viet Nam; (b) Appreciate the significance of various forms of financial support required to incubate, nurture technology innovation as well as technology-based entrepreneurship; and promote exchange of knowledge and lessons learned from other countries in setting up and governance of national technology innovation fund/s to enhance innovation based competitiveness of small and medium-sized enterprises. APCTT had invited experts from China, India, Malaysia and Republic of Korea to share their experiences with the participants of the workshop and to have in depth discussions with the senior officials of SATI.

(e) Consultative Workshop on “Innovation System Diagnosis and Strategy Development - Best Practices”, 28 November 2012, Manila, Philippines. Targeted technology-innovation initiatives are a key element of the development strategies of countries in the Asia-Pacific region. Such initiatives have to be aligned with or contribute to industrial production, job creation and further economic development of the countries. This consultative workshop was organized in conjunction with the APCTT’s Technical Committee meeting held on 26 and 27 November in Manila in cooperation with the Science & Technology Policy Institute (STEPI), of the Government of Republic of Korea and Technology Application and Promotion Institute (TAPI) of the Department of Science & Technology, Government of the Philippines. The workshop aimed to (a) Deliberate on the principles of science, technology and innovation (STI) policy guidelines, diagnosis and strategy development to promote techno-entrepreneurship and enhance competitiveness of small and medium sized entrepreneurs; (b) Share experiences and best practices of STI policy guidelines, diagnosis and

strategy development approaches and identify challenges of the Asia-Pacific countries; and (c) Explore opportunities for developing Asia-Pacific regional and sub-regional technology innovation systems for inclusive and sustainable development. Member countries of the Technical Committee were invited to participate in the consultative workshop and present their latest technology innovation policies and its delivery mechanisms, practices followed for diagnosing innovation systems, including its performance and development of strategies to strengthen the systems of innovation.

(f) Asia-Pacific NIS On-line Resource Centre. APCTT has developed a web-based resource centre namely, the Asia-Pacific NIS online Resource Centre (www.nis.apctt.org) for providing access to and disseminating information on various project activities, presentations made by national and international experts at NIS Forums and various regional and national workshops and its conclusions and recommendations. This would not only help the target users to appreciate current developments in the Asia-Pacific countries to mainstream technology innovation in national development but also facilitate networking with experts from various countries sharing their knowledge and experiences. The Resource Centre also contains knowledge resources related to the concepts, design, and development of NIS. It is envisaged that the Resource Centre will enable countries in the Asia-Pacific region to gain insights into the components of an NIS, critically evaluate their NIS, and best practices applied elsewhere.

MITIGATING CLIMATE CHANGE THROUGH ATTRACTING FOREIGN DIRECT INVESTMENT IN ADVANCED FOSSIL FUEL TECHNOLOGIES

Mitigation of climate change will not only require de-carbonizing the global economy through the promotion of cleaner advanced energy technologies but also steadily increase the efficiency in using fossil fuels in electricity generation. A project funded by the United Nations

is being implemented by UNECE, UNCTAD and ESCAP to enhance the capabilities of selected economies in transition and emerging market economies to attract foreign direct investment in advanced fossil fuel technologies for electricity. The countries participating in the project are Afghanistan, China, India, Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, Ukraine, and Uzbekistan.

ESCAP has assigned implementation of the India portion of the project to APCTT. The project aims to: (a) increase skills to develop and maintain an attractive investment climate to encourage foreign direct investment into the power sector based on coal and other fossil fuels to meet the growing demand for electricity and achieving related climate change goals; (b) improve cooperative relationships between energy policy makers and investors; and (c) increase skills to develop pre-feasibility studies on the power sector and related fossil fuels project. Under this project the following activities were carried out:

(a) Workshop on “Advances in Fossil Fuel Technologies and Investments for Power Generation” 06-07 June 2012, New Delhi. This workshop was organized by APCTT in cooperation with UNECE, UNCTAD, Ministry of Power, Government of India. The Main objectives of the workshop were to (a) deliver and discuss findings of the India baseline study on electricity generation, regulatory frameworks and investment climate having a focus on low carbon fossil technologies; (b) present an overview of current advanced fossil fuel technologies for power generation and their deployment in India and other selected countries; (c) present opportunities and challenges in developing and deploying advanced fossil fuel technologies in India; and (d) share experiences and best practices of funding and creating an investment climate for cleaner electricity production. Senior officials and experts from the government, regulators, utilities, producers and equipment manufactures in India and policy makers from the Governments of Afghanistan and Kazakhstan participated in the

workshop. About 25 experts presented their views and deliberated on the promotion and advances in the development of advanced fossil fuel technologies (AFFT) in India; national approaches, including investment policies and opportunities and challenges in deployment of AFFTs; investment and financing for deployment of advanced fossil fuel based power generation technologies in India and development of power sector with reference to AFFTs.

(b) “Towards a Greener Energy Future: International Investment in Advanced Fossil Fuel Technologies”, 08 September 2012, Xiamen, P.R. of China. This conference organized by UNCTAD in cooperation with the Ministry of Commerce, Government of P.R. of China was held in conjunction with the 16th China International Fair for Investment and Trade (CIFIT). It was aimed at fostering awareness of issues for attracting foreign investments and enhancing technology transfer in advanced fossil fuel technologies for electricity generation in China. It provided a forum to exchange issues and concerns among policy makers, businesses (including companies and financial institutions) and scholars with respect to an enabling policy environment. It examined the potential outward investment by Chinese companies into relevant projects in other countries. APCTT being the project partner institution participated to share key findings of the India baseline study and also assisted UNCTAD in identifying and participation of Indian experts at the conference. Experts from UNIDO, World Bank, ADB and multinational power equipment manufacturers presented their past experiences, future challenges and future opportunities and discussed the role of the corporate sector in greening the Chinese electricity generation.

(c) International Conference on Attracting Foreign Investment in Advanced Fossil Fuel Technologies, 14-15 November 2012, Almaty, Kazakhstan. An international Investor Conference on Attracting Foreign Investment in AFFTs was held in November 2012 in Kazakhstan and was organized by UNECE in cooperation with ESCAP-



APCTT, UNCTAD, World Energy Council, Global Sustainable Electricity Partnership and the International Project Finance Association. The overall outcome of the conference is to mitigate the climate change through deployment of advanced fossil fuel technologies through national and cross-border investments in and among Afghanistan, China, India, Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, Ukraine, and Uzbekistan - the project target countries. The conference looked at possible action to translate Rio+20 outcomes in the field of sustainable electricity and the role of fossil fuels. It also addressed technological choices for an efficient and sustainable energy future, including enhanced efficiency of power plants. The Conference provided opportunities to discuss in a private setting, potential inward and outward investment opportunities in the power sector among producers of electricity, manufacturer/supplier of power equipment/plants, and national and international investors. This high profile event was attended by stake holders from all the project target countries and various international agencies that promote international investment and energy for sustainable development. About ten high level officials from several Government agencies and public sector companies operating in the power sector in India participated in the Conference. A large number of delegations from India were invited and supported by APCTT to participate in this Conference. They include state power utilities, senior policy makers from the Ministry of Power, Government of India and central regulatory authorities in the power sector.

INNOVATION SYSTEMS FOR PROMOTING HIGH AND EMERGING TECHNOLOGIES IN THE ASIA-PACIFIC REGION

APCTT initiated a project on “Promotion of a Regional Network among R&D Institutes in the Asia-Pacific to Strengthen Capacity of R&D Management and Innovation in New and Emerging Areas of Technology”. Under this programme of work, the focus will initially be on the nanotechnology sector. A major objective is to create a regional network of R&D institutions

working in the area of nanotechnology-based value-added product development. It is envisaged that, through this network, best practices can be shared and R&D management capacity of researchers can be strengthened to promote collaboration in the area of nanotechnology-based value added product development to enhance the competitiveness of enterprises in developing countries of the Asia-Pacific region. The following activities have been carried out during the current year, under this project:

(a) Asia-Pacific Network for R&D Management in High and Emerging Technologies. APCTT is currently designing and developing a website as a regional information network on nanotechnology to serve as a one-stop shop for information about researchers, R&D projects, R&D outputs for commercialization, resource materials, country status reports, study reports, newsletter, etc The website would be enriched with contents in cooperation with the stakeholders in the participating member countries.

(b) “Manual on Critical Issues in Nanotechnology R&D Management: An Asia-Pacific Perspective”. APCTT is currently developing this manual to be used as resource material in the forthcoming capacity building activities for strengthening R&D management capacity of researchers/research managers in the participating member countries. The Manual would cover some of the following critical R&D management aspects that were identified at the Expert group Meeting (EGM), held in December 2011: (1) Nanosafety, standardization, and certification; (2) Protection and valuation of IP; (3) The commercialization of R&D results; and (4) Case studies on the development and commercialization of nanotechnology-based value added products from the Asia-Pacific region.

(c) Study visit to Sri Lanka, 14-15 June 2012. Sri Lanka has been quite active in the development and commercialization of nanotechnology based application technologies among developing countries in the Asia-Pacific region. APCTT carried out a study visit to two leading R&D

institutes - Sri Lanka Institute of Nanotechnology (SLINTEC) and Industrial Technology Institute (ITI) to learn how the R&D institutes in Sri Lanka: (1) work with industry to develop nanotech-based value added products; (2) protect and share their nanotech IP; and (3) ensure compliance to nanosafety, standardization and certification.

(d) Study visit to Philippines, 25-26 July 2012.

A study visit to two leading R&D institutes- Industrial Technology Research Institute (ITDI); and De La Salle University (DLSU) in the Philippines was undertaken to discuss with senior researchers engaged in the development of nanotechnology-based value added products and collect relevant information material for the training manual. APCTT interacted with 15 senior researchers of Materials Science Division (MSD) of Industrial Technology Research Institute (ITDI), Department of Science and Technology (DOST). A detailed presentation of nanotechnology R&D programmes of ITDI was made to the visiting APCTT staff. APCTT presented its current programmes, including the nanotechnology programme followed by a tour to ITDI's laboratories, and demonstrated how to use the technology4sme.net website to identify partners for commercialization of R&D outputs by the ITDI researchers. During the visit to De La Salle University, Manila, the APCTT staff had discussions with senior officials of the university regarding the purpose of the visit, relevant aspects of APCTT's nanotechnology programme and possible areas of cooperation. A series of discussions were held with a team of researchers and scientists who are actively engaged in the nanotechnology area. A tour was also undertaken to their respective laboratories to get an idea about their research facilities and capabilities.

TECHNOLOGY TRANSFER SERVICES

Technology providers (sellers) and technology seekers (buyers)

APCTT provides buyers and sellers of technologies with a technology trade platform and offers

technology exchange and transfer services to promote technology cooperation and trade among organizations and enterprises of the Asia-Pacific region. APCTT receives offers of, and requests for, technology from SMEs, research institutions, universities, business firms and business intermediaries. In addition to these web-based services, APCTT also facilitates technology transfer for SMEs through its networks of focal points and technology transfer intermediaries. When approached, APCTT offers search services to technology providers and seekers especially by partnering with its focal points and intermediary networks.

APCTT, through its networks of technology transfer intermediaries as well as its technology transfer portal (www.technology4sme.net) serviced queries related to 101 technology offers and 178 technology requests from SMEs and entrepreneurs across the Asia-Pacific region during the period from October 2011 to September 2012. The Centre's technology transfer portal, www.technology4sme.net, continues to serve as an active platform for information exchange between APCTT, SMEs and business firms in the Asia-Pacific region. Some specific examples of APCTT interventions to promote technology transfer partnerships include the following:

- (a) Facilitated contacts between an Indian company and a Chinese manufacturer for technology transfer related to the recycling of PET waste into Polyester polyols;
- (b) Facilitated contacts between an Indian company and a Bangladesh based business firm for technology transfer related to sodium silicate;
- (c) Helped a business firm in the Islamic Republic of Iran to establish contacts with technology suppliers in Egypt for the transfer of technology related to manufacturing pulp from waste paper;
- (d) Assisted an inventor in Sri Lanka for exploring technology transfer partnerships as well as registering for patent in India;



- (e) Assisted a Malaysian consultancy firm to explore business partnerships in several countries in the Asia-Pacific region;
- (f) Facilitated contacts between a technology provider from the Philippines and several business firms in Sri Lanka and India for exploring possibilities for technology transfer related to solar-assisted air conditioners.

Support to member countries for technology transfer

Acquiring technology through inter-firm technology transfer (TT) or from R&D institutions is critically important for SMEs with a view to enhancing their competitiveness and growth. Empirical evidence shows that planning and implementing effective technology transfer projects requires SMEs to possess or have access to a wide range of technical, business, regulatory and due diligence skills. Considering the large number of SMEs in the region, APCTT has embarked on a programme to develop trained personnel who can help SMEs to plan and implement technology transfer projects in a holistic manner. As an initial attempt, a Training of Trainers Programme on “Planning and Implementing Technology Transfer Projects” was organized by APCTT in partnership with the Technology Application and Promotion Institute (TAPI), Department of Science and Technology (DOST) of the Republic of the Philippines during 7-9 November 2011, Manila, Philippines for developing trainers chosen/nominated by the Technology Application and Promotion Institute (TAPI), Department of Science and Technology (DOST) of the Republic of the Philippines. This training programme attracted the participation of more than 40 technology transfer professionals and intermediaries in the Philippines who were trained on various aspects of planning and implementing technology transfer projects. Following a good response for this pilot programme organized in the Philippines, APCTT is currently exploring the possibilities for organizing similar programmes in Thailand and India and received few proposals from these countries.

The Asia-Pacific Business Forum was organized by United Nations Economic and Social

Commission for Asia and the Pacific during October 15-16, 2012 in Kuala Lumpur, Malaysia in collaboration with the Asian Strategy and Leadership Institute (ASLI), the Organisation for Economic Co-operation and Development (OECD) and the United Nations Development Programme (UNDP) and several other nodal agencies and institutions of the Malaysian government. APCTT organised the following two side events of APBF:

(a) APCTT-MOSTI-SIRIM Workshop for SMEs on “Valuation of Intellectual Property.” As one of the side events of APBF 2012, Asian and Pacific Centre for Transfer of Technology (APCTT) organized a “Workshop for Small and Medium Enterprises (SMEs) on Valuation of Intellectual Property” on 15 October 2012 in Kuala Lumpur in partnership with the Ministry of Science, Technology and Innovation (MOSTI), Government of Malaysia and SIRIM Berhad, Malaysia. This workshop was organized by APCTT to enhance the awareness of managers of SMEs in ESCAP member countries on various critical issues involved in the valuation of intellectual property, a key step in decision-making for acquiring a new technology by business firms. Hon. Secretary General of MOSTI, Malaysia, Dato’ Dr. Madinah Mohamad inaugurated the workshop. This workshop attracted the participation of over 50 participants from Malaysia, India, China, Philippines, Myanmar, Thailand Vietnam, Lao PDR, Cambodia and Indonesia as well as from few of the OECD member countries as well.

(b) Business-to-Business Meetings on Technology Transfer. Asian and Pacific Centre for Transfer of Technology (APCTT) in collaboration with United Nations Asian and Pacific Centre for Agricultural Engineering and Machinery (UNACAEM), SIRIM Berhad, Malaysian Agricultural Research and Development Institute (MARDI) and South-South Global Assets and Technology Exchange (SS-GATE) organized a Business-to-Business (B2B) meeting on Technology Transfer on 16 October 2012 in Kuala Lumpur. This B2B meeting was organized by APCTT and UNAPCAEM to provide an enabling

platform for business firms from ESCAP member countries to explore possibilities for technology-based business cooperation at the sub-regional and regional levels. The key focus areas of the B2B meeting were energy, agriculture, medical systems, electronics, food processing, and biotechnology. Representatives of business firms, chambers of commerce, government organizations involved in business promotion as well as research organizations interested in commercializing their technologies from Malaysia, Philippines, Indonesia, India, China, Philippines, Brunei Darussalam, Lao PDR, Thailand and Myanmar participated in the B2B meetings and made presentations on their specific interests and the nature and extent of cooperation sought by them which was followed by one-to-one meetings between interested technologies seekers and technology providers. As part of the B2B meeting, APCTT and UNAPCAEM created a “Myanmar Pavilion” and provided an opportunity for delegates from Myanmar to share information on investment opportunities and possibilities for business cooperation with Myanmar.

TECHNOLOGY INFORMATION SERVICES

The dissemination of technological information is one of the key functions of APCTT. Over the past three decades, the Centre has provided technology information services to national policymakers, SMEs and technology transfer intermediaries. During this period, the APCTT information services have evolved to focus on current issues while meeting the overarching goal of fostering balanced and environmentally sustainable growth of SMEs in the Asia-Pacific region. The *Asia-Pacific Tech Monitor* and the *Value Added Technology Information Services (VATIS) Update* series, periodicals published by the Centre, disseminate a range of technological information on latest technological innovations, technology policies, innovation management, technology transfer and events. As recommended by the Governing Council of APCTT in 2007, effective from the September-October 2008 issues, both the *Tech Monitor* and *VATIS Update* series have become completely web-based and may be

accessed and downloaded for free from www.techmonitor.net. As recommended by APCTT’s Governing Council and Technical Committee meetings held in 2010, the periodicity of *Asia-Pacific Tech Monitor* and *VATIS Updates* (excepting Ozone Layer Protection) were revised from bi-monthly to quarterly beginning January 2012.

During the past few years, APCTT has also brought out e-guidebooks and e-reports, on themes that are of contemporary relevance to SMEs. During the reporting period, APCTT has developed a Renewable Energy Business Directory for the benefit of business firms, technology transfer intermediaries and entrepreneurs interested in technology transfer and/or business partnerships in the renewable energy sector

STRENGTHENING COOPERATION WITH THE LEAST DEVELOPED COUNTRIES, LANDLOCKED DEVELOPING COUNTRIES AND PACIFIC ISLAND DEVELOPING COUNTRIES

As part of the project entitled “Establishing an Institutional Cooperation Mechanism to Promote Renewable Energy,” APCTT has made explicit efforts to involve least developed countries such as Bangladesh, Fiji Islands, Mongolia and Nepal in all the planned activities of this project. APCTT also made efforts to enter into partnership arrangements with selected institutions in Nepal and Fiji Islands through the modality of Letter of Agreement (LoA).

The second phase of the project to promote and strengthen the NIS in the Asia-Pacific Region among other developing countries, it includes Afghanistan, Bangladesh, Bhutan, Cambodia, Laos People’s Democratic Republic, Myanmar and Nepal. During the reporting period APCTT carried out a field visit to Myanmar and organized capacity building workshop in Nepal. APCTT is working with Laos PDR to organize a capacity building workshop on NIS focusing on technology transfer management.



Afghanistan is one of the target countries of the UNDA project implemented by UNECE, UNCTAD and ESCAP. This project is aimed to assist the countries to attract investments in advanced fossil fuel technologies for electricity generation with a view to support industrial and economic competitiveness, ensuring energy security and achieve low-carbon sustainable development. Four senior officials from the Government of Afghanistan participated in the workshop on advances in fossil fuel technologies and investments for power generation, held in June 2012 at New Delhi, India.

NORMATIVE AND ANALYTICAL WORK

To foster cooperation between its members in the promotion of economic and social development in the Asian and Pacific region, ESCAP undertakes a combination of normative, analytical and technical cooperation work. Regional-level analysis includes a review of the socio-economic performance in the region to identify trends, highlight good practices and foster regional cooperation. To assist ESCAP in this endeavour, APCTT has given priority to normative and analytical work with a regional perspective that could serve as a basis for operational activities. During this reporting period, APCTT has completed the development of the following publications:

- (a) “Effective management of technology transfer, in particular of clean and renewable technologies, for enhancing the competitiveness of SMEs, including its gender dimension.
- (b) Desk study report on “Policies to Promote Renewable Energy Technologies (RETs) in the Asia-Pacific Region”.

At the invitation of the Research and Information Systems for Developing Countries (RIS), India, APCTT shared the concept of NIS and its efforts to promote NIS and strengthen key components in the Asia-Pacific countries at the Sixth Asian Biotechnology and Development Conference held on 06-07 October 2012 in Hyderabad, India. This Conference was held in conjunction with Conference of the Parties (COP) to the Convention on Biological Diversity and Meeting of the Parties

(MOP) to the Cartagena Protocol on Biosafety.

One of the APCTT staff members delivered a guest lecture to the post-graduate students of International Relations programme of Keio University, Japan on “Energy Security and Sustainable Development in the Asia-Pacific”, December 26, 2011, Tokyo, Japan.

APCTT TECHNICAL COMMITTEE AND GOVERNING COUNCIL MEETINGS

The 8th Meeting of the Technical Committee of APCTT was held from 26-27 November, 2012 in Manila Philippines and the 8th Session of the Governing Council of APCTT was held on 14 December, 2012 in Bangkok, Thailand.

Foreign Deputations in APCTT activities from DSIR and Its organizations

Senior Officers of DSIR and its organizations were deputed as resource persons/participants to various events as given below :

- Consultative Meeting for the “Establishment of a Renewable Energy Technology Bank (RET-Bank)” organized by APCTT during 14-15 May 2012, Bangkok, Thailand.
- Workshop on “National Financing of Technology Innovation”, 30-31 October 2012, Hanoi, Viet Nam.
- Expert Group Meeting “Networking of R&D Institutions in the Asia-Pacific to strengthen capacity of R&D Management and Innovation in the field of Nanotechnology” 07-08 December 2011, Bangkok, Thailand.
- 8th Meeting of the “Technical Committee and Consultative Workshop on Innovation System Diagnosis and Strategy Development - Best Practices”, 26-28 November 2012 in Manila, Philippines.
- 8th Session of the Governing Council of APCTT, 14 December, 2012 at Bangkok Thailand.



IV. INFORMATION TECHNOLOGY AND e-GOVERNANCE

1. INTRODUCTION

‘Information Technology and e-Governance’ (IT-eG) division was formed in the mid of the Xth Plan period to facilitate the accelerated usage of various Information Technology opportunities and hence provide an IT enabled work environment in the Department. Primarily aims to convert the existing procedures and processes into *citizen centered*, IT-eG division keeps implementing e-Governance in the Department progressively in conformance to the National eGovernance Action Plan. For the implementation of an ‘IT Action Plan’, IT-eG Division operates on a separate IT Budget Head that came into effect in DSIR since FY 2004-05.

2. IT ACTION PLAN

For carrying out IT-eG activities in the department, a comprehensive IT-Action Plan was formulated in line with the Government directions issued from time to time:

- *Infrastructure Development:* Provide and maintain Personal Computers (PCs) and other essential IT- equipment and software to all the functionaries.
- *Networking:* Up gradation, extension and maintenance of the Local Area Network (LAN).

- *Office Automation:* Implement various applications software that not only maintain records of receipt, issue of letters and movement of files but also offer enhancement in accountability, responsiveness and transparency in governance.
- *IntraDSIR:* Enrich the contents of the IntraDSIR by including downloadable forms and circulars relevant to employees of the Department.
- *IT Training:* Provide relevant training courses to the officers/ staff that enable them to work on computers by using application software developed.
- *e-Reports:* Convert the Acts, Rules, Circulars and other published materials of interest or relevance to the public, in the electronic form.
- *Website:* Enrich the contents of the DSIR website by including downloadable forms and guidelines relevant to various citizen services that Department provides.

3. IT-EG ACTIVITIES

With the available program development and management skills and expertise, IT governance implementation activities that has been carried out during 2012-13 may broadly be categories into the following:

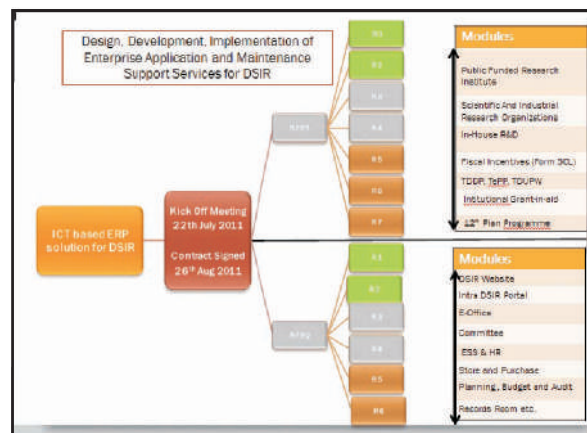


- (i) Maintained all the existed/created IT applications and infrastructure to ensure smooth functioning of IT-centric work environment.
- (ii) Identified some adoptable IT trends/application, validated /customized them for possible implementation along with an ERP solution that is being developed to add value to the existing IT-centric work environment.

A project in PPP mode that was initiated to facilitate evolve a highly productive and user-friendly, electronic knowledge-based workplace in DSIR, that would offer effective C2G & G2C services ensuring minimized overheads and prompt information availability, while adhering to Government of India Rules, Regulations and Policies, pursuing some key interventions through IT enablement of processes while building Enterprise Resource Planning (ERP) Solutions. Under this, the comprehensive set of initiatives have been taken to aim at transforming DSIR into embracing a performance culture - leveraging process redesign, automation of administrative procedures, enhancing collaboration/ networking, clarity in definition of roles (individual/ team/ cross-functional), analysis of required skill sets for various roles, augmenting team performances, workplace learning and mentoring, analysis of required skill sets for various roles, augmenting team performances, augmenting of skills, knowledge sharing, implement electronically enabled work places, electronic self services, and transparent mechanisms for decision support/ enhanced efficiency at all levels.

Number of modules are being developed have been grouped under two RFPs with pre-defined milestones. There are seven milestones under RFP1 that covers Enterprise Integration, Portal design for Program Implementation and e-Service Delivery. Similarly, there are six milestones under RFP2 that covers e-Enablement of the Processes, Workflow Management, Decision Support Systems, Record Management and Data

Warehousing & Mining. These milestones since were all prioritized with respect to various activities, several modules could go online.

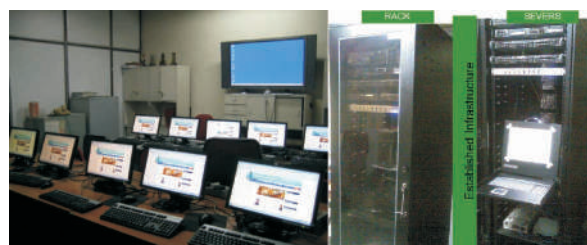


4. ACHIEVEMENTS

Several weekly review meetings were conducted that ensure adequate progress made on the project 'Design, Development, Implementation of Enterprise Application and Maintenance Support Services for DSIR'. Conforming to each points under the set Action Plan, the highlights on achievements through implementation of various infrastructure/ information systems developed has been as follows:

4.1 Infrastructure Development:

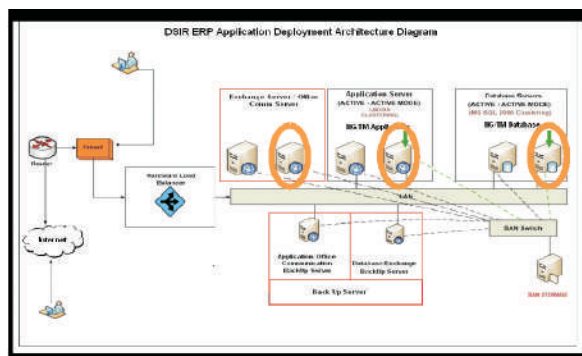
Various meetings of IT Committee were organized/attended as and when required, to assess and meet the specific recommendations to procure/develop IT related hardware/software. Department's stature has been mutated as it becomes one of the IPv6 compliance organisation, all those PC were not IPv6 compliance have been taken out of the existing intraNet and 46 of them have been replaced by



Thin Clients that operate over two new servers. IPv6 enabled Laptops were also issued to all Scientists/officers for use in office.

4.2 Networking:

The necessary hardware comprises of deployed switches and Rack mount servers in a Rack has establish a LAN connectivity that has been maintained with the help of services provided by NIC.



Through segmentation services over the routers, a VLAN for DSIR within Technology Bhawan was created and remain in use. A three levels Security Architecture has been adopted as authentication, use of cryptography/Encryption and allowing access to IP-restricted services. Three rack servers out of a proposed most suitable deployment architecture have been procured, installed and now made operational within an established SAN at CSIR HQ. These DSIR servers at CSIR HQ remain access able through a VPN service provided by NIC. A staging server with two production servers hosting numerous pre-audited software application housed at CSIR HQ, have facilitated the required full accessibility to developmental team in executing various activities on ERP solution project of DSIR.

4.3 Office Automation:

To enhance efficiency and transparency on the internal operations towards service delivery of an important component of the plan scheme of DSIR namely Industrial R&D Promotion, being a

regulatory Programme, ICT based Governance system has now been developed under RFP1 that has gone online for electronic submission of applications for registration / recognition / renewal of recognition for In-house R&D units & SIROs, Fiscal Incentives for Scientific Research, & PFRI.

Under this Enterprise Integration, Portal design for Program Implementation and e-Service Delivery, various modules now became operational have been the following:

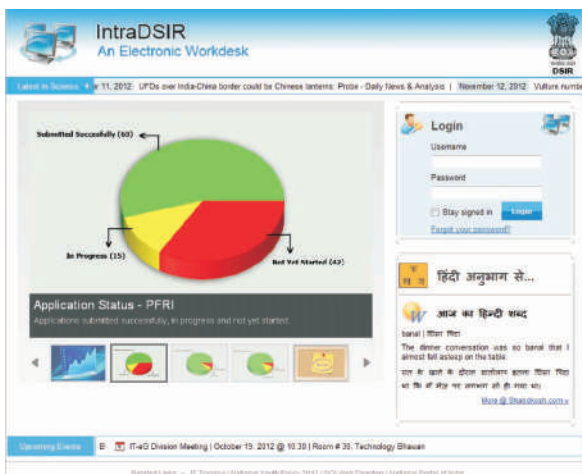
4.3.1 Extra DSIR

With the development and availability of a DSIR portal, the Institute/ organization/ individual could now use their authenticated ID and password on login button that has been made available at Home pages of existing website as well as on the revamped website of DSIR.



4.3.2 Intra DSIR

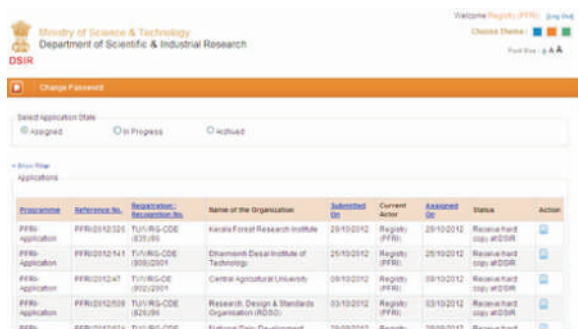
Once the submission of application online using respective web-enabled form in regards registration/recognition/renewal of recognition under In-house R&D units & SIROs, Fiscal Incentives for Scientific Research, or PFRI, the same then could now be processed online at the backend of each processes by identified functionaries using their authenticated ID & password over an *Electronic Workdesk*.



Dealing officers receive e-mail alerts and in addition they also view the submitted application in their in-tray of this electronic workdesk. Based on the assigned roles, each officer go a their respective programme landing pages and carry out the required backend processing of the applications. This includes generation of abstracts, meeting schedules, prepare MoMs, create Noting\seek approvals and also generate certificates respectively. The following are the modules have gone live;

4.3.3 Public Funded Research Institute

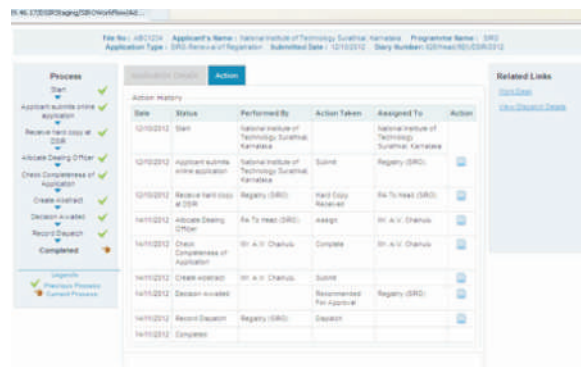
The module have gone live with both front and backend processing complete



Application No.	Applicant's Name	Submitted Date	Current Status	Assigned To	Status	Action
PFRI/2012/001	TU/IRG-COE (2012/001)	25/10/2012	Registry (PFRI)	25/10/2012	Review/Hand copy at DSIR	
PFRI/2012/002	TU/IRG-COE (2012/002)	25/10/2012	Registry (PFRI)	25/10/2012	Review/Hand copy at DSIR	
PFRI/2012/003	TU/IRG-COE (2012/003)	25/10/2012	Registry (PFRI)	25/10/2012	Review/Hand copy at DSIR	
PFRI/2012/004	TU/IRG-COE (2012/004)	25/10/2012	Registry (PFRI)	25/10/2012	Review/Hand copy at DSIR	
PFRI/2012/005	TU/IRG-COE (2012/005)	25/10/2012	Registry (PFRI)	25/10/2012	Review/Hand copy at DSIR	
PFRI/2012/006	TU/IRG-COE (2012/006)	25/10/2012	Registry (PFRI)	25/10/2012	Review/Hand copy at DSIR	
PFRI/2012/007	TU/IRG-COE (2012/007)	25/10/2012	Registry (PFRI)	25/10/2012	Review/Hand copy at DSIR	
PFRI/2012/008	TU/IRG-COE (2012/008)	25/10/2012	Registry (PFRI)	25/10/2012	Review/Hand copy at DSIR	
PFRI/2012/009	TU/IRG-COE (2012/009)	25/10/2012	Registry (PFRI)	25/10/2012	Review/Hand copy at DSIR	
PFRI/2012/010	TU/IRG-COE (2012/010)	25/10/2012	Registry (PFRI)	25/10/2012	Review/Hand copy at DSIR	

4.3.4 Scientific And Industrial Research Organizations

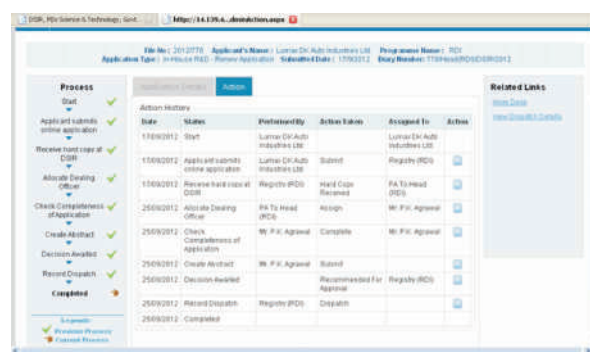
The module have gone live with both front and backend processing complete



Process	Date	Status	Performed By	Action Taken	Assigned To	Action
Start	12/10/2012	Start	National Institute of Technology, Surathkal, Karnataka		Registry (DSIR)	
Applicant submits online application	12/10/2012	Applicant submits online application	National Institute of Technology, Surathkal, Karnataka		Registry (DSIR)	
Receive hand copy at DSIR	12/10/2012	Receive hand copy at DSIR	Registry (DSIR)	Hand Copy Received	As To Head (DSIR)	
Allocate Dealing Officer	12/10/2012	Allocate Dealing Officer	Registry (DSIR)	Assign	Dr. A.V. Chaturvedi	
Check Completeness of Application	14/10/2012	Check Completeness of Application	Dr. A.V. Chaturvedi	Complete	Dr. A.V. Chaturvedi	
Create Abstract	14/10/2012	Create Abstract	Dr. A.V. Chaturvedi	Submit	Registry (DSIR)	
Decision Awarded	14/10/2012	Decision Awarded	Registry (DSIR)	Recommended For Approval	Registry (DSIR)	
Record Dispatch	14/10/2012	Record Dispatch	Registry (DSIR)	Dispatch		
Completed	14/10/2012	Completed				

4.3.5 In-House R&D

The module have gone live with both front and backend processing complete



Process	Date	Status	Performed By	Action Taken	Assigned To	Action
Start	11/09/2012	Start	Luxmi CV Auto Industries Ltd		Registry (DSIR)	
Applicant submits online application	11/09/2012	Applicant submits online application	Luxmi CV Auto Industries Ltd	Submit	Registry (DSIR)	
Receive hand copy at DSIR	11/09/2012	Receive hand copy at DSIR	Registry (DSIR)	Hand Copy Received	As To Head (DSIR)	
Allocate Dealing Officer	25/09/2012	Allocate Dealing Officer	As To Head (DSIR)	Assign	Dr. P.K. Agrawal	
Check Completeness of Application	25/09/2012	Check Completeness of Application	Dr. P.K. Agrawal	Complete	Dr. P.K. Agrawal	
Create Abstract	25/09/2012	Create Abstract	Dr. P.K. Agrawal	Submit	Registry (DSIR)	
Decision Awarded	25/09/2012	Decision Awarded	Registry (DSIR)	Recommended For Approval	Registry (DSIR)	
Record Dispatch	25/09/2012	Record Dispatch	Registry (DSIR)	Dispatch		
Completed	25/09/2012	Completed				

4.3.6 Fiscal Incentives (Form 3CL)

The module have gone live with both front and backend processing complete



Application No.	Applicant's Name	Submitted Date	Current Status	Assigned To	Status	Action
PFRI/2012/001	TU/IRG-COE (2012/001)	25/10/2012	Registry (PFRI)	25/10/2012	Review/Hand copy at DSIR	
PFRI/2012/002	TU/IRG-COE (2012/002)	25/10/2012	Registry (PFRI)	25/10/2012	Review/Hand copy at DSIR	
PFRI/2012/003	TU/IRG-COE (2012/003)	25/10/2012	Registry (PFRI)	25/10/2012	Review/Hand copy at DSIR	
PFRI/2012/004	TU/IRG-COE (2012/004)	25/10/2012	Registry (PFRI)	25/10/2012	Review/Hand copy at DSIR	
PFRI/2012/005	TU/IRG-COE (2012/005)	25/10/2012	Registry (PFRI)	25/10/2012	Review/Hand copy at DSIR	
PFRI/2012/006	TU/IRG-COE (2012/006)	25/10/2012	Registry (PFRI)	25/10/2012	Review/Hand copy at DSIR	
PFRI/2012/007	TU/IRG-COE (2012/007)	25/10/2012	Registry (PFRI)	25/10/2012	Review/Hand copy at DSIR	
PFRI/2012/008	TU/IRG-COE (2012/008)	25/10/2012	Registry (PFRI)	25/10/2012	Review/Hand copy at DSIR	
PFRI/2012/009	TU/IRG-COE (2012/009)	25/10/2012	Registry (PFRI)	25/10/2012	Review/Hand copy at DSIR	
PFRI/2012/010	TU/IRG-COE (2012/010)	25/10/2012	Registry (PFRI)	25/10/2012	Review/Hand copy at DSIR	

4.3.7 Institutional Grants-in-aid

Currently only the prototypes for various institutional grants-in-aid have been developed and these module would go live only after the required UAT could get successfully conducted.



Intra DSIR remains as an effective messaging client that facilitates attaching files and sending the same to other employees with pop up facility, it intend virtually to eliminate flow of paper based intra-office/inter-office memos, circulars and similar documents.



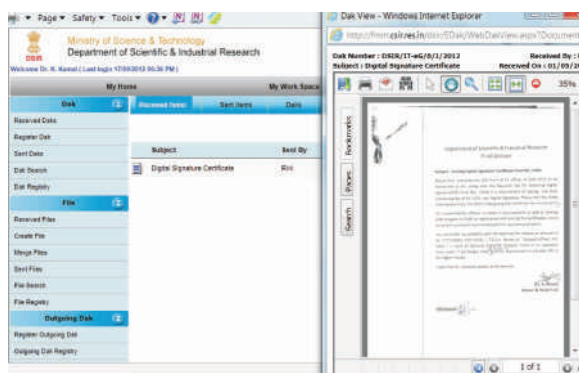
This also acts as a secured single sign on, role based access site for DSIR employees to all developed/developing applications of eGovernance that include all the modules of ERP solution eg., eOffice and Committee & Meeting, ESS and HR etc.

Under e-Enablement of the Processes, Workflow Management, Decision Support Systems, Record Management and Data Warehousing & Mining, following different applications have been developed, have under gone validation, UAT and have moved to a production server while awaiting the required third party Audit have been the following:

4.3.8 eOffice (eDak & eFile) Module

This module has been designed according to the currently practiced eDak system in DSIR. The

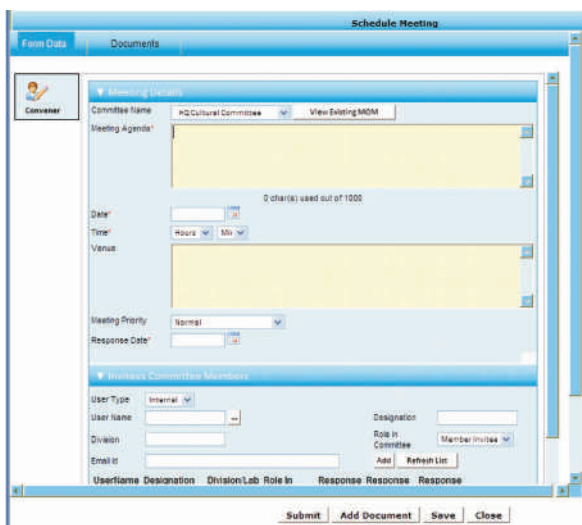
available GUI in this eOffice for End Users, helps display the web forms and save the data and to move eDak according to the route defined to the selected users. It facilitates the physical storage of Daks in an Electronic Form. The product provides the mode of selecting a dak either through the local hard drive of computer of an end user, or simply by scanning the Dak through Scanner and importing it to the desired location. Each eDak can be clicked and opened for providing a user-friendly view to the user.



The eOffice also provides facility on the physical storage of Files in an Electronic Form. The eFiles can be viewed by the users once they have been granted access rights to view or modify them. A file section provides a list of files that can be accessed by this user. Each file may comprise of several eDaks. Information related to each eFile would be associated with it which can also be viewed by user.

4.3.9 Committee and Meeting Module

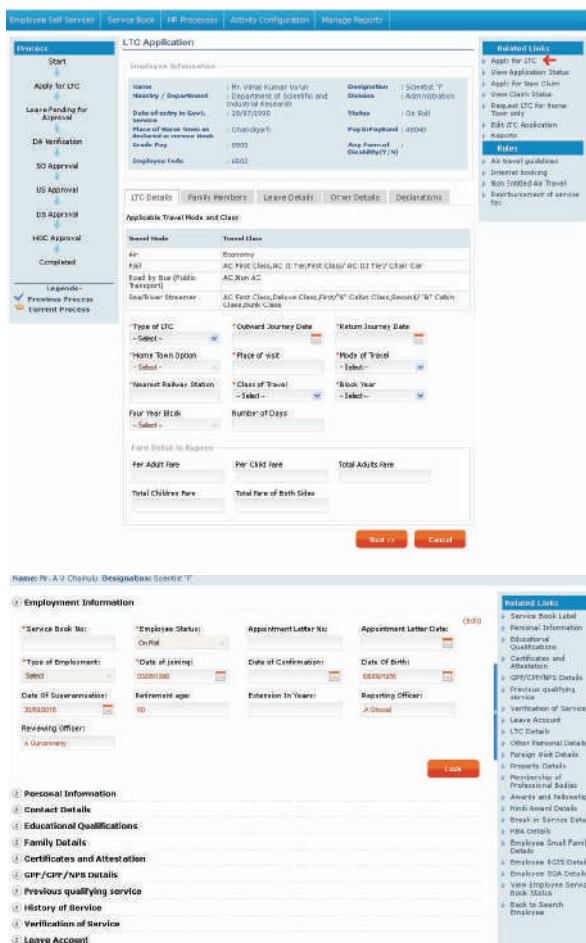
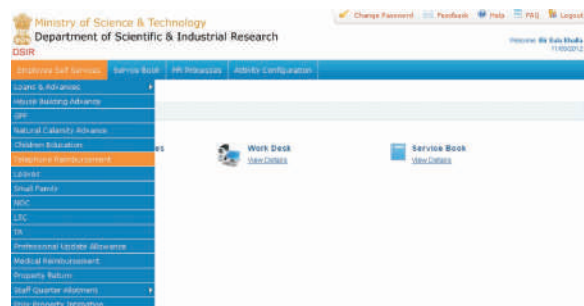
The committee and Meeting Module provide the Convener of the meeting to constitute a committee. Using this module the concern forms a Committee's Name along with the Members for Committee Approval, thus it is electronically routed to the members for their consents in form as Accept, Reconsider or Seek Clarification from the Convener of the meeting. After the members consented, convener finally could constitute the committee and Notify it through an Office



Memorandum electronically to all the stakeholders of this committee.

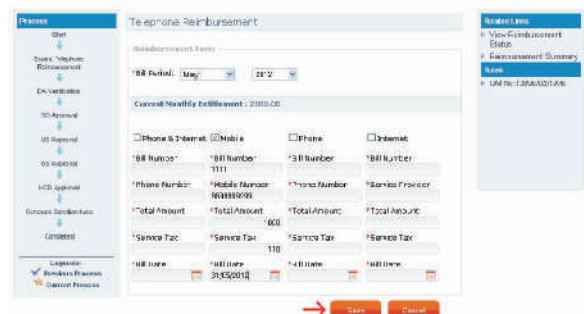
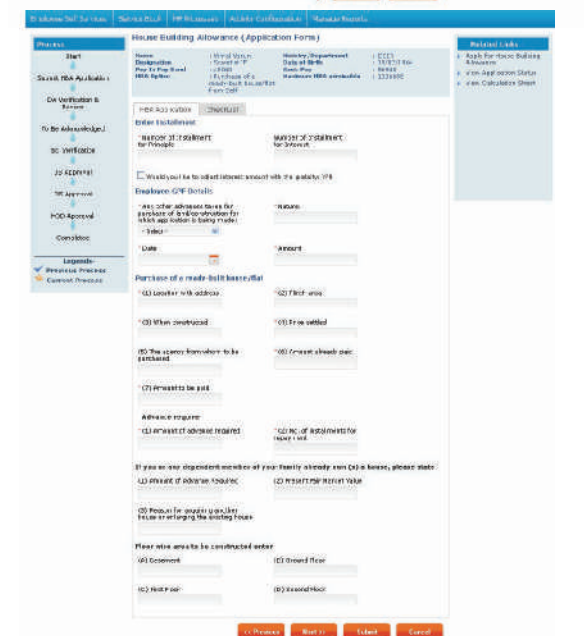
4.3.10 ESS and HR Modules

For online submission of employees application

under Employee Self Service(ESS) and HR modules have been developed and data collection and population that remain in progress.

The modules covering the activities related to HR processes have been developed include (i) Loans & Advances, (ii) House Building Advances, (iii) GPF, (iv) Children Education, (v) Telephone Reimbursement, (vi) Small Family,

(vii) Leaves etc. All these modules remain accessible by all DSIR employees through IntraDSIR single login.

4.4 IT Training:

With regard to use of these developed application modules, the Service providers are committed to train all employees of the DSIR. The Training Plan has been developed that include the latest procedures and processes available in the relevant areas of work. IT-eG division has established a training room with the required infrastructure, for imparting in-house trainings. Service Providers

have deputed its personnel to train the employees with necessary materials for imparting trainings. All DSIR employees have under gone training on the eOffice and Committee module. Similar training on use of other modules has also been planned.

4.5 e-Reports:

In addition to several technical reports, various directories of RDI, SIRO and PFRI; along with departments Annual Reports of the years 1991-2012 have all been made web accessible to the citizen.





4.6 Website:

Re-designing of the existing static website has been carried out which subsequently aimed to be made dynamic & database-driven and would be bilingual - supporting English and Hindi languages. The Graphical User Interface (GUI) of this re-designed website has been aimed to be user-friendly and rich in appearance since it uses superior graphics, self-explanatory, promptly guiding the user to different sections, offer appropriate navigation assistance to user in the form of tooltips, messages, images etc. wherever required / applicable. The user can switch between different themes / color schemes, and choose the font-size out of a number of pre-defined sizes as per their convenience.

In its present static version it remains compliant to Standards & Guidelines namely as (1) UUU Trilogy – Usable, User Centric, and Universally Accessible (2) Government of India Web Guidelines (GOIWG) issued by the Government of India and offers an easy-to-understand navigation. The re-designing of website was taken up to ease its seamless integration with other automated systems developed/being developed offering compatibility and smooth data flow between applications yet ensuring the security by means of Passwords, Secure network and encryption of data (https).

At present, this website of the Department is continuously being updated through regular updates being effected at the site <http://www.dsir.gov.in>

5. VARIOUS APPLICATIONS CUSTOMIZED AND USED

An IT-centric work environment existed in the Department with deployment of various web based applications which remains operational. Some of those information client server application systems as developed by other departments have also successfully been adopted by DSIR through required customization to

execute routine procedures and these applications systems have been the following;

5.1 Integrated Finance, DDO and Utilization Software (IFDUS)

Integrated Finance, DDO and Utilization Software (IFDUS) was developed for DSIR kept fully operational. The bills for Salary, Contingency, TA/DA and LTC Advance and Other Advances have been prepared and processed through this IFDUS.

5.2 Composite Pay Roll System

A Composite Pay Roll System that was developed by NIC for IFD of GOI departments being used in this department for preparation of bills for Salary, all advances, arrears and allowances. This system is used for calculation of Income Tax and Preparation of Form 16 and e-TDS (quarterly and annually). The system also has an interface for sending transactions to the Bank. A Data Entry Operator regularly updates the monthly payments and expenditures inputs for the system.

5.3 CPSMS

A web enabled application namely - Central Plan Schemes Monitoring Systems (CPSMS), developed in the office of the CGA serves as a common platform for monitoring of the Central Sector and Centrally Sponsored Schemes remained functional in DSIR. On this system a unique Sanction ID (SID) gets generated that enables tracking of releases as per the accounting and budget heads. Various reports such as Scheme-

Scheme Name	Account Head	Sanction Generated	Bill Generated (Rs.)	Release (Rs.)
Access to Internet from Technology Development and Innovation Scheme (AITS)	1402-00-000-00-00-00-00	6,00,00,000.00	14,00,00,000.00	8,00,00,000.00
Scheme Total		6,00,00,000.00	14,00,00,000.00	8,00,00,000.00
CENTRAL ELECTRONICS LIMITED (CEL)				
1402-00-000-00-00-00-00	6,00,00,000.00	14,00,00,000.00	8,00,00,000.00	8,00,00,000.00
1402-00-000-00-00-00-00	6,00,00,000.00	14,00,00,000.00	8,00,00,000.00	8,00,00,000.00
1402-00-000-00-00-00-00	6,00,00,000.00	14,00,00,000.00	8,00,00,000.00	8,00,00,000.00
Scheme Total		6,00,00,000.00	14,00,00,000.00	8,00,00,000.00
CONSOLIDATED DEVELOPMENT CENTRE (CDC)				
1402-00-000-00-00-00-00	6,00,00,000.00	14,00,00,000.00	8,00,00,000.00	8,00,00,000.00
1402-00-000-00-00-00-00	6,00,00,000.00	14,00,00,000.00	8,00,00,000.00	8,00,00,000.00
Scheme Total		6,00,00,000.00	14,00,00,000.00	8,00,00,000.00
DSIR - BSNL Scheme				
1402-00-000-00-00-00-00	6,00,00,000.00	14,00,00,000.00	8,00,00,000.00	8,00,00,000.00
1402-00-000-00-00-00-00	6,00,00,000.00	14,00,00,000.00	8,00,00,000.00	8,00,00,000.00
Scheme Total		6,00,00,000.00	14,00,00,000.00	8,00,00,000.00

wise Release, Bill Status Details, Sanction Status are generated from CPSMS Portal and sent to the Concerned officials for information.

5.4 CPGRAMS

Department remained equipped with a Public Grievance Redress & Monitoring System (CGPRAMS) designed and developed by DAR&PG & NIC. This WEB based system remains available centrally to the public accessible at DSIR website and for DSIR employees within the Department remains accessible at IntraDSIR. Nodal officer has the ID and password and hence submitted grievances through this system to the Department get attended regularly.

5.5 RTI

The static contents of a separate section on Right to Information added earlier to the DSIR website has been regularly updated and remains available for proactive disclosures under Section 4 (1) (b) of the RTI Act under Right to Information Act 2005 enacted on June 15, 2005. Various reports are generated from RTI-MIS Portal and sent to the Concerned officials for information.

6. ON-GOING ACTIVITIES

Considerable progress made under the ERP project is being reviewed regularly. It has been planned to impart training to the DSIR employees on weekly basis, for all those modules that are ready for use now.





V. IMPLEMENTATION OF RTI ACT 2005

The Right to Information Act 2005, enacted on 15th June 2005, has been implemented successfully in the department. As per the provisions of the Act, following officers are designated:

Nodal Officer	Dr K Jayakumar Joint Secretary - Admn	Room No.127 Anusandhan Bhawan 2 Rafi Marg New Delhi-110001	Tel: 23716582, 23351745 Fax: 23714788 jsa[at]csir[dot]res[dot]in
Appellate Authority	Dr (Smt) Jyoti SA Bhat Scientist 'G'	Room No. 17A Administrative Block Technology Bhawan New Mehrauli Road New Delhi-110016	Tel: 26960098, 26590256 Fax: 26960098 jsabhat[at]nic[dot]in
Transparency Officer	Shri G M Bagai Scientist 'F'	Room No. 6, Hall B Technology Bhawan New Mehrauli Road New Delhi-110016	Tel: 2660 2185 Fax: 26960629 gbagai[at]nic[dot]in
Central Public Information Officer	Shri Vimal Kumar Varun Scientist 'F'	Room No. 3A Administrative Block Technology Bhawan New Mehrauli Road New Delhi-110016	Tel: 26516078, 26590416 TeleFax: 26516078 Fax: 26960629 vkv[at]nic[dot]in
Central Assistant Public Information Officer	Dr Sujata Chaklanobis Scientist 'E'	Room No.15, Hall - B Technology Bhawan New Mehrauli Road New Delhi-110016	Tel: 26520887, 26590277 Fax: 26960629 priya[at]nic[dot]in
Central Assistant Public Information Officer	Dr Prabhat Kumar Dutta Scientist 'E'	Room No. 43 TIFAC Building Technology Bhawan New Mehrauli Road New Delhi-110016	Tel: 26590394 Fax: 26960629 pkdutta[at]nic[dot]in

The proactive disclosures under Section 4 (1) (b) of the RTI Act 2005 enacted on June 15, 2005 are regularly updated and available on the DSIR Website at <http://dsir.gov.in/rti/rti-dsir.htm>.

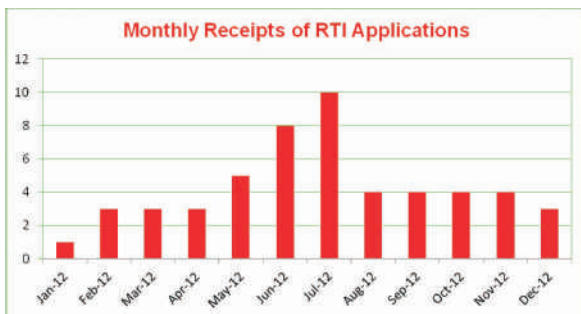
RTI - Implementation in DSIR

Right to Information Act, 2005 Department of Scientific & Industrial Research - <i>Implementation in</i> Proactive Disclosures under Section 4 (I) (b) of the Right To Information Act, 2005 1. Particulars of its organization, functions and duties; UPDATED [29 OCT 12] Administrative Setup; UPDATED [29 OCT 12] Organizational and Functional Structure 2. Powers and duties of its officers and employees UPDATED [05 JUN 09] 3. Procedure followed in the decision making process, including channels of supervision and accountability 4. Norms set by it for the discharge of its functions (in Citizens' Charter) [13 JUL 10] 5. Rules, regulations, instructions, manuals and records, held by it or under its control or used by its employees for discharging its functions 6. Statement of the categories of documents that are held by it or under its control 7. Particulars of any arrangement that exists for consultation with, or representation by, the members of the public in relation to the formulation of its policy or implementation thereof 8. Statement of the boards, councils, committees and other bodies consisting of two or more persons constituted as its part or for the purpose of its advice, and as to whether meetings of those boards, councils, committees and other bodies are open to the public, or the minutes of such meetings are accessible for public 9. Directory of its officers and employees UPDATED [06 DEC 12] Ref. DoPT's OM No. 21/36/2006-CS.I (C) dated 24 January 2008, Information/Data required for Policy, Planning & Cadre Management of CSS and to reply to various RTI references. RTI W PDF RTI UPDATED [22 FEB 08] 10. Monthly remuneration received by each of its officers and employees, including the system of compensation as provided in its regulations UPDATED [06 DEC 12] 11. Budget allocated to each of its agency, indicating the particulars of all plans, proposed expenditures and reports on disbursements made UPDATED [22 MAR 11] 12. Manner of execution of subsidy programmes, including the amounts allocated and the details of beneficiaries of such programmes 13. Particulars of recipients of concessions, permits or authorizations granted by it 14. Details in respect of the information, available to or held by it, reduced in an electronic form 15. Particulars of facilities available to citizens for obtaining information, including the working hours of a library or reading room, if maintained for public use 16. Names, designations and other particulars of the Public Information Officers, Assistant Public Information Officer, Appellate Authority, Nodal Officer, Transparency Officer UPDATED [06 JAN 12] 17. Other information as may be prescribed and thereafter update these publications every year UPDATED [28 JAN 08] The Fee and Cost are governed by the Right to Information (Regulation of Cost and Fee) Rules, 2005 and the Right to Information (Regulation of Cost and Fee) (Amendment) Rules, 2005 and subsequent amendments issued by Government of India, Ministry of Personnel, Public Grievances and Pensions (Department of Personal and Training). All Payments should be made / drawn in favour of Drawing and Disbursing Officer, Department of Scientific and Industrial Research only.



DSIR has complied with the directives received from Central Information Commission.

DSIR has received 52 Applications during 2012 [01/01/2012 to 31/12/2012] and all the Applications were registered and disposed off on RTI Request & Appeal Management Information System, <http://164.100.42.72/rrmis/>. The monthly receipt of the Applications is given below:



During 2012 [01/01/2012 to 31/12/2012], 14 applications were registered as first appeal and 04

applications were registered as second appeal.

Delivered a Lecture on use of 'RTI Annual Return Information System, RTI Request & Appeal Management Information System and RTI-MIS Updated System' during a Programme on 'Effective Implementation of RTI Act for Transparency Officer / Appellate Authorities and PIOs in the CSIR System' organized by Council of Scientific and Industrial Research at CSIR-Human Resource Development Centre, Ghaziabad on 31/05/2012.

DSIR has been effectively using various IT applications like RTI-MIS Updation System at <http://164.100.42.72/rtiupd/>, RTI Request & Appeal Management Information System at <http://164.100.42.72/rrmis/>. RTI Annual Return Information System at <http://rtiar.nic.in>. The quarterly returns were uploaded on RTI Annual Return Information System at <http://rtiar.nic.in>.

RTI Annual Return Information System
(Department of Scientific & Industrial Research)

Main Menu

- Master Updations**
 - Update Public Authority List
 - Assign/Reset Password to Public Authorities
 - Update Transparency Officer Details
 - Update Appellate List
 - Update PIO List
- Quarterly Return 2012-13**
 - Submit Quarterly Returns
 - Quarterly Returns Received from PAs
 - Submit Suggestions/Interventions
 - Reports/Queries
- RTI Manuals/Dislosures u/s 4/19(8) Webpage**
 - Update RTI Manuals/Dislosures u/s 4/19(8) Link
 - Change Password
 - User Manual

RTI Annual Return Information System
(Department of Scientific & Industrial Research)

Quarterly Returns received from Public Authorities

No.	Click to View	Name of Organisation	Year	Quarter	Date of Submission
1		DRB, Delhi	2012-2013	1st Quarter (Apr-Jun-12)	29/05/2012
2		R&D, Delhi	2012-2013	2nd Quarter (Jul-Sep-12)	29/05/2012
3		CSIR, Hyderabad	2012-2013	1st Quarter (Apr-Jun-12)	29/05/2012
4		CSIR, Hyderabad	2012-2013	2nd Quarter (Jul-Sep-12)	29/05/2012
5		CSIR, Lucknow	2012-2013	1st Quarter (Apr-Jun-12)	19/05/2012
6		CSIR, Lucknow	2012-2013	2nd Quarter (Jul-Sep-12)	19/05/2012
7		CSIR, Kolkata	2012-2013	1st Quarter (Apr-Jun-12)	19/05/2012
8		CSIR, Kolkata	2012-2013	2nd Quarter (Jul-Sep-12)	19/05/2012
9		CSIR, Chennai	2012-2013	1st Quarter (Apr-Jun-12)	19/05/2012
10		CSIR, Chennai	2012-2013	2nd Quarter (Jul-Sep-12)	19/05/2012
11		CSIR, Bangalore	2012-2013	1st Quarter (Apr-Jun-12)	19/05/2012
12		CSIR, Bangalore	2012-2013	2nd Quarter (Jul-Sep-12)	19/05/2012
13		CSIR, New Delhi	2012-2013	1st Quarter (Apr-Jun-12)	19/05/2012
14		CSIR, New Delhi	2012-2013	2nd Quarter (Jul-Sep-12)	19/05/2012
15		CSIR, Mohali	2012-2013	1st Quarter (Apr-Jun-12)	19/05/2012
16		CSIR, Mohali	2012-2013	2nd Quarter (Jul-Sep-12)	19/05/2012
17		CSIR, Bhopal	2012-2013	1st Quarter (Apr-Jun-12)	19/05/2012
18		CSIR, Bhopal	2012-2013	2nd Quarter (Jul-Sep-12)	19/05/2012
19		CSIR, Thiruvananthapuram	2012-2013	1st Quarter (Apr-Jun-12)	19/05/2012
20		CSIR, Thiruvananthapuram	2012-2013	2nd Quarter (Jul-Sep-12)	19/05/2012

RTI-MIS Updation System
(For Updation of Details of Public Authority, CPIO, Appellate Authority)

LOGIN:-

Ministry of Science & Technology

Department of Scientific & Industrial Research

Department of Scientific & Industrial Research

Submit Reset

your Organisation does not appear in Public Authority field after selecting appropriate

[RTI-MIS Home Page](#)

RTI-MIS Updation System
(Department of Scientific & Industrial Research)

Website Address(URL) of Public Authority: <http://www.dsr.gov.in/>

Webpage Link of RTI Manuals/Dislosures u/s 4/19(8): <http://www.dsr.gov.in/rti-dsr.htm>

Last Date of Uploading/Updating RTI Manuals/Dislosures in website: 06/12/2012

Submit Clear

Update Menu
Send your Suggestions
Logout

RTI-MIS Updation System

RESEARCH DESIGN

VI. AUTONOMOUS BODIES

VI-A. COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

S&T CONTRIBUTIONS

1.1 BIOLOGICAL SCIENCES CLUSTER

Scientific Excellence

Mutational variations buffered by chemical chaperons

Hidden genetic variations have the potential to lead to the evolution of new traits. Molecular chaperones, which assist protein folding, may conceal genetic variations in protein-coding regions. CSIR-IGIB investigated the potential of chemical milieu of cells to affect protein folding. It was found that osmolyte trimethylamine N-oxide (TMAO) can buffer mutations that impose kinetic traps in the folding pathways of two model proteins. This study has provided a new insight into understanding of an important phenomenon.

Tuberculosis Drug Streptomycin as a Potential Cancer Therapeutic

CSIR-IGIB reported that microRNAs (miRNAs) fine-tune gene expression, deregulation which has been causally associated with a number of debilitating conditions. Streptomycin, a well-known aminoglycoside drug, binds to RNA secondary structures and is shown to inhibit miR-21 function by direct binding to its precursor, thus presumably interfering with the processing by the Dicer enzyme.

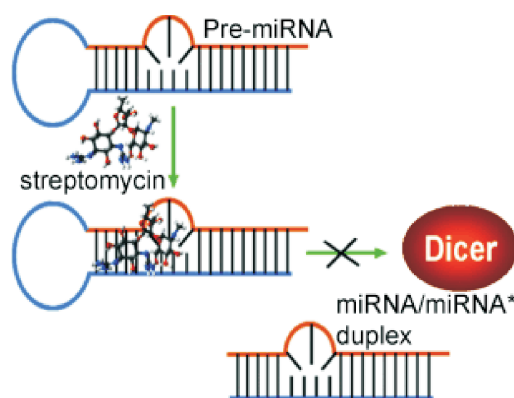


Fig. Scheme

Nonprocessive [2 + 2]e⁻ off-loading reductase domains from mycobacterial nonribosomal peptide synthetases

In mycobacteria, polyketide synthases and nonribosomal peptide synthetases (NRPSs) produce complex lipidic metabolites by using a thio-template mechanism of catalysis. CSIR-IGIB demonstrated that the off-loading reductase (R) domain of mycobacterial NRPSs performs two consecutive [2 + 2]e⁻ reductions to release corresponding alcohols. The first crystal structure of an R domain from *Mycobacterium tuberculosis* NRPS provides strong support to this mechanistic model. This study presents an elegant example of the recruitment of a canonical short-chain dehydrogenase/reductase family member as an off-loading domain in the context of assembly-line enzymology.

Common Variants of IL6, LEPR, and PBEF1 are associated with obesity in Indian Children

The increasing prevalence of obesity in urban Indian children is indicative of an impending crisis of metabolic disorders. Although perturbations in the secretion of adipokines and inflammatory molecules in childhood obesity are well documented, the contribution of common variants of genes encoding them is not well investigated. CSIR-IGIB assessed the association of 125 common variants from 21 genes encoding adipocytokines and inflammatory markers in 1,325 urban Indian children. Associations of ₹ 2069845, ₹ 1137100, and ₹ 3801266 were replicated ($P = 7.9 \times 10^{-4}$, 8.3×10^{-3} , and 0.036, respectively) and corroborated in meta-analysis ($P = 2.3 \times 10^{-6}$, 3.9×10^{-5} , and 4.3×10^{-4} , respectively) that remained significant after multiple testing corrections. This is a unique study where the association of the common variants of IL6, LEPR, and PBEF1 with obesity studied in Indian children.

Metastases suppressor NME2 associates with telomere ends and telomerase and reduces telomerase activity within cells

Analysis of chromatin-immunoprecipitation followed by sequencing (ChIP-seq) usually disregards sequence reads that do not map within binding positions (peaks). Using an unbiased approach, CSIR-IGIB analysed all reads for ChIP-seq experiments for human lung adenocarcinoma and fibrosarcoma cells for the metastasis suppressor non-metastatic 2 (NME2). It was found that NME2 associates with telomerase and reduces telomerase activity *in vitro* and *in vivo*, and resulted in reduced telomere length in aggressive human cancer cells. These findings reported a novel role for NME2 as a telomere binding protein that can alter telomerase function and telomere length. This presents an opportunity to investigate telomere-related interactions in metastasis suppression.

Genome-wide analysis reveals distinct patterns of epigenetic features in long non-coding RNA loci

A major fraction of the transcriptome of higher organisms is comprised of an extensive repertoire

of long non-coding RNA (lncRNA). lncRNAs are a proven component of epigenetic gene expression modulation, though their regulation remains poorly understood. CSIR-IGIB analysed pan-genomic DNA methylation and histone modification marks associated with transcription start site (TSS) of lncRNA in four different cell types and three different tissue types representing various cellular stages. It has been observed that histone marks associated with active transcription have similar distribution pattern around TSS irrespective of cell types. Also, the density of these marks correlates well with expression of protein-coding and lncRNA genes. In contrast, the lncRNA genes harbour higher methylation density around TSS than protein-coding genes regardless of their expression status. These observations suggest that epigenetic regulation of lncRNA common features with mRNA except the role of DNA methylation which is markedly dissimilar.

Translational applications of hologenome sequencing: Using next-generation sequencing on a sample containing mixed population of genomes from an epidemic with appropriate processing and enrichment.

The data was analyzed by CSIR-IGIB using an extensive computational pipeline involving mapping to reference genome sets and de-novo assembly. In depth analysis of the data generated revealed the presence of sequences corresponding to Japanese encephalitis virus. The genome of the virus was also independently de-novo assembled. The presence of the virus was in addition, verified using standard molecular biology techniques.

Hologenome sequencing approach can accurately identify causative pathogens from cell culture hologenome samples containing mixed population of genomes and in principle can be applied to patient hologenome samples without any background information. This methodology could be widely applied to identify and isolate pathogen genomes and understand their genomic variability during outbreaks.



New diagnostic method for detecting airway diseases

CSIR-IGIB has developed a new diagnostic method for detecting airway diseases. More than hundred patients with asthma or COPD have already been studied using this technique. It holds potential for early detection of bronchiolitis obliterans in post-transplant patients, a life threatening disease that can be suppressed if detected early. By using standard impulse oscillometry data and physiologic time series analysis, the study identifies cyclical and stochastic fluctuations in respiratory resistance during normal tidal breathing. Exaggeration of cyclical changes due to peripheral airway closure during exhalation is measurable as a novel index of lung function that provides exquisite detection of peripheral airway disease. Medical organizations worldwide have shown interest in adopting and testing this method. This study offers an entirely new direction in evaluation and monitoring of asthma and other airway diseases and points to the importance of application of mathematical tools to biological data for developing sensitive noninvasive markers in diseases.

Multistress-protective molecules in bacteria

Evidences in the literature reveal that bacteria in the natural environments are most often challenged with more than one stress condition (extremities of temperature, pH, high pressure, high oxidative stress, high osmolarity, uv-radiation and exposure to toxic chemicals). Hence they evolve with some molecules (proteins, lipids) which confer multistress-tolerance in them. These multistress-protective molecules interlink mechanisms involved in adaptation of bacteria to different types of stress conditions. They could be useful for creating genetically engineered bacterial strains suitable for bioremediation in harsh environments. Their inhibitors could be useful for safe preservation of food materials.

No information was available on the tolerance of microorganisms that occur in the extreme cold

climate of Antarctica to environmental stress factors. Database created by CSIR-CCMB on the stress tolerance of Antarctic bacteria fills up the gap. It has been demonstrated that the Antarctic bacteria are predominantly tolerant to alkali besides low temperature and sensitive to acid and ultraviolet- radiation. Some multistress-sensitive mutants have been obtained by Tn-5 transposon mutagenesis of two Antarctic organisms belonging to the genus *Pseudomonas*. By inverse PCR, it is found that the mutated gene in a potential multistress-sensitive mutant encodes citrate synthase. Other genes identified from similar mutants encode a putative oxidoreductase, a putative ABC transporter mannitol binding protein, a phosphotransferase and a general stress protein. Studies are in progress to detect the molecules that are found to be overproduced in some multistress-adapted variants of several Antarctic and mesophilic organisms, by analyzing their protein and lipid profile.

Importance in bioremediation of pollutants: The multistress-protective molecules isolated and characterized are useful for various purposes. Petroleum products and other man-made garbage that are accumulating in the harsh environments (polar regions, Siachen glacier) due to human activities (science camp, military camp, expedition) pose a serious threat to the environment. Removal of the contaminated soil by air-lifting being prohibitively costly, bioremediation using degrader bacteria strain appears to be a suitable alternative. However, bioremediation in harsh environments is not possible because of the very slow growth of bacteria in non-permissive environments. The growth rate of degrader bacteria could be improved by cloning and expressing the genes which encode the multistress protective proteins. Evidences in the literature support this idea. It was possible to increase the growth rate of the mesophilic bacterium *E coli* by 141-times at 8°C by recruiting two chaperonin proteins from an Antarctic bacteria through genetic engineering.

Importance in food preservation: The multistress-protective molecules confer multistress-tolerance

to food-borne bacteria. When food materials are exposed to several stressors (cold-water, organic acids, high salt solution, hydrogen peroxide) during processing and storage to render them safe for use, a substantial portion of the bacteria present in the food material are annihilated but the survivors get more tolerant to the stress factors they are exposed to. They also develop cross tolerance to some other stress factors they are not exposed to. Stress hardness and cross-tolerance are two major problems encountered in the food industry. If the chemical nature of the multistress protective molecules is known, their inhibitors could be designed for the safe preservation of food materials.

RNA binding proteins and gene regulation

In understanding role of RNA binding proteins in gene regulation, CSIR-CCMB solved solution structures of dsRNA binding domains of RDE-4 and CRC. Based on the studies, laboratory hypothesizes that two consecutive lysine mutations in dsRBD2 of RDE-4 impairs RNA recognition and hence disable RNAi pathway in *C. elegans*. Structural data on CRC suggests its divergent evolution from A Pendonuclease family of proteins and adoption to recognize RNA for carrying out regulatory roles in *Pseudomonas*.

The RNAi pathway of several organisms requires presence of double stranded RNA binding proteins for functioning of Dicer in gene regulation. In *C. elegans*, a double stranded RNA binding protein, RDE-4 (385 aa, 44 kDa) recognizes long exogenous dsRNA and initiates the RNAi pathway. Complete backbone and stereospecific methyl sidechain Ile (d1), Leu and Val chemical shifts of first 243 amino acids of RDE-4, namely RDE-4DC, has been achieved.

Hepatitis C Virus NS5A Binds to the mRNA Cap-binding Eukaryotic Translation Initiation 4F (eIF4F) Complex

For the first time CSIR-CCMB showed that HCV up-regulates host cap-dependent translation

machinery in Huh7.5 cells through simultaneous activation of mTORC1 and eukaryotic translation initiation factor 4E (eIF4E) by NS5A. NS5A, interestingly, overexpressed and subsequently hyperphosphorylated 4EBP1. NS5A phosphorylated eIF4E through the p38 MAPK-MNK pathway. Both HCV infection and NS5A expression augmented eIF4F complex assembly, an indicator of cap-dependent translation efficiency. Global translation, however, was not altered by HCV NS5A. 4EBP1 phosphorylation, but not that of S6K1, was uniquely resistant to rapamycin in NS5A-Huh7.5 cells, indicative of an alternate phosphorylation mechanism of 4EBP1. Resistance of Ser-473, but not Thr-308, phosphorylation of AKT to PI3K inhibitors suggested an activation of mTORC2 by NS5A. NS5A associated with eIF4F complex and polysomes, suggesting its active involvement in host translation. This is the first report that implicates an HCV protein in the up-regulation of host translation initiation apparatus through concomitant regulation of multiple pathways. Because both mTORC1 activation and eIF4E phosphorylation are involved in tumorigenesis, CSIR-CCMB proposes that their simultaneous activation by NS5A might contribute significantly to the development of hepatocellular carcinoma.

Use of nanoscaffolds to differentiate mesenchymal stem cells into osteogenic cell types and their *in vivo* potencies

Reconstruction of critical sized bone injuries is a major problem that continues to inspire the design of new materials and grafts. Natural ceramics (hydroxyapatite (HA) coralline HA, or synthetic HA) and b-tricalcium phosphate (b-TCP) have been explored for use as scaffolds in bone tissue engineering, among several other materials. CSIR-CCMB evaluated the bone forming capacity of nanosize bioceramics synthesized in situ in poly-vinyl alcohol (PVA) with different ratios of HA and b-TCP; the Ca/P ratio was 1.62 for bioceramic P1, 1.60 for P2 and 1.58 for P3. Further

osteogenesis *in vitro* with mesenchymal stem cells (MSC) acquired from different sources and their bone healing properties *in vivo* were also evaluated. MSCs isolated from human placenta, Wharton's jelly from umbilical cord, fetal bone marrow and adipose tissue, cultured in presence of nanosize bioceramic particles, were monitored for osteogenic differentiation. Placental cells showed the best osteogenic potential of the different MSCs studied on the basis of expression of osteogenic markers. Complete regeneration of the damaged region was observed *in vivo* when MSC derived from placenta were used with nanoceramic (Ca/P ratio 1.58) in the experimental defect created in the femur of Wistar rats. Even small variation in the Ca/P ratio can alter the outcome of tissue constructs. Similar studies carried out with biphasic ceramics in ratios from 10:90 to 90:10 were evaluated to assess the role of each component in bone wound healing in animals.

Immune modulatory responses of Mesenchymal stem cells from different sources in cultures and *in vivo*

Immune-properties of Mesenchymal Stem Cells (MSC) isolated from human placenta, umbilical cord matrix, adipose and bone marrow have been studied. MSC collected from all these sources possess low levels of MHC- a comparison I and lacked MHC-II. These cells inhibited the mixed lymphocytic reaction in culture conditions when incubated with human allogeneic peripheral blood mono nuclear cell (PBMNC) population. Even after differentiation into different cell lineages, these MSCs are able to suppress the mixed lymphocytic reaction when cultured with stimulated allogeneic PBMNC. The cytokines profiles were determined for all types of MSCs when co-cultured with PBMNC. IFN γ and IL-1 β increased in supernatants of all co-cultures and whereas TNF- α , I-1 α -, IL2 levels diminished. The low immunogenicity *in vitro* suggests that these cells can be used for allogeneic transplantation. A single infusion of MSC into immunocompetent BALB/c mouse resulted in immune suppressive

changes in lymph nodes and spleen. Bone marrow and thymus remained largely unchanged. These findings suggest that MSC from AD, PL, and WJ could be substituted for BMSC where it is difficult to get the required number of autologous mesenchymal stem cells of bone marrow.

These studies are important for use in cell therapy for any disorder. CSIR-CCMB compared Mesenchymal stem cells derived from different sources and most of these sources are medical waste and the cells have been obtained without any invasive procedure and stored. These studies prove the potential of these cells in bone healing injuries and their immunological impact.

An Insight into the Functional Mechanism of Type IB Topoisomerase

Most type IB topoisomerases do not require ATP. However, this enzyme is highly stimulated by ATP. The mechanism underlying this stimulation and involvement of different amino acids of the enzyme in binding with ATP and controlling the activity of the enzyme have been explored by CSIR-IICB scientists.

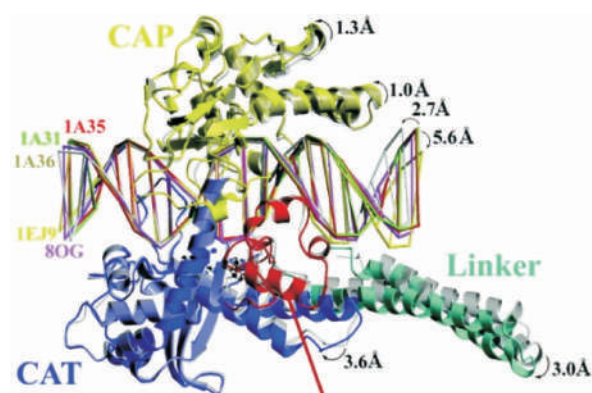


Fig. C-terminal domain

Visceral Leishmaniasis Immunotherapy

TLR4 stimulation by β -(1-4)-galactose terminal glycoconjugates induce expression of IFN- γ . CSIR-IICB scientists have shown that immunotherapy with the β -(1-4)-galactose terminal glycosphingophospholipid (GSPL)

antigen from *L. donovani* induces IFN- γ through the cooperative action of TLR4 and NKT-cells to cure murine visceral leishmaniasis.

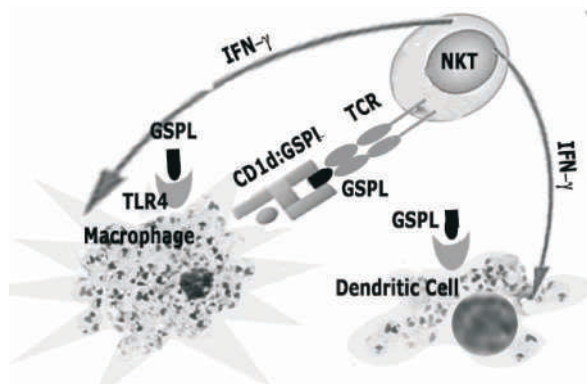


Fig. Visceral Leishmaniasis Immunotherapy

New Approach to Treat Drug Unresponsive Kala-azar

The kala-azar patients do not respond to the host-protective cytokine IFN γ at the active stage of the disease, the cause of which is unknown. This research is designed to understand how cell surface receptors for IFN γ respond under parasitized condition. CSIR-IICB scientists clarified the underlying mechanism and demonstrated that supplementation of cholesterol together with IFN γ may be a new approach to treat drug unresponsive Kala-azar cases.

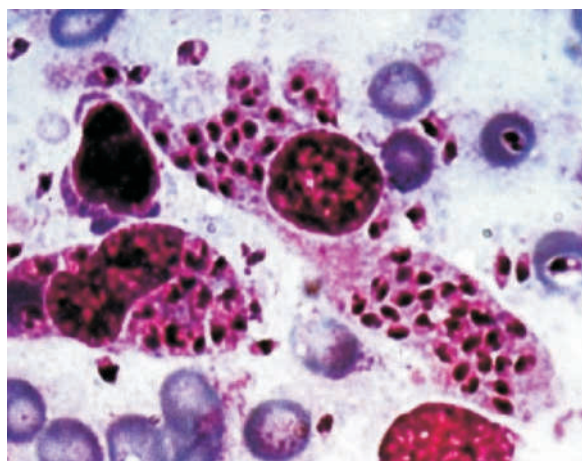


Fig. New approach to treat drug unresponsive Kala-azar

Easy Test for Visceral Leishmaniasis and Post-Kala-azar Dermal Leishmaniasis

CSIR-IICB scientists have developed a dipstick assay for the serodiagnosis of visceral leishmaniasis (VL) and post-kala-azar dermal leishmaniasis (PKDL). The dipstick can even be used at primary health centers. For detection of the circulating anti-leishmanial IgG in the patient sera, leishmanial antigens prepared from the cultured promastigote membranes (LAg) is used as test antigen. For the assay the dipstick is coated with two lines, a control line coated with unlabelled rabbit anti-human IgG, and a test line coated with LAg. The dipstick is dipped serially first in the diluted sera and then in a solution of secondary antibody i.e. goat anti-human IgG conjugated with HRP (horse radish peroxidase) with a rapid wash. The dipstick is then subjected to color development in a solution of diaminobenzidine (DAB) plus H₂O₂ and allowed for the color development. When color is developed on both the lines the test is positive. When color develops only in control line the test is negative, and when there is no color development the test is invalid. The whole process takes about 2 hours. When stored at room temperature without desiccation, dipsticks performs consistently for 12 months.

In CSIR-IICB dipsticks appeared equally sensitive and specific (100%) for VL from India and Brazil and for Indian PKDL. LAg dipsticks perform better than rK39 strip test for diagnosing VL patients from Brazil. This indigenously developed dipsticks strip test is approximately ten times economic than rK39 strip test.

A Molecule from Herbal Origin for the Treatment of Bronchial Asthma

Asthma is a non-infectious chronic inflammatory disease of the respiratory system characterized by a reversible airways obstruction. Acute airway obstruction, bronchial hyper-responsiveness and inflammatory state of the bronchial mucosa with increase levels of inflammatory mediators, are the most evident phenomenon which characterizes this

pathology. Despite the increase in the prescribed anti-asthmatic treatments, the current trends indicate asthma is set to be the most chronic disease in industrialized countries, affecting mostly the children (15%) than the adults (10%). Jointly CSIR-IICB, CSIR-IGIB, CSIR-IIIM, CSIR-IITR and CSIR-IICT scientists described a novel heterocyclic compound belonging to 'triazine-aryl-bis-indoles', useful for the treatment of asthma. The compound prepared is useful as phosphodiesterase-4 (PDE-4) enzyme inhibitor, inhibitor for signalling molecule for the treatment of asthma/COPD and asthma related diseases.

A novel quercetin analogue from a medicinal plant promotes peak bone mass achievement

CSIR-CDRI reported that extracts made from the stem bark of *Ulmus wallichiana* promoted peak bone mass achievement in growing rats and preserved trabecular bone mass and cortical bone strength in ovariectomized (OVX) rats. Further, 6-C- β -D-glucopyranosyl-(2S,3S)-(+)-3',4',5,7-tetrahydroxyflavanol (GTDF), a novel flavonol-C-glucoside isolated from the extracts of *Ulmus wallichiana* had a non-estrogenic bone sparing effects on OVX rats. The effects of GTDF on osteoblast function and its mode of action and *in vivo* osteogenic effect was studied. GTDF stimulated osteoblast proliferation, survival and differentiation, but had no effect on osteoclastic or adipocytic differentiation. In cultured osteoblasts, GTDF transactivated aryl hydrocarbon receptor (AhR). Activation of AhR mediated the stimulatory effect of GTDF on osteoblast proliferation and differentiation. Furthermore, GTDF stimulated cAMP production, which mediated osteogenic gene expression. Together, data suggest that GTDF stimulates osteoblast growth and differentiation via AhR and promotes modeling-directed bone accrual, accelerates bone healing after injury and exerts anabolic effects on osteopenic rats by likely direct stimulatory effect on osteoprogenitors. Based on these preclinical data, clinical evaluation of GTDF as potential bone anabolic agent is warranted.

L-Proline catalysed multicomponent synthesis of 3-amino alkylated indoles via a Mannichtype reaction under solvent-free conditions

An efficient L-proline catalyzed one-pot synthesis of 3-amino-alkylated indoles has been developed

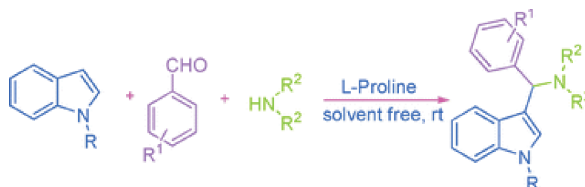


Fig. L-proline catalysed multicomponent synthesis of 3-amino alkylated indoles

by CSIR-CDRI via a three-component Mannich-type reaction viz. secondary amines, aldehyde and indoles under solvent-free conditions at room temperature. Several amino acids (acidic, basic and neutral) have been screened for the reaction but the best results were obtained with L-proline.

β -Cyclodextrin catalysed synthesis of tryptanthrin

An efficient and green method has been developed by CSIR-CDRI for the synthesis of

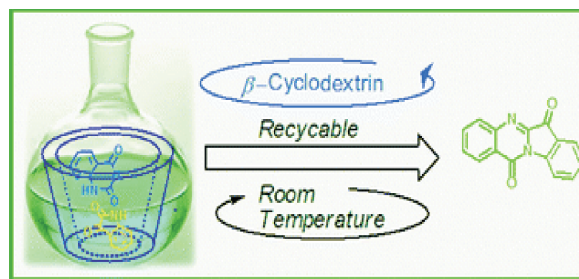


Fig. β -cyclo-dextrin catalysed synthesis of tryptanthrin

tryptanthrin employing β -cyclodextrin as a catalyst in aqueous media at room temperature from isatoic anhydride and isatin. The reactions were performed under mild conditions to afford biologically active natural product tryptanthrin in excellent yields.

Partial biodistribution and pharmacokinetics of isoniazid and rifabutin following pulmonary delivery of inhalable microparticles to rhesus macaques

Dry powder inhalations (DPI) of microparticles containing isoniazid (INH) and rifabutin (RFB) are under preclinical development at CSIR-CDRI for use in pulmonary tuberculosis. Microparticles containing 0.25, 2.5, or 25 mg of each drug were administered daily for 90 days to rhesus macaques ($n = 4/\text{group}$). Single inhalations or intravenous (i.v.) doses were administered to separate groups. Drugs in serum, alveolar macrophages, and organ homogenates were assayed by high-performance liquid chromatography (HPLC). The RFB/INH in the lungs ($101.10 \pm 12.90/101.07 \pm 8.09 \mu\text{g/g}$ of tissue) was twice that of the liver concentrations ($60.22 \pm 04.97/52.08 \pm 4.62 \mu\text{g/g}$) and four times that of the kidneys ($22.89 \pm 05.22/30.25 \pm 3.71 \mu\text{g/g}$). Pharmacokinetic parameters indicated the operation of flip-flop kinetics. Thus, the elimination half-life ($t(1/2)$) of RFB and INH was calculated as 8.01 ± 0.5 and 2.49 ± 0.23 h, respectively, upon intravenous (iv) administration, and as 13.8 ± 0.8 and 10.43 ± 0.77 h following a single inhalation; or 13.36 ± 3.51 and 10.13 ± 3.01 at a presumed steady state (day 60 of dosing). Targeted and sustained drug delivery to nonhuman primate lungs and alveolar macrophages was demonstrated. Flip-flop serum pharmacokinetics was observed, and nonlinearity in some pharmacokinetic parameters at logarithmic dose increments was indicated. The results suggest that human patients would benefit through improvement in biodistribution following DPI.

A synthetic S6 segment derived from KvAP channel self-assembles, permeabilizes lipid vesicles

KvAP is a voltage-gated tetrameric $\text{K}(+)$ channel with six transmembrane (S1-S6) segments in each monomer from the archaeon *Aeropyrum pernix*. CSIR-CDRI made an attempt to understand the plausible role of the S6 segment, which has been

proposed to form the inner lining of the pore, in the membrane assembly and functional properties of KvAP channel. For this purpose, a 22-residue peptide, corresponding to the S6 transmembrane segment of KvAP (amino acids 218- 239), and a scrambled peptide (S6-SCR) with rearrangement of only hydrophobic amino acids but without changing its composition were synthesized and characterized structurally and functionally. Although both peptides bound to the negatively charged phosphatidylcholine/phosphatidylglycerol model membrane with comparable affinity, significant differences were observed between these peptides in their localization, self-assembly and aggregation properties onto this membrane. S6- SCR also exhibited reduced helical structures in SDS micelles and phosphatidylcholine/phosphatidylglycerol lipid vesicles as compared with the S6 peptide. Furthermore, the S6 peptide showed significant membrane-permeabilizing capability as evidenced by the release of calcein from the calcein-entrapped lipid vesicles, whereas S6-SCR showed much weaker efficacy. Interestingly, although the S6 peptide showed ion channel activity in the bilayer lipid membrane, despite having the same amino acid composition, S6-SCR was significantly inactive. The results demonstrated sequencespecific structural and functional properties of the S6 wild type peptide. The selected S6 segment is probably an important structural element that could play an important role in the membrane interaction, membrane assembly, and functional property of the KvAP channel.

Anti-inflammatory properties of melittin, venom antimicrobial peptide

The bee venom antimicrobial peptide, melittin, besides showing versatile activity against microorganisms also neutralizes lipopolysaccharide (LPS)-induced proinflammatory responses in macrophage cells. However, how the amino acid sequence of melittin contributes in its anti-inflammatory properties is mostly unknown. To determine the importance of the leucine zipper sequence of melittin in its neutralization of LPS-

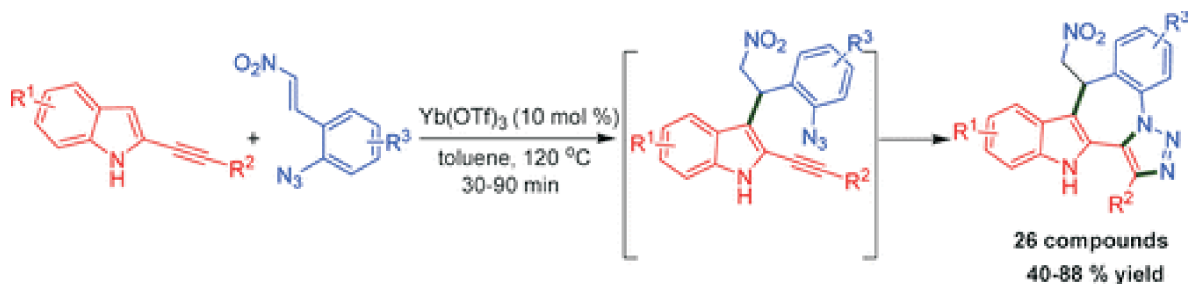


Fig.

induced inflammatory responses in macrophages and interaction with LPS, anti-inflammatory properties of melittin and its three analogues and their interactions with LPS were studied in detail by CSIR-CDRI. Two of these analogues, namely melittin Mut-1 (MM-1) and melittin Mut-2 (MM-2), possess leucine to alanine substitutions in the single and double heptadec leucine residue(s) of melittin, respectively, whereas the third analogue is a scrambled peptide (Mel-SCR) that contains the amino acid composition of melittin with minor rearrangement in its leucine zipper sequence. Although MM-1 partly inhibited the production of pro-inflammatory cytokines in RAW 264.7 and rat primary macrophage cells in the presence of LPS, MM-2 and Mel-SCR were negligibly active. A progressive decrease in interaction of melittin with LPS, aggregation in LPS, and dissociation of LPS aggregates with alteration in the leucine zipper sequence of melittin was observed. Furthermore, with alteration in the leucine zipper sequence of melittin, these analogues failed to exhibit cellular responses associated with neutralization of LPS-

induced inflammatory responses in macrophage cells by melittin. The data indicated a probable important role of the leucine zipper sequence of melittin in neutralizing LPS-induced pro-inflammatory responses in macrophage cells as well as in its interaction with LPS.

Cascade intermolecular michael addition–intramolecular azide/internal alkyne 1,3-dipolar cycloaddition reaction in one pot

A rapid one-pot protocol for the synthesis of indole-based polyheterocycles via a sequential Lewis acid catalyzed intermolecular Michael addition and an intramolecular azide/internal alkyne 1,3-dipolar cycloaddition reaction has been described by CSIR-CDRI. The generality of the method has been demonstrated by treating a series of aromatic/aliphatic 2-alkynyl indoles with substituted (E)-1-azido-2-(2-nitrovinyl) benzenes to furnish annulated tetracyclic indolo[2,3-c][1,2,3] triazolo [1,5-a][1]benzazepines in good yields.

Candidate Drugs under Advance Stages of Development

CSIR-CDRI has developed following candidate drugs which are under advance stages of development as listed for specific disease/disorder:

Table 1.1 Candidate drugs under advance stage for development

Diseases / Disorders	Candidate Drug	Efficacy	Clinical Status	Licensees & Collaborators
Liver Disorder	Picroliv	Hepatoprotective	Phase III clinical trial completed at CSSMU, Lucknow and Seth GS Medical College & KEM Hospital Mumbai.	DIL, Mumbai
Dyslipidemia	80-574 + Atorvastatin	Antidyslipidemic	Extended phase III clinical trial	Cadila Pharmaceuticals Ltd., Ahmedabad
Malaria	97-78	Antimalarial	Phase-I single dose clinical study completed. Single dose pharmacokinetic study in healthy volunteers initiated.	IPCA Labs., Mumbai
Diabetes	CDR 134D123	Antihyperglycemic	Phase-I single & multiple dose studies completed. A quality document as per Ayurvedic Pharmacopoeia of India specifications, is being compiled for submission to CCRAS for expedited inclusion of <i>Xylocarpus granatum</i> in the Extra Ayurvedic Pharmacopoeia to avail marketing permission from AYUSH. Additional Quality Monograph including additional Botanical & Chemical information submitted to DGCCRAS.	TVC Sky Shop Ltd., Mumbai
Diabetes & Dyslipidemia	CDR 134F194	Antihyperglycemic	DCG(I) permission to conduct Phase 1 Clinical Trial received in May 2011 and preparation for the same has been initiated. The preparations for the drug formulation to be used in Phase-I Single Dose and Multiple Dose Clinical Trial studies from a GMP certified company is in progress and the clinical trial would commence soon	TVC Sky Shop Ltd., Mumbai
Osteoporosis	99-373	Anti-osteoporotic	Plan and Protocol of phase I clinical trial has been approved by DCG(I).	Negotiations in progress with MDRI
Malaria	99-411	Antimalarial	Pre-clinical data is under compilation for IND submission.	IPCA Labs., Mumbai
Stroke	Herbal Medicament	Neuroprotective	Draft IND received from Themis Medicare is under review at CDRI for preparation of final IND document	Themis Medicare Ltd., Mumbai



Potential New Leads

CSIR-CDRI has developed the following potential new leads and are ready for licencing

Table 1.2 Potential New leads

Diseases / Disorders	Lead	Efficacy	Status	Licensees & Collaborators
Osteoporosis	CDR1020F147 OsteoJuvenate	Optimum bone health	Completed requisite preclinical development; Process to obtain approval for clinical trial has been initiated	Natural Remedies Pvt., Ltd., Bangalore
Osteoporosis	S-007-1500	Fracture healing	Compound found safe in single dose toxicity study by oral route in rat and mice and by IM route in rat. One year stability study completed	Under negotiation
Osteoporosis	CDR914K058	Osteogenic	Efficacy established in animal models. Synthesis of compound in progress Licensing agreement with Kemxtree, USA is in the final stage for developing it as a rapid bone fracture healing anabolic agents	Under negotiation
Thrombosis	S-007-867	Anti-thrombotic	Compound found safe in single dose toxicity study by oral route in rat and mice and by IM route in rat.	Open for licensing
	S-002-333	Anti-thrombotic	Compound found safe in single dose toxicity study by oral route in rat	Open for licensing
Diabetes & Dyslipidemia	CDR267F018	Anti-dyslipidemic	28 day repeat dose toxicity study in Rh monkey: No significant toxic effect observed up to dose of 250 mg/kg po.	Open for licensing
Contraception	S-010-1255	Spermicidal & Anti-trichomonal	Potent spermicidal and anti-trichomonal (against both metronidazole susceptible and resistant strains) activity established with much higher safety index compared with Nonox-9	Open for licensing
Cancer	S-009-131	Anti-cancer	As per the studies in mice bearing cervical cancer (HeLa), activity is better than that of standard drug Adriamycin	Open for licensing
Tuberculosis	S-006-830	Anti-TB	MIC<3 µg/mL for Mtb H37Rv. Efficacy established <i>in vitro</i> & <i>ex vivo</i> . Large scale synthesis completed. QC analysis of pure compound in progress.	Being developed under OSDD

Demonstration of Process Know-how of CDR-134- D123 (antihyperglycemic)

CDR134D123 is a standardized fraction isolated from a marine source. The product has shown promising antihyperglycemic activity. CSIR-CDRI has licensed the product to M/s TVC Skyshop Ltd., Mumbai for further development and commercialization. Phase I single and multiple dose study have been completed. Efforts are in

place to avail marketing permission for the product in herbal mode. The process Know-how for preparation of CDR134D123 has been successfully demonstrated to the M/s TVC Skyshop Ltd during year.

Novel Path of Curing Ulcer by Indian Traditional Healer, the Turmeric

Gastric ulcer relates injury to mucosal layer with disrupted blood vessels, collagen matrices and vascular architecture in stomach. CSIR-IICB



Fig. Indian Traditional Healer, the Turmeric

scientists have found that curcumin (major component of turmeric) significantly accelerates healing of gastric ulceration caused by excessive intake of pain killer. The novel path is the induction of angiogenesis (new blood vessel formation) via upregulation of matrix metalloproteinase-2 during healing phase.

Antioxidant Enzymes from Mangrove Fungi & Actinomycetes: A Novel Tool for Industrial Applications

Mangrove microbes are ascertained to be an important source of new bioactive compounds. Marine actinomycetes and fungi are efficient producers of new secondary metabolites that show a range of biological activities including antibacterial, antifungal, anticancer, antioxidant producers etc. CSIR-IMMT isolated actinomycetes and fungi from sediments of three different mangroves areas such as Bhitarkanika, Dhamra and Mahanadi areas of Odisha. The physico-chemical parameters have direct effect on the microbial diversity of the study areas. Isolated strains were screened for the presence of antioxidant enzyme i.e. catalase. Out of these isolates, the strains showing maximum effervescence during screening were studied for assay purpose. Fungal and actinobacterial strains such as MGF-3 and MGA-6 were showing maximum catalase activity such as 101U and 13U of enzyme activity respectively. Strains were identified morphologically, biochemically and

microscopically as *Streptomyces sampsonii* and *Trichoderma viride*. It is concluded that the mangrove microbes are the potential source of antioxidant enzymes and can be further exploited for various industrial purposes.

New insecticidal proteins from plants

CSIR-NBRI isolated six insecticidal proteins, three from ferns, two from mosses and one from salad onion. All of them were effective against whiteflies (LC₅₀ ranging from 175 µg to 10 µg/ml), while three were also found effective against aphids. All toxin encoding genes were cloned from the source plants. Three of these insecticidal genes were cloned at the downstream of four promoters separately (CaMV35S, two insect specific promoters and one phloem specific promoter) in pBI based binary vector. In this way, a total of 12 plant transformation vectors were developed.

Natural Strawberry Red Color from Plants

CSIR-NBRI developed technology for Natural Strawberry Red color for cosmetic use as lip balm. The isolated color is stable, lipophilic and non-toxic. The product has antioxidant and antimicrobial properties.



Fig. Lip Balm Natural Strawberry red color

Genomic and expressed SSRs for levant cotton (*Gossypium herbaceum* L.)

Four microsatellite-enriched genomic libraries for CA(15), GA(15), AAG(8) and ATG(8) repeats and transcriptome sequences of five cDNA libraries of *Gossypium herbaceum* were explored to develop simple sequence repeat (SSR) markers by CSIR-NBRI. A total of 428 unique clones from repeat enriched genomic libraries were mined for 584 genomic SSRs (gSSRs). In addition, 99780 unigenes from transcriptome sequencing were explored for 8900 SSR containing sequences with 12471 expressed SSRs. The study resulted in addition of 1970 expressed SSRs and 263 gSSRs to the public domain for the use of genetic studies of cotton. When 150 gSSRs and 50 expressed SSRs were tested on a panel of four species of cotton, 68 gSSRs and 12 expressed SSRs revealed polymorphism. These 200 SSRs were further deployed on 15 genotypes of levant cotton for the genetic diversity assessment. This is the first

report on the successful use of repeat enriched genomic library and expressed sequence database for microsatellite markers development in *G. herbaceum*.

Response of stomata to environmental determinants and ABA in *Selaginella bryopteris*, a resurrection spike moss species

Experimental studies carried out by CSIR-NBRI demonstrated that *S. bryopteris* plants show a poor mechanism for its stomatal regulation in response to high light, high temperature, high VPD, high CO₂ and to ABA treatment. At the same time the plants show a high stomatal conductance leading to unrestricted rates of transpiration and a lack of capacity to optimize water use efficiency (WUE). Apparently the plant survives under desiccation by down regulation of metabolic activity and inward curling of its fronds which reduced the transpiration by reducing effective leaf area.

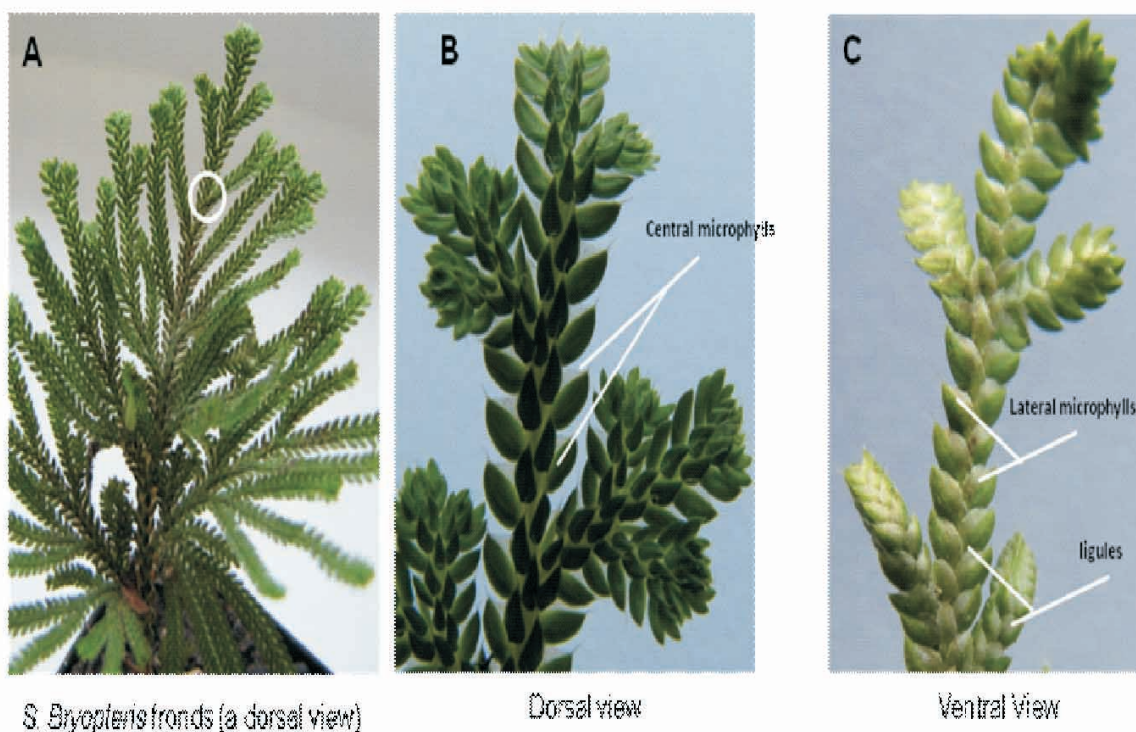
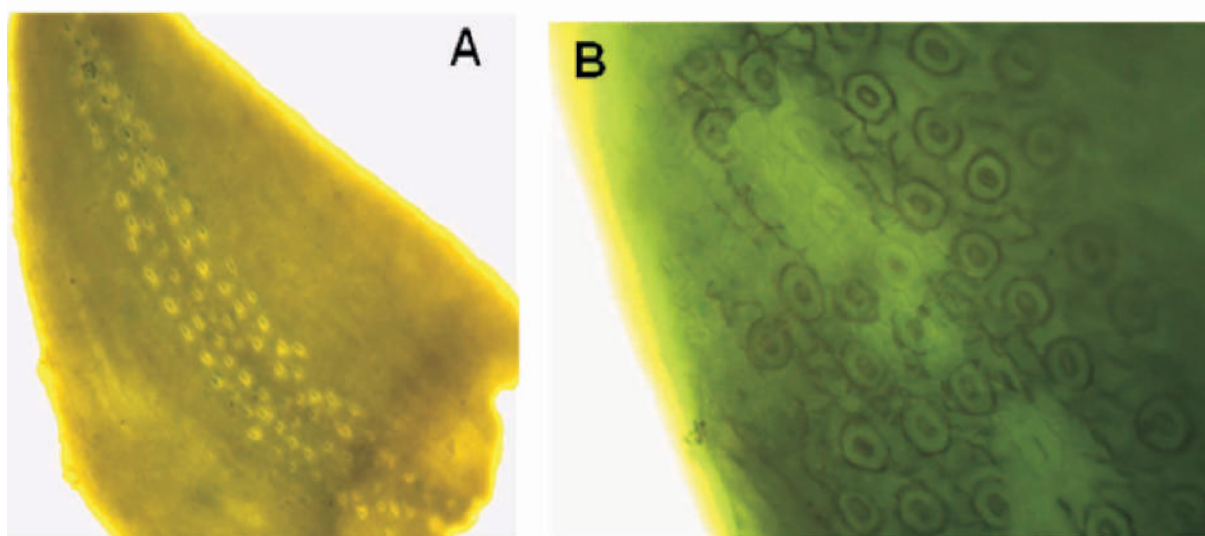


Fig. Fronds of *S. bryopteris* growing in a pot (A). Close dorsal view of the frond showing the alternate arrangement of the microphylls on the axis (B). Ventral view of the fronds showing the lateral microphylls and the transparent ligule at its base (C).



Central microphyll (adaxial surface)

Lateral microphyll (abaxial surface)

Fig. Morphometric study of the stomata of *S. bryopteris*. Adaxial surface view of the central microphyll showing the presence of stomata in a regular row pattern (A). Abaxial surface of the lateral microphyll showing the scattered stomata (B).

Differential effects of Arsenic (As) on essential and non-essential amino acids in rice grains

CSIR-NBRI analyzed the amino acids (AA) profile in rice grain grown in As affected areas. The sixteen rice genotypes differing in grain As accumulation, grown at three sites with different soil As concentrations, in ascending order, Chinsurah<Purbosthali<Birnagar were analyzed for the amino acid (AA) profile. Grain As accumulation negatively correlated with essential amino acids (EAAs) which were more prominent in high As accumulating rice genotypes (HAARGs). Conversely, non-essential amino acids (NEAAs) showed an increase in low As accumulating rice genotypes (LAARGs) but a decrease in HAARGs. EAAs like isoleucine, leucine, valine, phenylalanine, and tyrosine also decreased in most of the genotypes. NEAAs like glutamic acid, glycine, proline, and histidine showed an increase in all LAARGs. Likewise, sulfur containing AAs (methionine and cysteine) increased in LAARGs but decreased in HAARGs. Among NEAAs in HAARGs, only arginine and serine showed some induction in most of the genotypes. At the highest As site (Birnagar) total EAAs and NEAAs showed significant reduction in

HAARGs compared to LAARGs. The study concluded that As accumulation in rice grain alters EAAs and NEAAs differentially, and reduction was more pronounced in HAARGs than in LAARGs. Thus, As tainted rice limits required levels of AAs in rice based diets and therefore cannot alone fulfill the recommended daily intake (RDI) of AAs.

Pathway engineering and system biology approach towards homologous and heterologous expression of high-value phytochemicals

The molecular basis of metabolite production in *Podophyllum hexandrum* and *Picrorrhiza kurrooa* has been elucidated by CSIR-IHBT. Improved protocol for the isolation of RNA from rhizome tissue of *P. hexandrum* was developed and transcriptome data were generated. De novo assembling to obtain a total of 60,089 assembled transcript sequences, with an average coverage of 88.34 and average length of 543.11bp was done. A total of 11 full-length genes associated with podophyllotoxin biosynthesis were cloned and analyzed. These were Phenylalanine ammonia-lyase (PAL), p-CoumaroylCoA ligase

(4CL), Cinnamic acid 4-hydroxylase (C4H), Hydroxycinnamoyl transferase (HCT), Caffeic acid 3-O-methyltransferases (COMT), Cinnamoyl CoA NADPH oxidoreductase (CCR), Pinorensinol lariciresinol reductase (PLR) and Secoisolariciresinol dehydrogenase (SLD), P450s (of 3 different types). Detailed expression analysis was carried out to identify the possible regulatory genes of the pathway. The functionality of SLD was validated. Transcriptome data of leaf tissue of *P. kurroo* were generated. A total of 74,336 assembled transcript sequences were obtained, with an average coverage of 76.6 and average length of 439.5. A regeneration protocol was also standardized using leaf segments and aseptic shoot

cultures. Successfully optimised the parameters for developing transgenic plants using GUS reporter gene.

De-novo sequence assembly and transcriptome analysis of *Venturia inaequalis*, the deadly apple scab pathogen

Apple scab caused by *Venturia inaequalis* is one of the most deadly diseases of apple. Due to several distinct features, it has emerged as a model fungal pathogen to study various aspects of hemibiotrophic plant pathogen interactions. CSIR-IHBT studied, de-novo assembling, annotation and characterization of the transcriptome of *V. inaequalis*. In total, 94,350,055 reads specific to *Venturia* were obtained, and assembled into 62,061 contigs representing 24,571 unique genes. Biological process categories like metabolic process, response to stimulus, nucleic acid metabolism, cellular process and transport were among the highly represented GO terms. Also, efforts were made to explore EC classification, KEGG pathway and those encoding kinases, proteases, glycoside hydrolases, cutinases, cytochrome P450 and transcription factors present in this scab pathogen. Several putative pathogenicity determinants and candidate effectors of *V. inaequalis* were identified. Large number of transcripts encoding membrane transporters was identified and comparative analysis revealed that the number of transporters encoded by *Venturia* is significantly more as compared to that encoded by several other important plant fungal pathogens. Interestingly, RxLR motifs were detected in several of the secreted proteins of *Venturia*. Phylogenomics study unraveled that *V. inaequalis* is closely related to *Pyrenophora tritici-repentis* (the causal organism of tan spot of wheat). However, availability of complete genome sequence are required to augment this result. This work would further facilitate research towards understanding the intricacies of its interactions with host apple and innovating newer ways to control this disease.

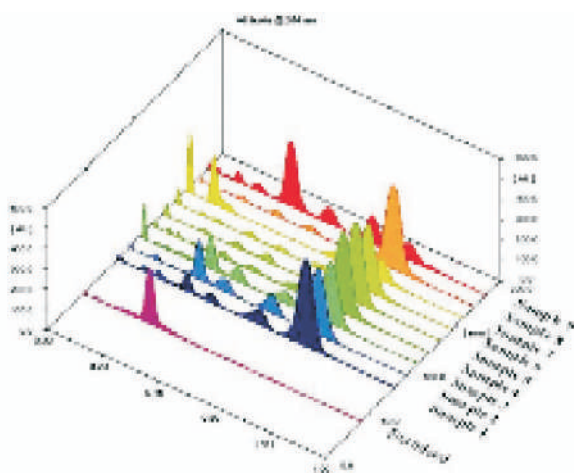


Fig. HPTLC CCD image at 254 nm: standard tracks (A-E) of 1b at different concentrations, samples tracks 1-9 indicating formation of 1b

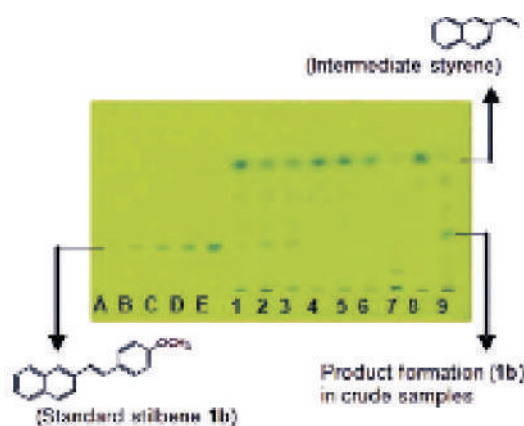


Fig. 3D HPTLC densitogram of samples

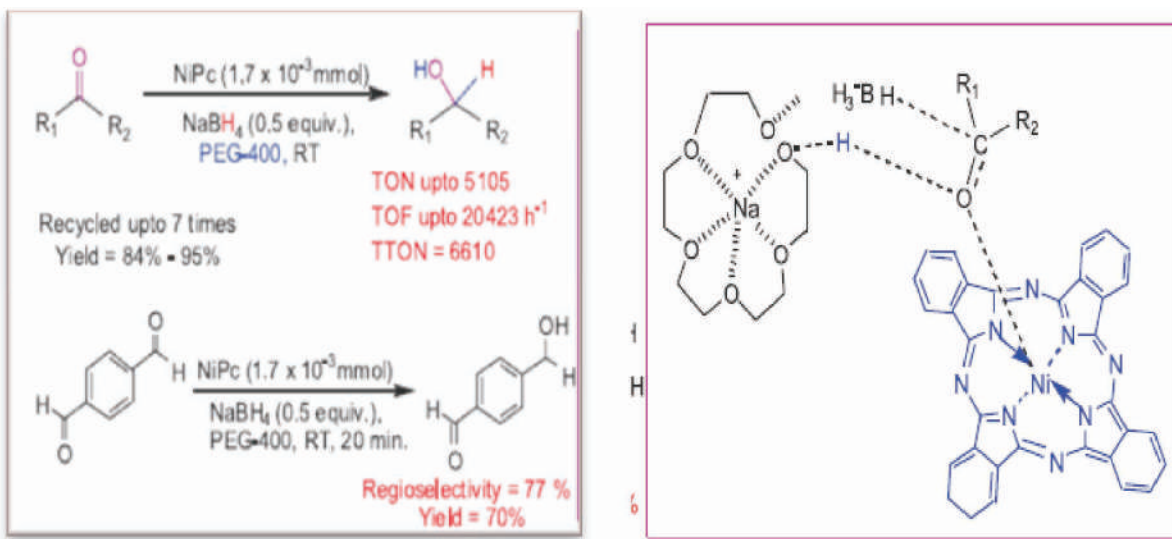


Fig. Carbonyl reduction

Dehydrative-Heck olefination of 2° aryl alcohols in ionic liquid for stilbenoide synthesis

Alcohols being readily accessible have received great attention as precursors in various tandem oxidative /dehydrative cross coupling strategies. However, the direct use of 2° aryl alcohols as an in situ source of styrene (via dehydration) in Heck coupling has remained unexplored. The cross contamination of reagents/catalysts due to different media requirements in Heck and dehydration steps, limit the scope when these two steps are required to be done in one pot. Moreover, 2° aryl alcohols under Heck like conditions generally get converted into respective carbonyls via isomerization or oxidation processes. A tandem strategy has been developed by CSIR-IHBT wherein 2° aryl alcohols were directly coupled with aryl halides to provide stilbenoids through a dehydrative Heck sequence in the ionic liquid [hmim]Br and producing only water as byproduct under microwave irradiation. Classical methods do not permit this sequence to proceed in one pot, due to cross contamination of catalysts while other methods require multiple steps. This is the first report of its kind that utilizes HPTLC for the detection of the products

formation which finally allowed to establish the optimum condition for formation of stilbenoids.

Nickel phthalocyanine assisted highly efficient and selective carbonyl reduction

A reusable green catalytic system based on nickel phthalocyanine with polyethylene glycol- 400 has been developed by CSIR-IHBT for highly chemo- and regioselective reduction of carbonyl compounds to corresponding alcohols at room temperature. The catalytic system tolerated various aromatic, hetero aromatic and aliphatic carbonyl compounds with high turnover number and frequency. This is the first report on regioselective reduction of 1,3- and 1,4-benzenedicarbaldehydes to corresponding alcohols. The catalyst was reused up to seven times without any significance loss in activity. PEG-400, by making crown ether-type complex with sodium borohydride, facilitated the attack of hydride on carbonyl group which was activated by NiPc through Lewis acid–base interaction.

SYBR green real time PCR based detection of *V. inaequalis*

Early detection of presence of the pathogens is crucial for timely detection of disease to take

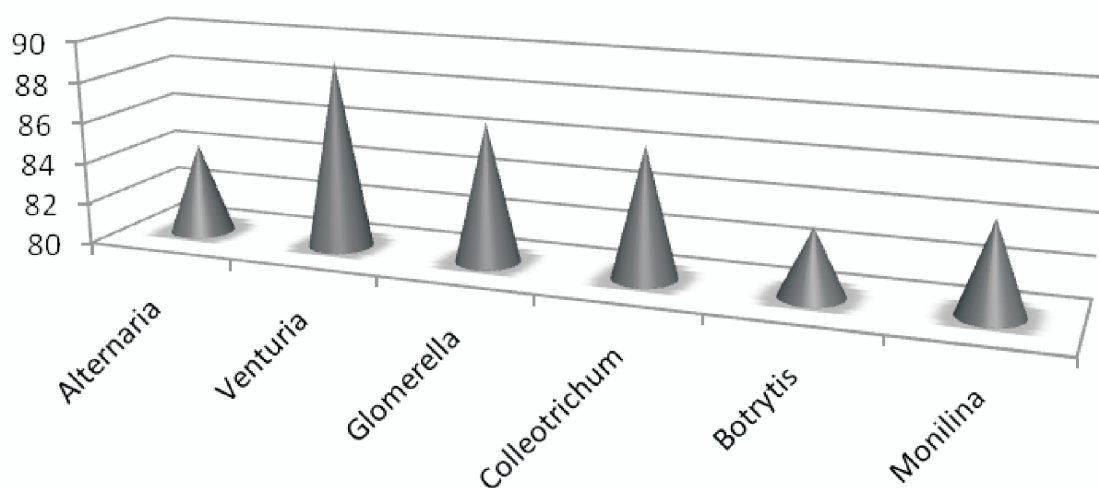


Fig. SYBR green real time PCR based detection of *V. inaequalis*

appropriate reassurance to prevent yield losses due to several plant diseases. Previously CSIR-IHBT reported the robustness of PCR-RFLP based assay to detect and distinguish *Venturia inaequalis*, the causal of apple scab from other fungal pathogens of apple. Efficacy of the primers in SYBR green real-time PCR based assay to sensitively detect the *Venturia* was tested. DNA isolated from the pure culture of the fungal strains of *V. inaequalis*, *A. alternata*, *G. cingulata*, *C. acutatum*, *M. laxa* and *B. cinerea* were subjected to SYBR based RT-PCR assay. The melting curve analysis revealed distinct T_m for *V. inaequalis* when compared to other fungi tested (*V. inaequalis*: T_m = 89.155; *A. alternata*: T_m = 84.42; *G. cingulata*: T_m = 86.77; *C. acutatum*: T_m = 86.32; *M. laxa*: T_m = 84.2 and *B. cinerea*: T_m = 83.2; (Fig). The assay was able to detect the pathogen in the field infected leaf.

Transgenic crop plants and genes for resistance to insect pests

Five promoters (NBRI17, NBRI18, NBRI20, NBRI22 and NBRI23) for wound inducible expression have been cloned by CSIR-NBRI into plant expression vector and transformed in tobacco. Two strong wound inducible promoters like

RbPCDpro, GgEXPA1 that are activated within 5 minutes of mechanical/insect wounding, were isolated. Expressing the CryIAC protein under the RbPCD1 promoter in transgenic *Arabidopsis* has shown rapid expression of toxins without affecting the growth of transgenic plants, killing insects within 8 hours of feeding as against more than 24 hours in transgenic cotton using the same gene under the CaMV35S promoter that also exhibit developmental abnormalities.

Transgenic plants of chickpea (T_0 and T_1) expressing Cry1Ac and Cry1Ab endotoxins have been developed and selected promising plants showed complete resistance to *Helicoverpa armigera*. Transgenic T_5/T_6 tomato plants expressing high level of Cry1Ab endotoxin have shown complete protection against *H. armigera* and *Spodoptera litura* without any effect on yield and are ready for limited trial and commercialization. The Agrobacterium-mediated transformation of embryonic callus of chickpea has been documented and transgenic chickpea plants expressing 116 ng mg⁻¹ soluble protein of Cry1Ac toxin has been developed via somatic embryogenesis route.

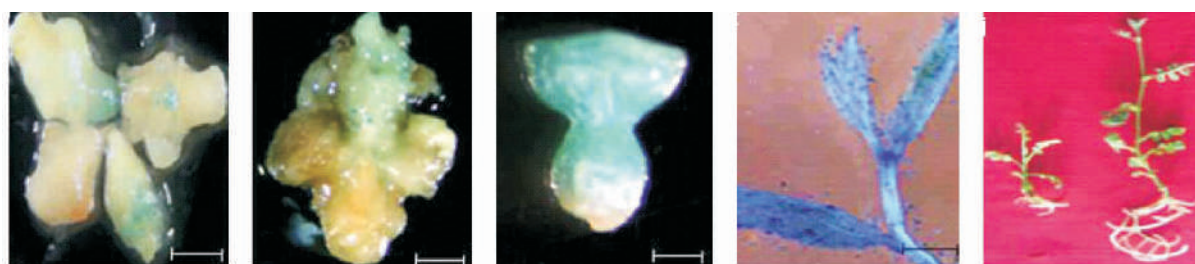


Fig. Different developmental stages of somatic embryos after Agrobacterium-mediated transformation of MEA-derived embryogenic callus and molecular characterization of transgenic plants. A-histochemical GUS expression in embryogenic callus (x10), B-torpedo shaped embryo (x10), C-developing dicotyledonary embryo (x40), D-stable GUS expression in leaves of fully developed transgenic plant (x40), E-complete plantlet regenerated via somatic embryogenesis after Agrobacterium-mediated transformation.

Repression of DNA repair protein during rapid meiotic and mitotic division

CSIR-NBRI studied molecular and functional diversity of microbes which included all agro climatic zones in India. Microarray analysis of *A. thaliana* plants colonized by plant growth promoting bacteria MTCC5279 have been studied to gain insight into MTCC5279 assisted plant growth promotion in *Arabidopsis thaliana* (Fig.). The gene expression changes, represented by oligonucleotide array (24652 genes) were found to be involved in maintenance of genome integrity (At5g20850), growth hormone (At3g23890 and

At4g36110), amino acid synthesis (At5g63890), abscisic acid (ABA) signaling and ethylene suppression (At2g29090, At5g17850), Ca²⁺ dependent signaling (At3g57530) and induction of induced systemic resistance (At2g46370,

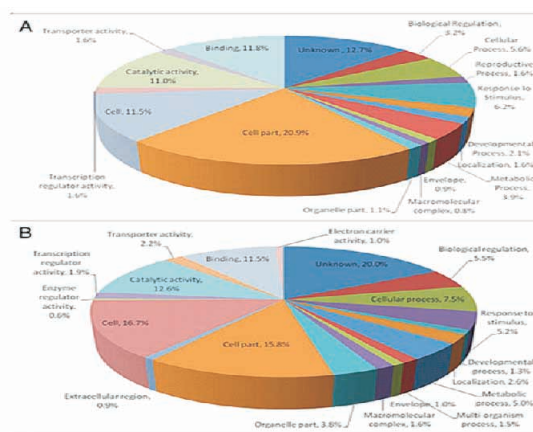


Fig. Functional categorization of up-regulated (A) and down-regulated (B) Arabidopsis thaliana genes in terms of their gene ontology involved in plant growth promotion by the colonization of Pseudomonas putida MTCC5279

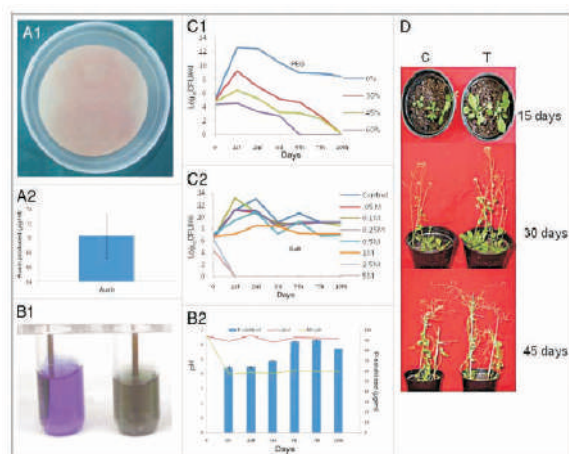


Fig. Auxin production (A1, A2); P-solubilization (B1, B2); abiotic stress tolerance (C1, C2) and plant growth promotional attribute to Pseudomonas putida MTCC5279 on Arabidopsis thaliana (D)

At2g44840). The genes At3g32920 and At2g15890 which are suggested to act early in petal, stamen and embryonic development are among the down-regulated genes. This is report of the first time MTCC5279 assisted repression of At3g32920, a putative DNA repair protein involved in recombination and DNA strand transfer in a process of rapid meiotic and mitotic division.

New report of phosphate solubilizing *Trichoderma* from India

Trichoderma species are usually considered soil organisms that colonize plant roots, sometimes forming a symbiotic relationship. CSIR-NBRI isolated and identified a new phosphate solubilizing *Trichoderma* (*T. koningiopsis*) from rice plants based on morphological and molecular characterization. The BLASTn and *Tricho*BLAST results on ITS sequence showed 99-100% homology to *T. koningiopsis* accessions and in particular to vouchered culture *T. koningiopsis* GenBank accession no DQ379015. The GenBank accession for ITS sequence of *T. koningiopsis* NBRI-PR5 is JN375992 and it is the first report of *T. koningiopsis* from India.

New Varieties / Cultivars *Chrysanthemum* – NBRI-Pushpangadan

A new cultivar of chrysanthemum, named 'NBRI – Pushpangadan', in honour of the former Director of CSIR-NBRI, Dr. P. Pushpangadan, was developed through bud sport selection. 'NBRI-Pushpangadan' is a yellow-flowered mutant of chrysanthemum cultivar 'A- 22', evolved as bud sport. Plant attains height up to 49 cm and produces more than 210 yellow anemone flower heads. Plant spread is 46.5 cm (N-S) and 42 cm (E-W). Flower head size (across) is 4.30 cm. Disc floret in the central region is pin cushion type and its colour is yellow (Yellow Group 6A, Fan-1). Ray florets are tubular and their number in a flower head is 21 and their colour is yellow (Yellow Group 6D, Fan-1).



Fig. NBRI – Pushpangadan: a new variety of *Chrysanthemum* developed by CSIR-NBRI

Morphological analysis of vegetative and floral characters of 'A-22' and its bud sports 'NBRI-Pushpangadan' revealed that all the characters of control and bud sports are almost same except the flower head colour and shape. The cultivar is ideal for pot plant and bedding.

Antioxidant furofuran lignans from *Premna integrifolia*

Two new furofuran lignans, premnadimer and 4 β -hydroxyasarinin-1-O- β -glucopyranoside were isolated by CSIR-CIMAP from the stem bark of *Premna integrifolia*. The Compounds were evaluated for radical scavenging and ferric reducing antioxidant power. Radical scavenging activity was found maximum in 4''-hydroxy-E-globularinin followed by 10-O-trans-p-coumaroylcatalpol and new dimer. In FRAP assay, premnosidic acid, 10-O-trans-p-coumaroyl-6-O- α -L-rhamnopyranosyl catalpol exhibited maximum ferric reducing ability supported by high reducing power.

Withania wet rot caused by *Choanephora cucurbitarum*

A new disease initially produced water soaked lesions on leaves and stems that progressed to a wet rot appeared in *Withania* fields during monsoon at Lucknow and in adjoining areas of northern India. Based on cultural, morphological and molecular characteristics fungus was identified by CSIR-CIMAP as *Choanephora cucurbitarum* (Berk. & Ravenel) Thaxt. Its sequence was submitted to NCBI GenBank with accession no. JN639861.

Efficient genetic transformation of *Withania coagulans* mediated by *Agrobacterium tumefaciens*

An efficient *Agrobacterium*-mediated transformation of *Withania coagulans* has been achieved by CSIR-IGIB using leaf explants of multiple shoot culture. The *Agrobacterium* strain LBA4404 harbouring the binary vector pIG121Hm containing β -glucuronidase gene (*gusA*) under the control of a CaMV35S promoter was used in the development of transformation protocol. 100%

frequency of transient GUS expression was achieved with 5% stable transformation efficiency using developed and optimized conditions. PCR analysis of T0 transgenic plants showed the presence of *gusA* and *nptII* genes confirming the transgenic event. Histochemical GUS expression was observed in the putative transgenic *W. coagulans* plants. Metabolite analysis showed the presence of similar type of withanolides in the transgenic and non-transgenic regenerated plants. *Agrobacterium tumefaciens* mediated transformation system via leaf explants developed in our lab will be useful for pathway manipulation using metabolic engineering for bioactive withanolides in *Withania*.

Longevity-promoting effects of 4-hydroxy-E-globularinin in *Caenorhabditis elegans*

CSIR-CIMAP reported that 4-Hydroxy-E-globularinin (4-HEG) from *Premna integrifolia* exhibited the longevity-promoting activity of 4-HEG in the animal model *Caenorhabditis elegans*. 4-HEG (20 mM) enhanced the mean life span of worms by over 18.8% under normal culture conditions and also enhanced their survival under oxidative stress. The longevity-promoting activity was associated with reduced reactive oxygen species (ROS) levels and fat accumulation in the worms. Gene-specific mutant studies varied the role of ROS detoxication pathways and simultaneous nuclear translocation of DAF-16 in the 4-HEG-

mediated effects. Quantitative real-time PCR estimations and observations of transcriptional reporters indicated that 4-HEG was able to upregulate stress-inducible genes, viz., *hsp-16.2* and *sod-3*. It is inferred that 4-HEG may serve as a lead compound of plant origin for the development of important nutraceuticals superseding the aging process.

The results demonstrate that 4-HEG has the potential to significantly increase the life span of worms under standard laboratory conditions of 20°C and paraquat-induced oxidative stress as well. It was observed that 4-HEG also has the ability to attenuate ROS and fat accumulation inside worms, leading to improved physiological parameters. Finally, it was demonstrated that an endogenous ROS detoxication pathway, nuclear localization of the major transcription factor DAF-16, and upregulation of several DAF-16-regulated stress-inducible genes, viz., *hsp-16.2* and *sod-3*, are responsible for the 4-HEG-mediated longevity in *C. elegans*. This study for the first time reports the longevity promoting activity of 4-HEG from *P. integrifolia* in the *C. elegans* model system.

Environmental Contaminants: New Screening Technologies and Effect on Human Health

Alpha-1 antitrypsin (AAT) deficiency is an inherited disorder that causes low levels of, or no

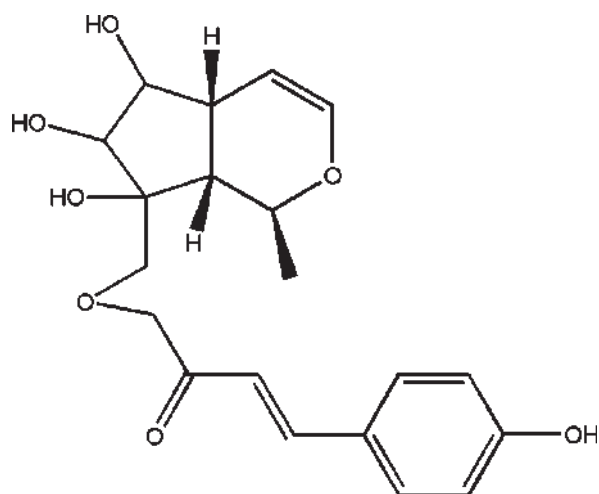


Fig. 4-Hydroxy-E-globularinin

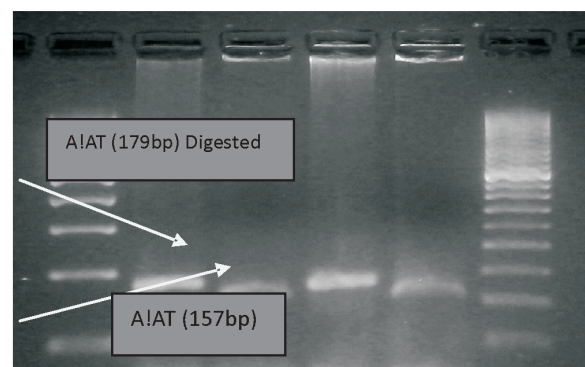


Fig. Detection of A1AT gene by site directed mutagenesis PCR method. Lanes 1,2 A1AT gene 179bp normal (MM type). The primers used to amplify the sequence that included the Z mutation site yielded a product of the corrected size (179 bp) in all cases. Subsequently, PCR products were digested with *Taq I* enzyme. The normal fragment was 157 bp long.



alpha-1 antitrypsin in the blood. The most common illness in adults with alpha 1 antitrypsin deficiency is lung disease during the third and fourth decades of life. Most commonly it is associated with chronic obstructive pulmonary disease (COPD). Mutations in the PI gene, located on chromosome 14, are associated with this genetic disorder. The Z protein is due to a single amino acid substitution of 342 glutamine to lysine. Although cigarette smoking is the main environmental risk factor, only about 15% of smokers develop clinically significant disease suggesting other influences on disease expression. The study carried out by CSIR-NEIST included hospital based age and sex matched 100 cases of COPD and 100 controls without COPD recruited from nearby places of Assam. The study reveals that other genes besides A1AT (ZZ type) could be responsible for the prevalence of COPD. PCR amplification showed characteristic 179bp band indicating the presence of homozygous 'MM' type in all the samples. The sequences obtained were aligned with the mRNA of normal (MM type) Alpha-1-Antitrypsin gene. No difference was found in position Glu342 GAG Lys AAG in COPD smoker, COPD Non-Smoker, Non-COPD Smoker and Non-COPD Non-smoker respectively. It is observed that smoking was the prior cause of COPD. A1AT deficiency is not prevalent in our population subset but certain other genes could be the attributable factor for COPD.

Exploration and Screening of Bacterial Diversity in North-East India and Its Potential Application in Biocontrol

Phylogenetic analysis of alkaline proteinase producing fluorescent pseudomonads associated with green gram (*Vigna radiata* L.) rhizosphere. Fifty fluorescent pseudomonads were isolated by CSIR-NEIST from rhizospheric soil of green gram from nearby area of Kaziranga, Assam, India and assayed for their extracellular proteinase production. Out of these isolates 20 were found to be prominent in proteinase production. Genetic diversity of the 20 isolates were analyzed through BOX-PCR fingerprinting and 16S rDNA-RFLP along with three reference strains, viz.,

Pseudomonas fluorescens (NCIM2099T), *P. aureofaciens* (NCIM2026T) and *P. aeruginosa* (MTCC2582T). Based on phenotypic characters and 16S rDNA sequence similarity all the 8 highly proteinase producing strains were affiliated with *P. aeruginosa*. The proteinase was extracted from two most prominent strains (KFP1 and KFP2), purified by a three-step process involving (NH₄)₂SO₄ precipitation, gel filtration and ion exchange chromatography. The enzyme had an optimal pH of 8.0 and exhibit highest activity at 60°C and 37°C by KFP1 and KFP2 respectively. The purified enzyme was migrated as a single band on native and SDS-PAGE with a molecular mass of 32 kDa. Zn²⁺, Cu²⁺ and Ni²⁺ ion inhibited the enzyme activity. Enzyme activity was also inhibited by EDTA established as their metallo-proteinase nature.

DNA fingerprinting of fluorescent pseudomonads associated with rhizospheric soil of green gram - role in plant growth promotion under water stress

A total of 130 fluorescent pseudomonads from green gram rhizospheric soil of Jorhat district of Assam were isolated and characterized by CSIR-NEIST for multiple plant growth promoting traits, such as the production of indole acetic acid (IAA), nitrogen fixation, phosphorus (P) solubilization, siderophore production, production of ammonia (NH₃) and production of different enzymes viz., protease, chitinase, pectinase and cellulase. On the basis of PGPR characteristics 8 isolates were tested for 1-aminocyclopropane-1-carboxylic acid (ACC) deaminase activity. Further *in vitro* studies of role of two potential bacterial isolates on water stress resistance were examined. *In vivo* study of these two isolates in green gram plant revealed increase in root length of 10-20% and dry weight of between 22 to 35% in comparison to the positive controls under water stress condition. Chlorophyll content as well as accumulation of proline in the bacterized plant was compared with control one under stress condition. Proline accumulation and increase in chlorophyll concentration was higher in bacterized plant as compared to control. 16S

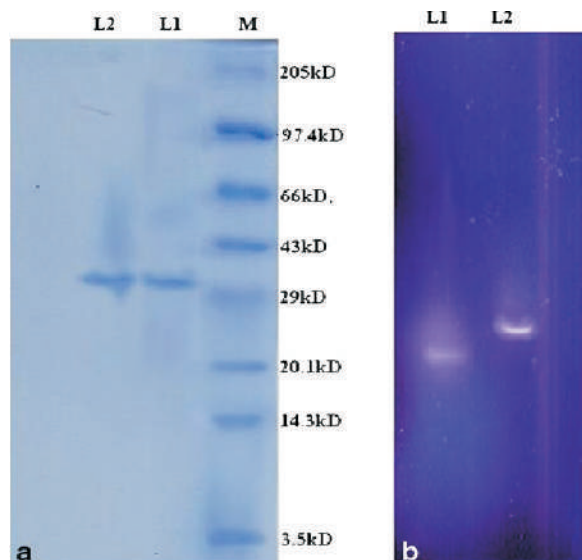


Fig. SDS-PAGE (15%) of the purified proteinase from *Pseudomonas aeruginosa* KFP1 and *P. aeruginosa* KFP2; M, molecular mass standard; L1, purified proteinase of KFP1; and L2, purified proteinase from KFP2 showing 32 kDa molar mass. b. Zymography of purified proteinase; L1, zymography of KFP1 purified proteinase and L2, zymography of KFP2-purified proteinase

rDNA-RFLP and BOX-PCR fingerprinting revealed huge genetic diversity among the isolates with different PGPR traits.

Diversity and proteinase-producing bacteria isolated from rhino's dung

Twenty four bacteria were isolated by CSIR-NEIST in four different media. Based on the sequence similarity of 16S rDNA and phylogenetic analysis, isolates belonged to nine genera, *Providencia* sp. (9 nos.), *Bacillus* sp. (5 nos.), *Pseudomonas* sp. (3 nos.), *Achromobacter* sp. (2 no.), *Brevibacillus* sp. (1 no.), *Sphingobacterium* sp. (1 no.), *Proteus* sp. (1 no.), *Caryophanon* sp. (1 no.) and *Acinetobacter* sp. (1 no.). The study revealed high degree of genetic variability among different genera of bacteria and *Providencia* is the predominant bacteria in rhino dung in this area. Only two strains *Achromobacter* sp. KRD9 and *Providencia* sp. KRD23 were found potential for proteinase production with molecular mass of 41kDa. The broad range temperature, pH dependency, dehairing ability, detergent stability

and compatibility with consistent activity and excellent storage stability make the enzyme potentially useful for application in the detergent and leather industry. This perhaps the first report on genetic diversity and isolation of proteinase producing bacteria from rhino dung.

Survey, Isolation and Preliminary Characterization of Microbial (Bacteria) Populations of Southern Brahmaputra Corridor of Assam

Bacterial strain has been isolated and identified by CSIR-NEIST as Plant Growth Promoting Rhizobacteria (PGPR) which shows growth promotion on different vegetable crop plants. The Nutrient agar and Nutrient broth were used for culturing PGPR strains. A pure culture of rhizobacterial strain was maintained in NA slants. The bacterial culture was spread by spraying near the root region of the individual plants and a 20% dilution of bacterial bioformulation was sprayed on leaves, stems and near the collar region of the crop plants. Similarly, a bacterial consortium (RB1+RB4+RB5) bioformulation was prepared and spread in the crop plants. The strains were identified at CSIR-IMTECH as follows: RB1 (MTCC 8297) *Bacillus cereus*, RB4 (MTCC 8299) & RB5 (MTCC 8300) *Pseudomonas rhodesiae*.

The effect of PGPR on growth enhancement in crops, viz, chilli (*Capsicum annum*), brinjal (*Solanum melongena*), tomato (*Solanum lycopersicum*), cauliflower (*Brassica oleracea* var. botrytis), lady's finger (*Abelmoschus esculentus*), and rice (*Oryza sativa*) and tea (*Camellia sinensis*) was carried out in experimental field. The treated crops have shown various morphological differences like enhanced height, change in leaf colour, numbers of leaves etc. and have shown significant results in increase biomass when compared to control group. Two sets of crops have been planted, one treated with bioformulation and another without any treatment. The measurements and number of leaves were taken at regular intervals. Treated crops have shown a wide range of differences like number of leaves, height early

flowering compared to the control crops. The effects of the PGPR combinations in plants were also determined through estimation of biochemical parameters. Fruit samples of vegetable crops were collected after treatment with PGPR and were subjected for biochemical estimation. Estimation of Total carbohydrate content, total soluble protein and free amino acids analysis showed higher value in treated crops than the control.

Genetic diversity of antimicrobial agents producing *Streptomyces* isolated from protected forest area of Assam and Arunachal Pradesh

CSIR-NEIST screened 200 nos. of *Streptomyces* strains for antimicrobial activity against fungal pathogens (*Candida albicans* MTCC3017, *Fusarium oxysporum* f. sp. *ciceri* NCIM1281, *Aspergillus niger*, *Rhizoctonia solani*) and bacterial pathogens, viz., *Staphylococcus aureus* MTCC96, *Bacillus subtilis* MTCC441, *E. coli* MTCC739) and *Pseudomonas aeruginosa* MTCC2458. Out of these strains, 8 nos. showed antifungal activity against *F. oxysporum*, *R. solani* and *C. albicans*. In case of bacteria, 16 nos. of strain showed antibacterial activity against *Staphylococcus aureus* MTCC96 and *Bacillus subtilis* MTCC441 and six antifungal strains could degrade colloidal chitin in amended media. Antimicrobial metabolite was extracted from active strains in ethyl acetate. Extracted metabolite was subjected to the fractionation and purified by preparative TLC (hexane and ethyl acetate, 1:1). Three fractions were collected from the metabolite of *Streptomyces roseochromogenus* TSR12 and tested against the pathogens. Two fractions exhibited antibacterial activity against the bacteria (Fig. b). Further purification and chemical profiling of the bioactive compound(s) is in progress.

Phylogenetic analysis of antimicrobial *Streptomyces* strains isolated from Tawang

Fifty nos. of *Streptomyces* spp. isolated from Tawang were investigated for antifungal activity against *Fusarium oxysporum* and 6 isolates were found to be positive. Sequencing of 16S rDNA of

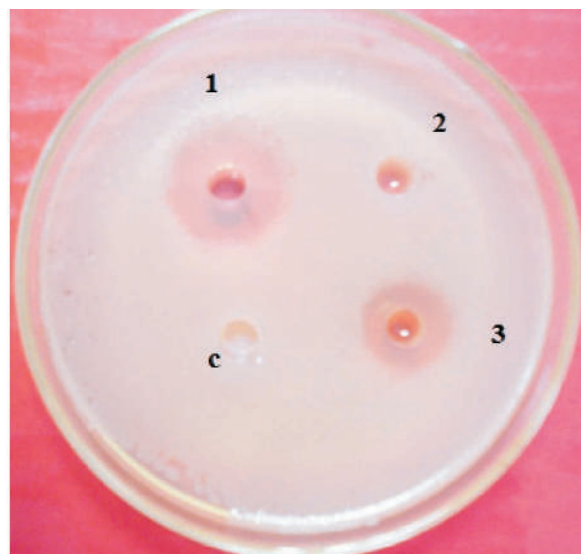


Fig. Screening of bioactive metabolite of *Streptomyces* sp. against *Candida albicans*; b. Bioassay results of TLC purified compound (fraction 1, 2 and 3; c-control); extracted from *S. roseochromogenus*

these *Streptomyces* was done and sequences to be submitted to NCBI-Gene Bank. Some isolates found to positive in proteinase and amylase production. Antifungal activity *Streptomyces* strains growing in colloidal chitin amended media were subsequently amplified gene coding for Family 18 chitinase A (ChiA). A real time qPCR comparative $\Delta\Delta C_T$ study among the six isolates showed glycosyl hydrolase (GTR25) to be the transcriptionally active.

The six antimicrobial agent producing strains were identified as *Streptomyces virginiae*, *S. sporoverrucosus*, *S. roseochromogenus*, *S.*

kanamycelicus, *S. purpeofuscus* and *S. indigoferus* which were exhibited great genetic diversity.

Better vaccines for tuberculosis

CSIR-IMTECH proposed the use of novel vaccines called lipidated-promiscuous-peptide vaccines. These synthetic vaccines are safer than BCG because they do not contain infectious material. Moreover, they generate long-lasting, protective immune responses and are not influenced by pre-existing antibodies. This type of vaccine strategy has already proven to be successful in an animal model of tuberculosis and is being tested in human clinical trials for other infectious diseases and cancer.

Lipidated-promiscuous-peptide vaccines have all the essential qualities that can make them successful in tuberculosis-endemic countries. Such vaccines can impart better protection than BCG and will have a long-reaching positive impact on millions of people.

Genomes of mango, pomegranate pathogens decoded

CSIR-IMTECH analyzed and reported the fully annotated genome of the *Xanthomonas* pathogens that cause serious diseases in high value fruit crops like mangoes, pomegranates and grape.

Interestingly the team found that the genomes of these bacterial pathogens, that cause diseases in



Fig. The genomes of pathogen affecting mango (left) and pomegranate have been decoded.
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diverse fruits like mango pomegranate, grape and citrus, are highly identical suggesting their recent origin. Further the set of unique genes and markers present in their genomes will be valuable in epidemiological and evolutionary studies of these fruit pathogens.

These are the first plant pathogen genomes published from India. The study has also been covered as a featured article in Nature India (doi:10.1038/nindia.2012.70).

Molecular mechanism of signal transduction and gene regulation by *M. tuberculosis* phop-phor system

The PhoP and PhoR proteins from *Mycobacterium tuberculosis* controls expression of genes involved in complex lipid biosynthesis and regulation of unknown virulence determinants in human and mouse macrophages or in mice.

CSIR-IMTECH (a) established cross-talk between *M. tuberculosis* PhoP and PhoR proteins, (b) identified genetic determinants recognized by PhoP, (c) characterized molecular mechanism of sequence-specific DNA binding, and (d) identified strikingly novel structural features of the transcription factor that contributes to its expanded regulatory capability as a global regulator.

To determine the mechanism, Scientist of the institute showed that the protein recognizes a 23-bp sequence of the *phoP* upstream region comprising two adjacent direct repeat motifs believed to promote transcription regulation. Protein phosphorylation was not required for DNA binding; however, phosphorylation enhanced *in vitro* DNA binding through protein-protein interaction(s). Using biochemical probes, the group determined stoichiometry and a relatively unusual orientation of PhoP protomers within the DNA-protein binary complex- a model in which two PhoP protomers bind the duplex DNA with a symmetric head-to-head orientation.

Institute probed the molecular basis of sequence-specific PhoP-DNA interactions leading to



identification of single amino acid of the protein and a specific base-pair of the target DNA as specificity-determinants. It is also shown that phosphorylation switch the transactivation domain to a different conformation, which specify additional protein-protein contacts between PhoP protomers bound to adjacent cognate sites. These observations raise the possibility that PhoP, in the unphosphorylated and phosphorylated form may be capable of adopting different orientations as it binds to a vast array of genes to activate or repress transcription. In agreement with this view, we recently identified mechanism of dual mode of promoter recognition by PhoP—namely phosphorylation-independent and phosphorylation dependent. Together, our biochemical analyses on domain structure and inter-domain interactions of PhoP are central to understanding of how the DNA binding transcription factor may possibly function as a global regulator in *M. tuberculosis*. It has also been showed how PhoP activates complex lipid biosynthesis only upon phosphorylation, and thereby contributes to morphology of the bacilli.

Host nuclear receptors as combats and cohorts to *Mycobacterium tuberculosis* survival

Mycobacterium tuberculosis–macrophage interactions are key to pathogenesis and clearance of these bacteria. Although interactions between *M. tuberculosis*–associated lipids and TLRs, non-TLRs, and opsonic receptors have been investigated, interactions of these lipids and infected macrophage lipid repertoire with lipid-sensing nuclear receptors expressed in macrophages have not been addressed. CSIR-IMTECH showed that *M. tuberculosis*–macrophage lipids can interact with host peroxisome proliferators activated receptor γ and testicular receptor 4 to ensure survival of the pathogen by modulating macrophage function. These two lipid-sensing nuclear receptors create a foamy niche within macrophage by modulating oxidized low-density lipoprotein receptor CD36, phagolysosomal maturation block by induction of IL-10, and a blunted innate response by alternative polarization of the macrophages, which leads to survival of *M. tuberculosis*. These results also suggest possible heterologous ligands for

peroxisome proliferator-activated receptor γ and testicular receptor 4 and are suggestive of adaptive or coevolution of the host and pathogen. Relative mRNA expression levels of these receptors in PBMCs derived from clinical samples convincingly implicate them in tuberculosis susceptibility. These observations expose a novel paradigm in the pathogenesis of *M. tuberculosis* amenable for pharmacological modulation.

The possibility that host nuclear receptor crosstalks to *M. tuberculosis* lipid repertoire and may modulate antimicrobial responses have not been explored at all and is an original hypothesis, to which CSIR-IMTECH preliminary findings. There is less redundancy and pleiotrophy at level of the nuclear receptor as compared over signaling networks; with many of them being master regulators of certain phenotypes and as such offer themselves as novel therapeutic targets. Nuclear receptors are convenient for therapeutic intervention by agonist/antagonist good on ADMET. Institute has so far identified PPAR γ and TR4 to be pro- *M. tuberculosis* and LXR α to be anti- *M. tuberculosis*.

Extracellular polymeric substances from marine bacterium *Vibrio parahaemolyticus*

A marine bacterial strain identified as *Vibrio parahaemolyticus* by 16S rRNA gene (HM355955) sequencing and gas chromatography (GC) coupled with MIDI was selected by CSIR-CSMCRI from a natural biofilm by its capability to produce extracellular polymeric substances (EPS). The EPS had an average molecule size of 15.278 μm and exhibited characteristic diffraction peaks at 5.985°, 9.150° and 22.823°, with d-spacings of 14.76661, 9.29989 and 3.89650 Å, respectively. The Fourier-transform infrared spectroscopy (FTIR) spectrum revealed aliphatic methyl, primary amine, halide groups, uronic acid and saccharides. Gas chromatography mass spectrometry (GCMS) confirmed the presence of arabinose, galactose, glucose and mannose. ¹HNMR (nuclear magnetic resonance) revealed functional groups characteristic of polysaccharides. The EPS were amorphous in nature (C₁xrd 0.092), with a 67.37% emulsifying

activity, thermostable up to 250°C and displayed pseudoplastic rheology. MALDI-TOF-TOF analysis revealed a series of masses, exhibiting low-mass peaks (m/z) corresponding to oligosaccharides and higher-mass peaks for polysaccharides consisting of different ratios of pentose and hexose moieties. This is the first report of a detailed characterisation of the EPS produced by *V. parahaemolyticus*, which could be further explored for biotechnological and industrial use.

Amide linker orientation profoundly influences serum compatibility and lung transfection properties of cationic amphiphile

Understanding the influence of structural parameters of cationic amphiphiles on their gene transfer properties is important for designing efficient liposomal gene delivery reagents. In search for a serum compatible cationic amphiphile with circulation stable linker functionality, CSIR-IICT scientists designed a highly serum compatible novel cationic amphiphile which has shown remarkably selectivity in transfecting mouse lung. It was also demonstrated that reversing orientation of amide linker functionality in the molecular structure adversely affects the serum compatibility and the lung selective gene transfer property of cationic amphiphiles. Importantly, these new lipoplexes (electrostatic complexes of cationic liposomes and plasmid DNA) exhibited remarkable mouse lung selective gene transfer properties. This work demonstrated for the first time that amide linker orientation profoundly influences the serum compatibility and lung transfection efficiencies of cationic amphiphiles.

Induction of ROS, mitochondrial damage and autophagy in lung epithelial cancer cells by ironoxide nanoparticles

Autophagy has attracted a great deal of research interest in tumor therapy in recent years. CSIR-IITR reported that ironoxide NPs synthesized by us selectively induces autophagy in cancer cells (A549) and not in normal cells (IMR-90). It was also noteworthy that autophagy correlated with ROS production as well as mitochondrial damage. Protection of NAC against ROS clearly suggested

the implication of ROS in hyper-activation of autophagy and cell death. Pre-treatment of cancer cells with 3-MA also exhibited protection against autophagy and promote cellular viability. Results also showed involvement of classical mTOR pathway in autophagy induction by ironoxide NPs in A549 cells. The results had shown that bare ironoxide NPs are significantly cytotoxic to human cancer cells (A549) but not to the normal human lung fibroblast cells (IMR-90). In other words our nanoparticles selectively kill cancerous cells. It is encouraging to conclude that ironoxide NPs bear the potential of its applications in biomedicine, such as tumor therapy specifically by inducing autophagy mediated cell death of cancer cells.

Effect of Long term exposure of cypermethrin on adult rats

CSIR-IITR investigated the effects of cypermethrin on biochemical, histopathological, and motor behavioral indices of the nigrostriatal dopaminergic system in adult rats treated with or without cypermethrin (1/10 adult dose) during postnatal days 5–19. Spontaneous locomotor activity (SLA) and rotarod tests were performed to assess motor behavior. Levels of dopamine, 3,4-dihydroxyphenylacetic acid (DOPAC) and homovanillic acid

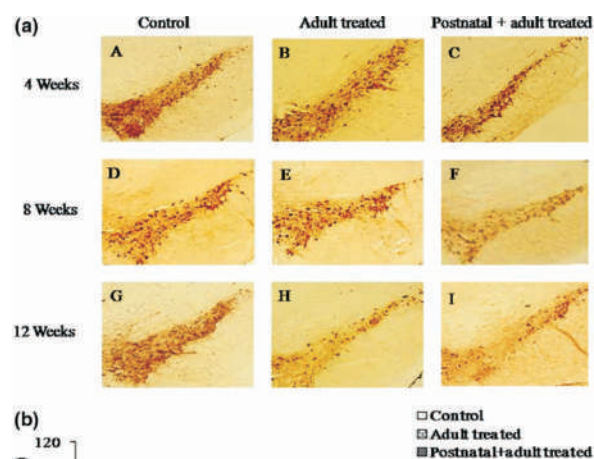


Fig. Tyrosine hydroxylase (TH) immunoreactivity of dopaminergic neurons in the substantia nigra pars compacta of the brain, as observed by bright-field microscopy at 10X and 4X magnifications, respectively. (a) The representative TH immunoreactivity in control (A, D, and G), cypermethrin adult alone-treated (B, E, and H).

(HVA) in the striatum, and tyrosine hydroxylase (TH) immunoreactivity and 42,6-diamidino-2-phenylindole (DAPI)/Fluoro-Jade B staining in the substantia nigra were measured to assess dopaminergic neurodegeneration. Postnatal treated animals did not exhibit significant changes in any measured parameters. The significant reduction in the time of stay on rotarod, spontaneous locomotor activity, dopamine, 3,4-dihydroxyphenylacetic acid, and tyrosine hydroxylase immunoreactivity while an increase in homovanillic acid level and Fluoro-Jade B-positive cells were observed in cypermethrin treated adult rats. These changes were more pronounced in the animals treated with

cypermethrin during postnatal days followed by adulthood compared with adulthood alone. The results obtained thus demonstrate that exposure to cypermethrin during adulthood induces dopaminergic neurodegeneration in rats and postnatal exposure enhances the susceptibility of animals to dopaminergic neurodegeneration if rechallenged during adulthood.

Melatonin as a Neuroprotective Agent in the Rodent Models of Parkinson's disease: Is it All Set to Irrefutable Clinical Translation?

Parkinson's disease (PD), a neurodegenerative disorder, is characterized by the selective

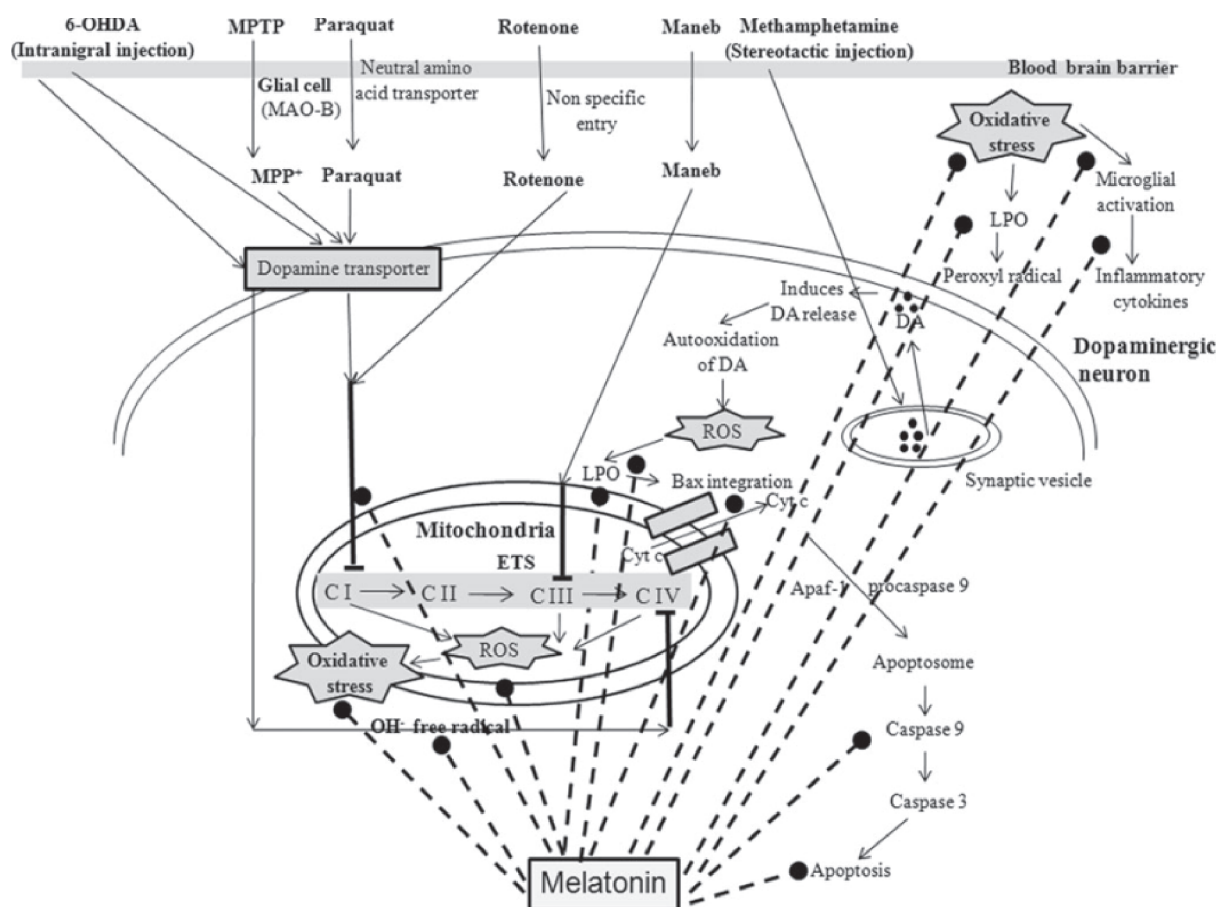


Fig. Diagrammatic representation of the 6-OHDA, MPTP, paraquat, rotenone, maneb, and methamphetamine-induced neurodegeneration. The routes of various neurotoxins across the blood-brain barrier and their subsequent passage through the dopaminergic neurons are shown in the figure along with the subsequent major steps responsible for neurodegeneration (solid arrows). From the bottom of the image, dotted lines with circular end are projected to show how melatonin acts on the various steps involved in toxins-induced degeneration (CI, CII, CIII and CIV-mitochondrial complexes I, II, III, and IV; ROS-reactive oxygen species; LPO-lipid peroxidation; DA-dopamine; Cyt-cytochrome; ETS-electron transport system; MAO-B-monoamine oxidase-B enzyme)

degeneration of the nigrostriatal dopaminergic neurons, continuing or permanent deficiency of dopamine, accretion of an abnormal form of alpha synuclein in the adjacent neurons, and dysregulation of ubiquitin proteasomal system, mitochondrial metabolism, permeability and integrity, and cellular apoptosis resulting in rigidity, bradykinesia, resting tremor, and postural instability. Melatonin, an indoleamine produced almost in all the organisms, has anti-inflammatory, anti-apoptotic, and anti-oxidant nature. Experimental studies employing 1-methyl 4-phenyl 1, 2, 3, 6-tetrahydropyridine (MPTP), 6-hydroxydopamine (6-OHDA), methamphetamine, rotenone, and maneb and paraquat models have shown an enormous potential of melatonin in amelioration of the symptomatic features of PD. Although a few reviews published previously have described the multifaceted efficacy of melatonin against MPTP and 6-OHDA rodent models, due to development and validation of the newer models as well as the extensive studies on the usage of melatonin in entrenched PD models, it is worthwhile to bring up to date note on the usage of melatonin as a neuroprotective agent in PD. CSIR-IITR presented an update on the usage and applications of melatonin in PD models along with incongruous observations.

Engineered ZnO and TiO₂ nanoparticles induce oxidative stress and DNA damage leading to reduced viability of *Escherichia coli*

Extensive use of engineered nanoparticle (ENP)-based consumer products and their release into the environment has raised a global concern pertaining to their adverse effects on human and environmental health. CSIR-IITR studies the toxicity mechanism of ZnO and TiO₂ ENPs in a gram-negative bacterium, *Escherichia coli*. Internalization and uniform distribution of characterized bare ENPs in the nano range without agglomeration was observed in *E. coli* by electron microscopy and flow cytometry. The data showed a statistically significant concentration-dependent decrease in *E. coli* cell viability by both conventional plate count method and flow

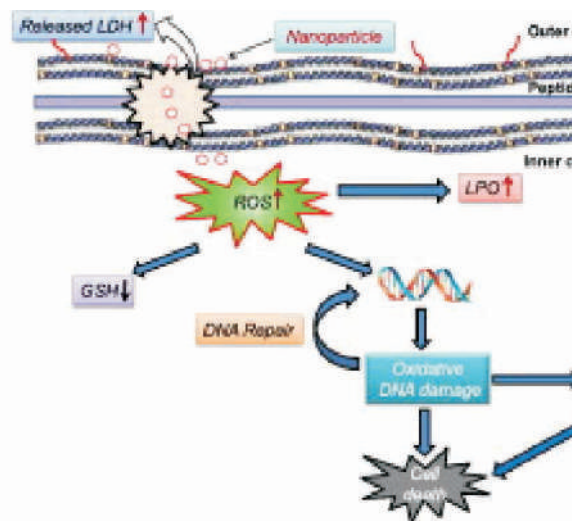


Fig. Possible mechanism of ZnO and TiO₂ ENP-Induce genotoxicity and cytotoxicity

cytometric live–dead discrimination assay. Significant ($p < 0.05$) DNA damage in *E. coli* cells was also observed after ENP treatment. Glutathione depletion with a concomitant increase in hydroperoxide ions, malondialdehyde levels, reactive oxygen species, and lactate dehydrogenase activity demonstrates that ZnO and TiO₂ ENPs induce oxidative stress leading to genotoxicity and cytotoxicity in *E. coli*. The study substantiates the need for reassessment of the safety/toxicity of metal oxide ENPs.

Biodegradable Poly(vinyl alcohol)-polyethylenimine Nano composites for Enhanced Gene Expression *In Vitro* and *In Vivo*

Use of cationic polymers as nonviral gene vectors has several limitations such as low transfection efficiency, high toxicity, and inactivation by serum. In this study, varying amounts of low molecular weight branched polyethylenimine 1.8 kDa (bPEI 1.8) were introduced on to a neutral polymer, poly(vinyl alcohol) (PVA), to bring in cationic charge on the resulting PVA-PEI (PP) nanocomposites. CSIR-IITR rationalized that by introducing bPEI 1.8, buffering and condensation properties of the proposed nanocomposites would result in improved gene transfer capability. A series of PVA-PEI (PP) nanocomposites was synthesized using well-established epoxide chemistry and

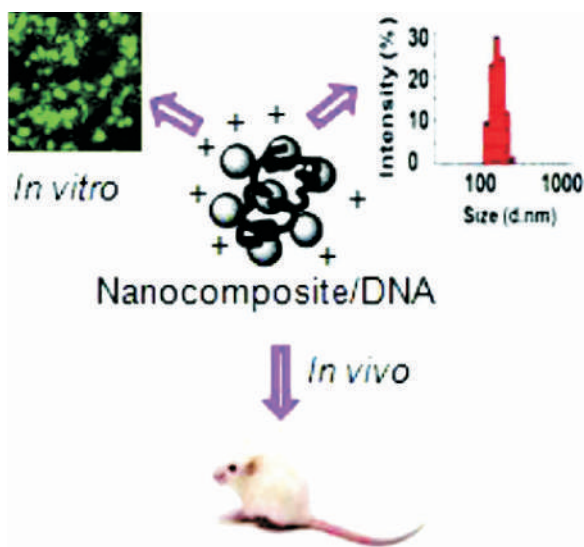


Fig. Biodegradable Poly (vinyl alcohol)-polyethylenimine Nanocomposites for enhanced gene expression in vitro and in vivo

characterized by IR and NMR. Particle size of the PP/DNA complexes ranged between 120 to 135 nm, as determined by dynamic light scattering (DLS), and DNA retardation assay revealed efficient binding capability of PP nanocomposites to negatively charged nucleic acids. In vitro transfection of PP/DNA complexes in HEK293, HeLa, and CHO cells revealed that the best working formulation in the synthesized series, PP-3/DNA complex, displayed ~2–50-fold higher transfection efficiency than bPEIs (1.8 and 25 kDa) and commercial transfection reagents. More importantly, the PP/DNA complexes were stable over a period of time, along with their superior transfection efficiency in the presence of serum compared to serum-free conditions, retaining the nontoxic property of low molecular weight bPEI. The *in vivo* administration of PP-3/DNA complex in Balb/c mice showed maximum gene expression in their spleen. The study demonstrates the potential of PP nanocomposites as promising nonviral gene vectors for *in vivo* applications.

miR-497 and miR-302b Regulate Ethanol-induced Neuronal Cell Death through BCL2 Protein and Cyclin D2

In chronic alcoholism, brain shrinkage and cognitive defects because of neuronal death are

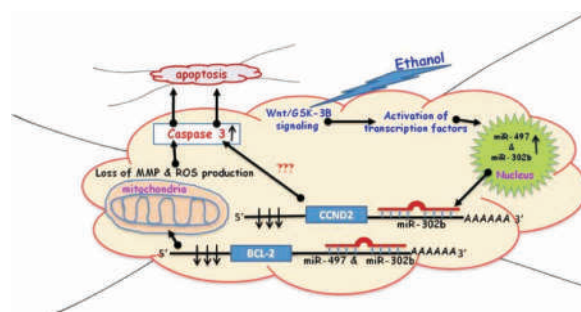


Fig. Pictorial summary of results. The arrows with • at the bottom indicate a connection between two events. ↑ indicate an increase in activity or expression, and ↓ indicate decreased expression.

well established, although the sequence of molecular events has not been fully explored yet. CSIR-IITR explored the role of microRNAs (miRNAs) in ethanol-induced apoptosis of neuronal cells. Ethanol-sensitive miRNAs in SH-SY5Y, a human neuroblastoma cell line, were identified using real-time PCR-based TaqMan low-density arrays. Long-term exposure to ethanol (0.5% v/v for 72 h) produced a maximum increase in expression of miR-497 (474-fold) and miR-302b (322-fold). Similar to SH-SY5Y, long-term exposure to ethanol induced miR-497 and miR-302b in IMR-32, another human neuroblastoma cell line. Using *in silico* approaches, BCL2 and cyclin D2 (CCND2) were identified as probable target genes of these miRNAs. Cotransfection studies with 3' -UTR of these genes and miRNA mimics have demonstrated that BCL2 is a direct target of miR-497 and that CCND2 is regulated negatively by either miR-302b or miR-497. Overexpression of either miR-497 or miR-302b reduced expression of their identified target genes and increased caspase 3-mediated apoptosis of SH-SY5Y cells. However, overexpression of only miR-497 increased reactive oxygen species formation, disrupted mitochondrial membrane potential, and induced cytochrome c release (mitochondria-related events of apoptosis). Moreover, ethanol induced changes in miRNAs, and their target genes were substantially prevented by pre-exposure to GSK-3B inhibitors. In conclusion, our studies have shown that ethanol-induced neuronal apoptosis follows both the mitochondria-mediated (miR-497- and BCL2-

mediated) and non-mitochondria-mediated (miR-302b- and CCND2-mediated) pathway.

Linear PEI nanoparticles: efficient pDNA/siRNA carriers *in vitro* and *in vivo*

Linear polyethylenimine (LPEI, 25 kDa) nanoparticles' (LPN) series was synthesized by varying percentage of cross-linking with 1,4-butanediol diglycidyl ether (BDE) and their size, surface charge, morphology, pDNA protection/release, cytotoxicity and transfection efficiency were evaluated by CSIR-IITR. Synthesized nanoparticles (NPs) were spherical in shape (size: ~109 - 235 nm; zeta potential: +38 to +16 mV). These NPs showed increased buffering capacity with increasing percent cross-linking and also exhibited excellent transfection efficiency (i.e., ~1.3 - 14.7 folds in case of LPN-5) in comparison with LPEI and the commercial transfection agents used in this study. LPN-5 based GFP-specific siRNA delivery resulted in ~86% suppression of

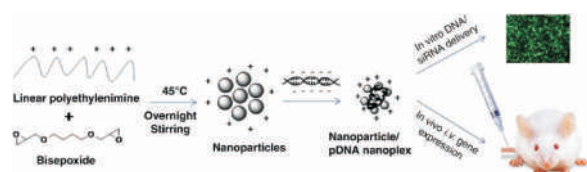


Fig. Linear PEI nanoparticles; efficient pDNA/siRNA carriers *in vitro* and *in vivo*

targeted gene expression. These particles were relatively nontoxic *in vitro* (in cell lines) and *in vivo* (in *Drosophila*). *In vivo* gene expression studies using LPN-5 in Balb/c mice through intravenous injection showed maximum expression of the reporter gene in the spleen. These results together demonstrate the potential of these particles as efficient transfection reagents.

Identification of environmental reservoirs of nontyphoidal salmonellosis

CSIR-IITR carried out a study of identification of environmental reservoirs of *Salmonella enterica* subsp. *enterica* serovar Typhimurium (abbreviated as *Salmonella typhimurium*) in sediments, water,

and aquatic flora collected from the Ganges River (Ganges riverine material) was carried out by adopting a two-step strategy. Step 1 comprised a selective serovar-specific capture of *Salmonella typhimurium* from potential reservoirs. Step 2 involved culture-free detection of selectively captured *Salmonella typhimurium* by *ttr* gene-specific molecular beacon (MB) based quantitative polymerase chain reaction (q-PCR). The *ttr* gene-specific MB designed in this study could detect 1 colony-forming unit (cfu)/PCR captured by serovar-specific DNA aptamer. Sediments, water, and aquatic flora collected from the Ganges River were highly contaminated with *Salmonella typhimurium*. The preanalytical step in the form of serovar-specific DNA aptamer-based biocapture of bacterial cells was found to enhance the sensitivity of the fluorescent probe in the presence of nonspecific DNA. Information about the presence of environmental reservoirs of *Salmonella typhimurium* in the Ganges River region may pave the way for forecasting and management of nontyphoidal salmonellosis in south Asia.

Industrial hygiene and toxicity studies in unorganized bone-based industrial units

A large variety of ornamental and decorative items are manufactured from bone waste by various unorganized sectors in India. An initial survey by CSIR-IITR indicated that workers were exposed at various phases of final product. The subjects (12 industrial units) were tested for total suspended particulate matter (TSPM), particulate matter <10 microm (PM(10)), and particulate matter <2.5 microm (PM(2.5)). Prevalent levels of TSPM ranged between 2.90 and 5.89 mg m⁻³. Respirable fractions of occupational dust as PM(10) and PM(2.5) were found in the range of 0.30-2.08 and 0.26-0.50 mg m⁻³, respectively. Cytotoxicity study was conducted using hemolysis as a sensitive marker. In an *in vitro* study, rat RBCs were exposed to the concentration of 25-1,000 microg/ml for 15-120 min. A considerable variation was observed in the hemolytic activity



of samples collected from different areas. At 500 microg/ml concentration, the hemolytic activity (12 h) was found to be in the range of 18-25%. Due to limitation in sample mass of respirable fractions, only one concentration (100 microg/ml/ 2 h) was used for comparative study on hemolysis of RBCs caused by PM(10) and PM(2.5). Interestingly, the hemolytic activity was more at PM(2.5) than PM(10) and TSPM. These results suggest that the respirable particles are capable of reaching deep into the respiratory system. The finding is significant notably when there are no standards available in occupationally exposed populations. This is the first such study. Data could be of importance to policy makers and regulators.

Optimization and validation of an extraction method for the analysis of polycyclic aromatic hydrocarbons in chocolate candies

Chocolate is a key ingredient in many foods such as milk shakes, candies, bars, cookies, and cereals. Chocolate candies are often consumed by mankind of all age groups. The presence of polycyclic aromatic hydrocarbons (PAHs) in chocolate candies may result in health risk to people. A rapid, precise, and economic extraction method was optimized and validated by CSIR-IITR for the simultaneous determination of polycyclic aromatic hydrocarbons in chocolate candy by high-performance liquid chromatography (HPLC) and gas chromatography-mass spectrometry (GS-MS) as a confirmatory technique. The method was optimized by using different solvents for liquid-liquid extraction, varying volume of de-emulsifying agent, and quantity of silica gel used for purification. The HPLC separation of 16 PAHs was carried out by C-18 column with mobile phase composed of acetonitrile : water (70 : 30) in isocratic mode with runtime of 20 min. Limit of detection, limit of quantification (LOQ), and correlation coefficients were found in the range of 0.3 to 4 ng g⁻¹, 0.9 to 12 ng g⁻¹ and 0.9109 to 0.9952, respectively. The exploration of 25 local chocolate candy samples for the presence of PAHs showed the mean content of benzo[a]pyrene as 1.62 ng g⁻¹, which representing the need to evaluate

effective measures to prevent more severe PAHs contamination in chocolate candies in future.

Usage pattern of synthetic food colours and exposure assessment through commodities preferentially consumed by children

Exposure studies in children are emphasized nowadays given children's higher consumption vulnerability. CSIR-IITR generated national-level data covering 16 major states of India on the usage pattern of colours and it identified food commodities through which a particular colour has the scope to exceed ADI limits. Out of the total analysed samples, 87.8% contained permitted colours, of which only 48% adhered to the prescribed limit of 100mgkg⁻¹. The majority of candyfloss, sugar toys, beverages, mouth fresheners, ice candy and bakery product samples exceeded the prescribed limit. Non-permitted colours were mostly prevalent in candyfloss and sugar toy samples. Though sunset yellow FCF (SSYFCF) and tartrazine were the two most popular colours, many samples used a blend of two or more colours. The blend of SSYFCF and tartrazine exceeded the prescribed limit by a factor of 37 in one sample, and the median and 95th percentile levels of this blend were 4.5- and 25.7-fold, respectively. The exposure assessment showed that the intake of erythrosine exceeded the ADI limits by two to six times at average levels of detected colours, whereas at the 95th percentile level both SSYFCF and erythrosine exceeded the respective ADI limits by three- to 12-fold in all five age groups. Thus, the uniform prescribed limit of synthetic colours at 100mgkg⁻¹ under Indian rules needs to be reviewed and should be governed by consumption profiles of the food commodities to check the unnecessary exposure of excessive colors to those vulnerable in the population that may pose a health risk.

Cholinesterase levels and morbidity in pesticide sprayers in North India

Pesticide sprayers in North India use different application methods for different crops. CSIR-IITR compared cholinesterase activity and symptoms in

knapsack and tractor-mounted pesticide sprayers. Blood cholinesterase activity and symptoms were recorded for 42 knapsack and 66 tractor-mounted sprayers attending a health camp in North India and for 30 controls. One hundred and eight of 197 (55%) eligible sprayers consented to participate. Mean acetylcholin-esterase (AChE) and butyrylcholinesterase activity was 33 and 60% lower, respectively, in knapsack sprayers than in controls (P,0.001) and 56 and 62% lower, respectively, in tractor-mounted sprayers than in controls (P,0.001). AChE depletion was greater in tractor-mounted sprayers than in knapsack sprayers (P,0.001). In knapsack sprayers compared to controls, odds ratios (OR) were significantly raised for musculoskeletal symptoms (OR 3.9, 95% CI 1.03–18) but not for other symptoms. In tractor-mounted sprayers compared to controls, ORs were significantly raised for neurological (OR 7, 95% CI 2–23), ocular (OR 8.7, 95% CI 2.7–32), respiratory (OR 5.14, 95% CI 1–29), cardiovascular (OR 7.5, 95% CI 2–42), gastrointestinal (OR 5.43, 95% CI 2–18) and musculoskeletal (OR 6.12, 95% CI 2–26) symptoms but not for dermal symptoms (OR 1.93, 95% CI 0.3–20). The risk of cholinesterase inhibition and symptoms is greater in tractor-mounted than in knapsack pesticide sprayers and in both groups compared to controls. Occupational exposure in pesticide sprayers in North India needs better control, perhaps through redesign of spraying equipment.

Studies on urban drinking water quality in a tropical zone

Anthropogenic activities associated with industrialization, agriculture and urbanization have led to the deterioration in water quality due to various contaminants. To assess the status of urban drinking water quality, samples were collected from the piped supplies as well as groundwater sources from different localities of residential, commercial and industrial areas of Lucknow City in a tropical zone of India by CSIR-IITR during pre-monsoon for estimation of coliform and faecal coliform bacteria, organochlorine pesticides (OCPs) and heavy metals. Bacterial contamination was found to be more in the samples from

commercial areas than residential and industrial areas. OCPs like α,γ -hexachlorocyclohexane and 1,1 p,p-DDE {dichloro-2, 2-bis(p-chlorophenyl) ethene}} were found to be present in most of the samples from study area. The total organochlorine pesticide levels were found to be within the European Union limit (0.5 $\mu\text{g/L}$) in most of the samples. Most of the heavy metals estimated in the samples were also found to be within the permissible limits as prescribed by World Health Organization for drinking water. Thus, these observations show that contamination of drinking water in urban areas may be mainly due to municipal, industrial and agricultural activities along with improper disposal of solid waste. This is an alarm to safety of public health and aquatic environment in tropics.

Assessment of Environmental Quality of Lucknow city, During Pre-monsoon (May-June 2011) and Post Monsoon (September-October, 2011)

The report entitled “Assessment of Environmental by CSIR-IITR Status of Lucknow City” for pre-monsoon, 2011 and post monsoon 2011 were released on 5th June on the occasion of World Environment Day and 4th November, 2011 CSIR-IITR foundation day respectively.

Lucknow is a fast growing city. The increase in population, transportation, construction, and other activities result in increased air pollution. Since 1997, the institute has been carrying out studies to assess the air quality of Lucknow city, twice a year i.e. during pre and post- monsoon seasons. This year's studies of pre-monsoon (March-April, 2011) and post-monsoon (September-October, 2011) was completed at 10 locations (4 in residential, 5 in commercial and 1 in industrial area) for air pollutants.

Technology Transfer

Baseline Information on select protected areas of Himachal Pradesh

The physical, soil and geological maps of the Dhawaladhar Wildlife Sanctuary (DWLS), Great



Fig. Dietary fibre extracted from apple

orchards with increased productivity may be raised. Several thousand plants have been taken up by farmers and there is a huge demand for certified quality planting material with the TC industries.

Identifying microbes useful for alleviating stress induced damages

An efficient Cr(VI) reducing bacterial strain *Microbacterium* sp. (JN674183), has been isolated by CSIR-CIMAP from rhizospheric soil irrigated with tannery effluent completely (100%) reduced the Cr(VI) at 0.2 mM concentration within 24 hours and could reduce the damage of plants caused by chromium toxicity. An efficient ACC-deaminase producing bacteria *Achromobacter* provided significant protection to *Ocimum sanctum* plants under flood stress; an improvement of over 40% in herb yield when exposed to 15 days of water logging. Application of these microbes is expected to reduce stress induced damage in the plants and will help in effective utilization of waste lands.

High speed, low cost non-invasive method for determination of drug concentration in animal plasma for pharmacokinetic analysis

The method developed at CSIR-CIMAP for non-invasive concentration determination of drug in

animal plasma is faster than Schebb's procedure and does not require any solid phase extraction of the drug. FT-NIR spectroscopy analysis combined with partial least squares (PLS) regression model was undertaken with validation through HPLC analysis. Pharmacokinetic parameters obtained through FT-NIR and HPLC were found to be statistically similar with errors below the acceptable limits. The study demonstrates the use of FT-NIR for pharmacokinetics and bio-availability studies. This high throughput method analyses more than 50 samples in an hour without solvents usage and provide ample scope for automation and commercial utilization.

Design of Ankle foot orthosis for patients with Diabetic foot ulcer

The accepted etiology of diabetic plantar wounds is excessive pressure on the insensitive foot that leads to callus formation, skin breakdown and infection. Thus off-loading of peak plantar pressures (PPPs) reduces the risk for skin breakdown and allows healing of open wounds. One of the effective offloading devices is Ankle foot orthosis (AFO). Among the pressure offloading techniques, AFO offers lot of advantages for physicians and patients. But the current design and materials used for fabrication of AFO make the treatment expensive which is not affordable by the patients in India. Therefore a new design of AFO for patients with diabetes having diabetic foot ulcer has been developed by CSIR-CLR.

AFO was designed in such a way that it can be worn either in left or in right foot. The foot part and the ankle part are molded as a single piece so that the excess of plantar flexion movement can be arrested. The Velcro fastener from the foot part wrap over the dorsal part of the foot so that slipping of foot can be controlled. The insole plays the major role in offloading the pressure at the ulcer site. The insole was designed exclusively with three layers of foam in which the middle layer is formed with many holes and the upper layer has projections in its inner side which lock the holes



Fig.

in middle layer. The upper layer is segmented so that each hole of the middle layer is locked by each segment of the upper layer. The foot care specialist can remove the segments at the ulcer site so that offloading will take place effectively.

Major Facilities

OSDD Chemistry Outreach Program (CSIR-CDRI Initiative)

On the occasion of the International Year of Chemistry, CSIR has launched a Chemistry Outreach Program to create an Open Chemical Library mainly by the M.Sc. as well as Ph.D. students at universities/institutes across the length and breadth of the country to synthesize a large number of organic compounds which will be screened against various infectious diseases under the Open Source Drug Discovery (OSDD) program. The endeavour envisages to:

- Impart practical training to large number of M.Sc. students specializing in Organic Chemistry;



Fig. OSDD

- Involve various universities, IITs, IISERs and other academic institutes;
- Besides, University departments designated for carrying out these works to train other students from nearby colleges and universities who do not have any facility; and
- The compounds generated from the exercise to be submitted to the repository for screening and archiving.

The details are available on <http://crdd.osdd.net/syncdb/index.html>

G.N. Ramachandran Protein Centre

G.N. Ramachandran Protein Centre was inaugurated in the CSIR-Institute of Microbial Technology, Chandigarh campus on 24, January, 2012 by Prof. Balaram, Director, Indian Institute of Science, Bengaluru. This Protein Centre is one-of-its-kind facility in India, solely focused on diverse forms of integrated activities on proteins. It houses groups involved in Research & Development involving using basic building blocks of proteins i.e. amino acids to supramolecular assemblies. In-silico as well as experimental science research is also being carried out for better understanding of functioning of proteins. This unique Protein Centre has all requisites to translate findings from basic research into applications for societal good.



Fig.

Incubator Facility for Biopharmaceuticals

Hon'ble Shri Pawan Kumar Bansal, the Union Minister for Parliamentary Affairs, Science and Technology & Earth Sciences and Vice President CSIR inaugurated the Incubator facility for Biopharmaceuticals in the campus of CSIR-IMTECH. This state of the art cGMP facility is approved by the Drug Controller General of India, for production of biopharmaceuticals, such as therapeutic proteins through microbial fermentation for toxicology and clinical trials. The facility is equipped with cGMP and validation compatible fermenters (5 L, 15 L, 40 L, 150 L), downstream processing equipment's such as centrifuges (batch and continuous), lab and pilot scale micro-/ ultrafiltration units, cell

disintegration systems, pilot and process scale chromatography systems and analytical equipments etc.





Fig.

Tissue and cell culture Facility

A Central Tissue Culture Facility has been established at CSIR-CDRI with an objective of development, maintenance, propagation, cryopreservation, revival of cell lines and extending the necessary support for research. Various cell lines were provided to user scientists for research and development. Some new cell types are also added on a need-based basis. Help has also been provided to students & investigators in trouble-shooting common problems encountered with the *in vitro* work. During the year, 129 flasks were provided to the users upon request. Besides, facility continued to provide short term training to personnel from academic institutions and industries in techniques of tissue and cell culture.

Bamboo Museum

To highlight the importance of bamboo, a unique museum with a total plinth area of 400 sqm has

been constructed at CSIR-IHBT using bamboo as the building material. The walls, roof and the floors of the museum are made of treated bamboos and

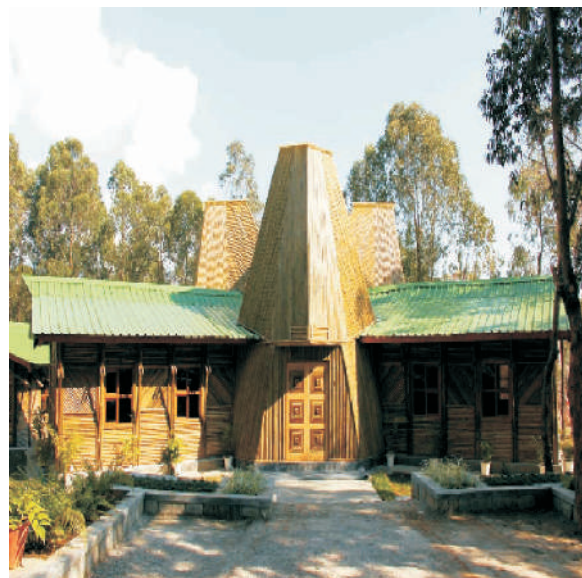


Fig. Bamboo Museum

bamboo panels. The opening in the ceiling is aesthetically fitted with fiberglass to allow sunlight for natural lighting. The articles and products made of bamboos are displayed in the museum.

Biological screening of outside samples

CSIR-CDRI has excellent facilities for carrying out *in vitro* and *in vivo* biological screenings against various disease models and the facility is being provided to R&D institutions, Universities, academic organizations and industrial houses within the country on payment basis. During the year, more than 35 external samples were screened against various models and report sent to the respective researchers.

New Models/Facilities in Animal House

CSIR-CDRI has sufficient number of healthy animals available for research. Some new disease specific animals such as specific hypertensive rat has been included in the facility.



Fig. New Models facilities in Animal House

Two new labs viz. Animal Genetic Monitoring Lab and Animal Health Monitoring Lab has been set up at CSIR-CDRI which would be very helpful in experimentation with laboratory animals.

1.2 CHEMICAL SCIENCES CLUSTER

Scientific Excellence

Assembly of nanoparticles in H1 Phase

CSIR-NCL demonstrated that dynamic phase separation of nonionic surfactant hexagonal domains is a generic technique for assembly of three-dimensional nanoparticulate networks. Inorganic, organic, and protein particles can be assembled into networks. The large surfactant content in solution renders the matrix amphiphilic, and therefore, hydrophobic nanoparticles can also be dispersed in such matrices. Dynamic templating of H1 mesophases involves mild conditions—near ambient temperatures and a facile water wash for template removal. Thus, it is possible to employ this technique to prepare networks of even relatively delicate bionanoparticles, such as ferritin protein, that would aggregate irreversibly on freezing. Materials prepared using this technique have potential for application in a wide variety of technologically important areas.

Synthesis of silver nanoparticles in spiral microreactor

CSIR-NCL studied the effect of segmented flow on the nanoparticle size distribution in a

unidirectionally expanding spiral microreactor, where secondary flows are prevalent in the absence of segmentation. Stearic acid sophorolipid reduced /capped Ag NPs were synthesized in the aqueous phase and air or kerosene was used as inert phases for creating the gas-liquid and liquid-liquid segmented flow, respectively. While, in one case the reactant phase is in the form of dispersed phase slugs, in the other case it is in the form of continuous phase, each exhibiting a different behavior. The slug sizes and the slip velocity, both of which govern the nature of internal mixing in the reactant phase slug controlled the nanoparticle size distribution. This observation was consistent for both, gas-liquid and liquid-liquid segmented flows. The micromixer having smaller orifice diameter yielded smaller slugs and also a narrow particle size distribution. In general, the particle sizes were much smaller for gas-liquid flow rather than for condition, unsteady behavior of slugs due to continuously varying radius of curvature results in variation in the slip velocity along the length of microchannel. This effect helps achieve a narrow particle size distribution than alone by the segmented flow.



Fig.

Water and a protic ionic liquid as refolding additives for chemically denatured enzymes

The ability of water and a protic ionic liquid, triethyl ammonium phosphate (TEAP) is demonstrated by CSIR-NCL for the first time for acting as refolding additives for the urea-induced chemical denatured state of the two enzymes, α -chymotrypsin and succinylated Con A. Very interestingly the enzymatic activity is regained and

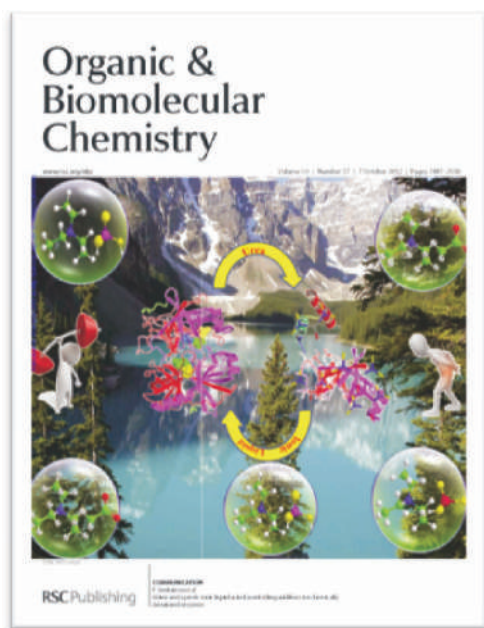


Fig.

in certain circumstances enhanced. This opens new opportunities for exploring environment-benign solvents in bio-related problems.

Synthesis of Benzodiazepinyl Phosphonates as Clostripain Inhibitors

CSIR-NCL synthesised of benzodiazepinyl phosphonates (BDPs). Ferric chloride efficiently catalyzed four-component condensation of diamines, acetone and phosphites in the presence of molecular sieves to furnish BDPs as novel chemical entities with good yield. The synthesized BDPs have shown significant protease inhibition activity against clostripain, a disease model for gas gangrene. Compound



Fig.

derived from 2,3-diamino toluene and diethyl phosphite inhibited the clostripain enzyme with an IC₅₀ value of 32 μ M suggesting that these novel chemical entities could be further explored as cysteine protease inhibitors.

Highly efficient (R-X-R)-type Carbamates as Molecular Transporters for Cellular Delivery

The backbone of one of the most-effective cell-penetrating peptides, the (R-X-R)-motif, arginine-rich peptides has been engineered to increase the efficacy of these oligomers for mammalian cell penetration several fold. This has been achieved by replacing the amide linkages by carbamate linkages, which leads to an increase in flexibility and hydrophobicity, and reduces the possibility of hydrogen-bonded secondary structures and to optimize the effect of guanidinium display.

These oligocarbamates were not only more efficient at cell penetration than the oligoamide controls, but also carried the cargo such as siRNA (siGLO), a tripeptide (Tyrosinerleutide) and also, much larger plasmid DNA (pMIR-Report luciferase) into the cell interior. The transported plasmid DNA expressed its biological activity, as

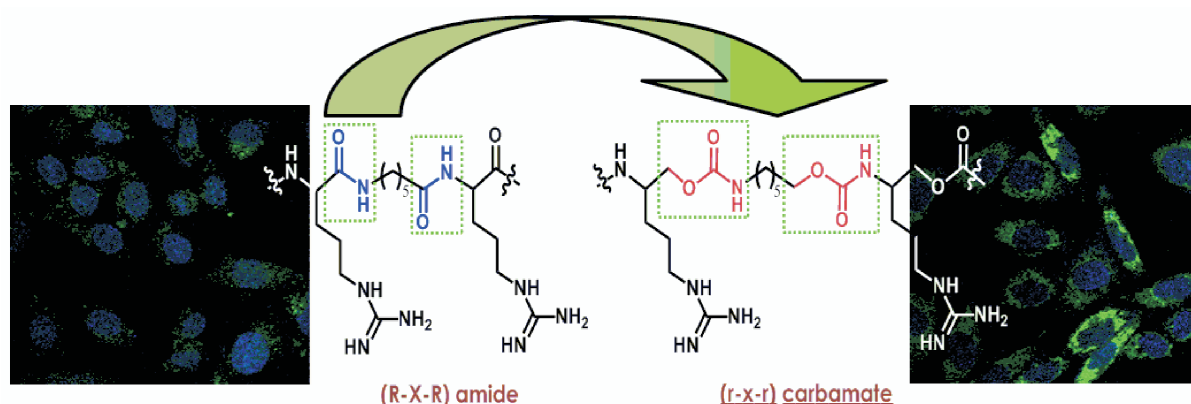


Fig.

evident from the expression of the reporter gene without the use of endosmolytic agents such as chloroquine. Moreover, oligocarbamate-DNA complexes were nontoxic compared to Lipofectamine2000, making these designed oligocarbamates extremely attractive for further development as transporters for cargo ranging from small molecules to peptides and oligonucleotides for therapeutic applications.

Conformationally rigid aromatic amino acids as potential building blocks for abiotic foldamers

Structural frameworks - called scaffolds, which help achieve a specific conformation (architecture) for the biopolymers are of considerable importance in dictating their material and biological function. Nature uses small α -amino acids as building blocks for the construction of functional biopolymers. CSIR-NCL described the development of conformationally constrained unnatural aromatic amino acids, constructed on rigid backbone wherein the carboxyl and amino groups project in two dimensions (planes) on the aromatic framework. Such a feature offers the possibility of design and development of conformationally ordered synthetic oligomers with intriguing structural architectures distinct from those classically observed. Furthermore, such amino acids will have the potential to extend the conformational space available for foldamer design (synthetic oligomers) with diverse

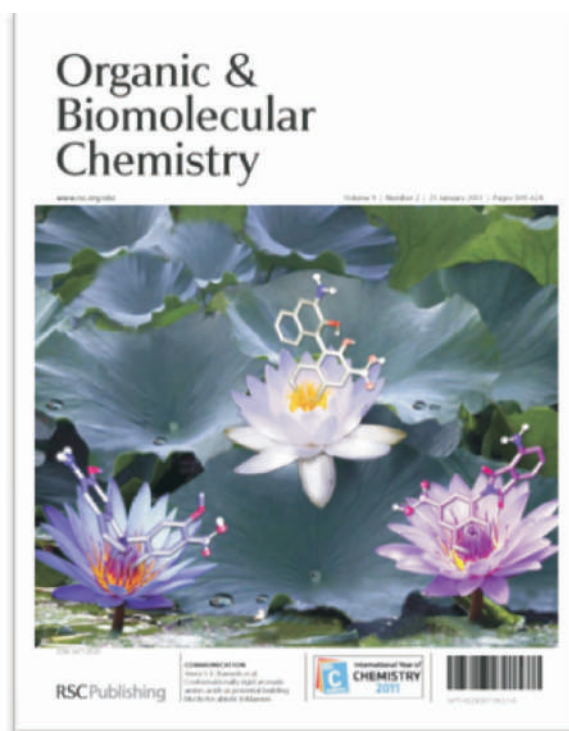


Fig.

backbone conformation and structural architectures.

Concise Enantioselective Synthesis of Reboxetine and (+)-epi-Cytoxazone

Reboxetine and (+)-epi-Cytoxazone are biologically active important drug molecules. Reboxetine is a norepinephrine reuptake inhibitor (NRI) and an antidepressant drug used in the treatment of clinical depression and panic disorder whereas (+)-epi-Cytoxazone is a microbial

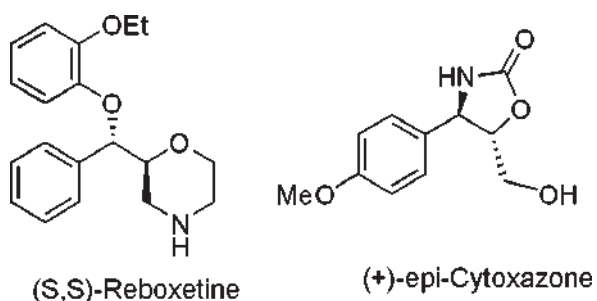


Fig.

metabolite isolated from *Streptomyces* sp., which has been identified as a potent cytokine modulator. The hydrolytic kinetic resolution (HKR) of racemic syn- or anti- alkoxy- and azido epoxides catalyzed by Co(salen) complex affords a practical access to a series of enantioenriched syn- or anti-alkoxy- and azido epoxides and their corresponding 1,2-diols in single step. The adopted synthetic route herein this methodology is very convenient and can be carried out under mild conditions with the readily available catalysts in both the enantiomeric forms. This strategy has been successfully employed in the concise enantioselective synthesis of bioactive molecules such as (S,S)-reboxetine and (+)-epi-cytosazone at CSIR-NCL.

Self-regulation of photovoltaic module temperature

CSIR-CSMCRI carried out a study to take advantage of the enhanced solar insolation in V-trough while limiting the temperature of the photovoltaic (PV) module at around the maximum (ca. 65 °C) observed for conventional usage without any concentration. Paraffin wax of 56–58 °C melting range was chosen as phase change material (PCM) and incorporated at the rear of the module to absorb the excess heat. The problem of low thermal conductivity of the wax was solved with the help of packed metal turnings wherein the wax resided. Two sets of experiments were performed indoor and outdoor. Employing a 0.06 m thick bed of the PCM matrix, the module temperature in the indoor experiment could be maintained at 65–68 °C for 3 h whereas in its

absence the temperature rose beyond 90 °C within 15 min. In outdoor studies, the module temperature in V-trough could be reduced from 78 °C to 62 °C with the PCM assembly and operation could be sustained throughout the day. Using the V-trough PV-PCM system, the output power over the day could be enhanced 1.55 times with self-regulation of temperature. The molten wax formed during operation re-solidified during the evening and night and could be re-used. A significant finding was the safe operation of the module even under low wind velocity conditions without sacrificing operational simplicity.

Characterization of polydimethylsiloxane pervaporation membranes using small-angle neutron scattering

CSIR-CSMCRI reported characterization of polydimethylsiloxane (PDMS) pervaporation membranes prepared from various conditions using the small-angle neutron scattering (SANS). The PDMS membranes were prepared by cross-linking reactions between hydroxyl terminated polydimethylsiloxane (HPDMS) and polymethylhydrosiloxane with pendant hydride (PHMS). The radius of gyration (R_g) of HPDMS and PHMS polymer chains determined from the SANS data analysis is found to be similar with the size of about 12 Å. Upon the initial cross-linking reaction at 25 °C, the R_g of the polymer was increased to 31 Å. The final membrane structure obtained after the completion of reaction is comprised of interacted polymer chains of the R_g values in the 55–61 Å range. With increasing the reaction temperature to 40 °C, about a two-fold increase in the chain length of polymer and polymer chain clustering was observed in the membrane structure. Such membrane exhibited high separation factor (α), of about 100–140 for hydrophobic organics over water. Similar high separation factor was observed for the membrane obtained by curing at 150 °C, which also has longer polymer chain and a larger polymer chain clusters. Thin film membranes coated over a porous support have loose membrane structures and show poor organic selectivity.

Microbial synthesis of Green Plastic-Polyhydroxyalkanoates (PHA) using *Jatropha* Biodiesel Waste Residues

Recognizing that cost is a key deterrent in the large scale promotion of green plastics Polyhydroxyalkanoates (PHAs), CSIR-CSMCRI used the crude glycerol stream from *Jatropha* biodiesel production as a low cost carbon source. It was further recognized that other useful nutrients required in the fermentation process can also be met from the above crude stream and other by-product streams such as deoiled cake. Critical to the success was the discovery of a potent marine bacteria, *Halomonas hydrothermalis* (Accession No. MTCC 5345), which converts the carbon from the feed into PHA with 18-20% carbon conversion efficiency and with PHA content of 70-75% with respect to cell dry weight. Analytical measurements conducted in the Institute as well as at CIPET, Ahmedabad. Solvay Advanced Polymers indicated similar properties to that of standard PHA (Sigma). Further, biodegradability in moist soil was evident after 50 days. The process is being scaled from gram scale to kilogram scale.

Biofuel from Marine Microalgae

CSIR-CSMCRI identified two coastal lagoons on the west coast having naturally occurring floating marine microalgal mats which are easy to harvest. The mats were predominantly *Microspora* sp. (ATCC Accession No. PTA - 12197) & *Cladophora* sp. (ATCC Accession No. PTA - 12199). Hexane extracted non-polar lipids from the biomass of the

microalgal mats were converted to Biodiesel (B20) to run an unmodified Tavera car.

Institute could raise 300 kg of auto-settling sundried biomass with an average biomass productivity of 32.45 g/m²/d (dry basis) and a maximum biomass productivity of 45 g/m²/d (dry basis) in open solar salt pans at CSIR-CSMCRI's experimental salt farm. The biomass was used for preparing 30 litres of B100 microalgal biodiesel (CvME). The test run using the biodiesel was flagged off by the Late Shri Vilasrao Deshmukh, Hon'ble Minister for Science & Technology & Earth Sciences at CSIR Headquarters, New Delhi on 30th March, 2012.

Cationic lipid-conjugated haloperidol derivatives as a new class of anticancer therapeutics

Haloperidol (HP), a neuroleptic drug, shows high affinity toward sigma receptors (SR). HP and reduced-HP at higher concentrations are known to induce apoptosis in SR-overexpressing carcinomas and melanomas. CSIR-IICT has developed cationic lipid-conjugated HP as a new class of anticancer therapeutics. It was demonstrated that in comparison to HP, the C-8 carbon chain analogue (HP-8) shows significantly high, SR-assisted antiproliferative activity against cancer cells presumably mediated through up regulation of caspase-3 and down regulation of pAkt. Importantly, they have shown that melanoma tumor aggressiveness in HP-C-8-treated mice is significantly lower than that in HP-treated mice.



Fig. a. Solar ponds where micro algae is cultivated; b. Biomass of microalgae and c. Biodiesel from microalga

HP-C8 simultaneously reduced Akt-protein level and increased Bax/Bcl-2 ratio in vascular endothelial cells thereby indicating a possible protein kinase down-regulatory and apoptosis inducing role in tumor endothelial cells. CSIR-IICT scientists have demonstrated for the first time that sigma receptor-targeting cationic lipid-modified HP derivatives are a promising new class of anticancer therapeutics.

Benefits of benzothiazoles

A series of substituted benzothiazoles were designed, synthesized, and evaluated by CSIR-IICT for their anticancer activity and their capacity to block tubulin polymerization. Three have promising anticancer activity, while one compound

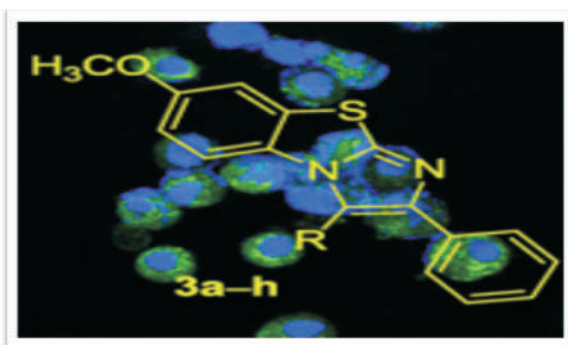


Fig.

effects cell-cycle arrest and inhibition of tubulin polymerization on par with combretastatin A-4. Modeling studies with the colchicine binding site gave insight into the SARs of these and other benzothiazole derivatives.

Potential allergens of green gram (*Vigna radiata* L. Millsp) identified as members of cupin superfamily and seed albumin

No systematic study on allergenicity of green gram seed proteins have been performed so far, although incidences of IgE-mediated reaction to green gram seedlings have been reported. CSIR-IITR investigated the allergenic potential of green gram, followed by identification and characterization of its relevant allergens using proteomic approaches. Methods BALB/c mice were sensitized

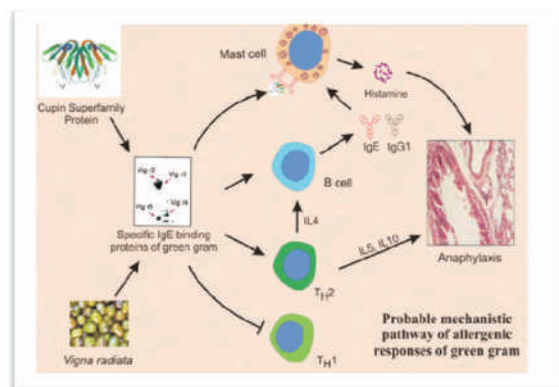


Fig. Probable mechanistic pathway of allergenic responses of green gram

intraperitoneally with green gram proteins, and levels of specific Igs, Th2 cytokines, histamine, anaphylactic symptoms and histopathological responses were studied. Twelve naso-bronchial allergic patients with a history of sensitization to green gram were selected on the basis of positive skin prick test and elevated specific IgE levels. Green gram allergens were identified and characterized by their ability to endure pepsin, by IgE immunoblot of two-dimensional (2D) gels in combination with mass spectrometry and by bioinformatics approaches. Increased specific IgE, IgG1, Th2 cytokine and histamine levels, high anaphylactic scores and histological changes in lungs and spleen of green gram crude protein extract treated mice are indicative of its sensitization ability. Four proteins (molecular weights: 52, 50, 30 and 18 kDa) showed pepsin resistance and IgE-binding capability with sensitized human and mice sera. The four proteins tentatively named as Vig r2 (52 kDa, pI 5.7), Vig r3 (50 kDa, pI 5.8), Vig r4 (30 kDa, pI 6.6) and Vig r5 (18 kDa, pI 5.5) showed significant sequence similarity with known allergens of soybean, lentil, pea, lupin, etc. Mass spectrometric analysis identified Vig r2 as 8S globulin b-isoform precursor, Vig r3 as 8S globulin a-isoform precursor and Vig r4 as seed albumin. Green gram seeds contain at least four clinically relevant allergenic proteins, namely Vig r2, Vig r3, Vig r4 and Vig r5 that were capable of inducing strong IgE-mediated reactions. One of the most important steps towards diagnostic and therapeutic approaches to deal effectively with food allergy is continued identification of newer food allergens

and their characterization. The significance of this study can be enormous as the data generated may work as basic biology data in developing a green gram species modified genetically that may have reduced allergenicity.

A mesoporous WN co-doped titania nano-material with enhanced photocatalytic aqueous nitrate removal activity under visible light

The work of CSIR-NML on the increased and selective nitrate reduction under visible light over a WN co-doped titania photocatalyst attracted the attention of well-known web-writer Giorgio De Faveri and agriculture experts. He commented that the study carried out by scientists of CSIR-NML proposed a preliminary but encouraging process to photocatalytically convert nitrate in nitrogen gas with minimal production of side-products.

A series of WN co-doped titania nanomaterials were synthesized with varying tungsten content and were characterized by TEM, XRD, UV-vis and nitrogen adsorption-desorption studies. Tungsten doped materials are found to be noodle shaped and mesoporous with a stable anatase phase after 500°C calcination. Peak shifting in the XRD pattern indicates the tungsten doping in the crystal lattice. Visible light absorption increases with the increasing tungsten amount. The hole scavengers, formic acid was found to be the best for nitrate reduction with more than 94% nitrogen gas selectivity. The amount of hole scavenger also controls the reaction efficiency and product selectivity. Both nitrate reduction and nitrogen gas selectivity increases with WN co-doping in

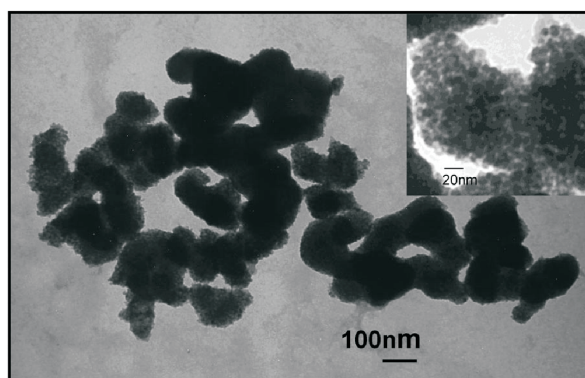


Fig. TEM image of 2-WTiN material

comparison to only N doped titania. High nitrate reduction with formic acid is attributed to the formation of (CO_2^-) species having high reduction potential. The material with 2% tungsten shows the highest surface area and the best photocatalytic activity under visible light. Presence of anion like chloride increases the nitrate photoreduction. Overall high nitrate reduction can be attributed to the synergistic effect of tungsten and nitrogen co-doping, optimum surface hydroxyl group, mesoporosity and appreciable visible light absorption of the materials.

Stereoselective multi-component organometallic reactions and synthesis of bioactive molecules using green methodologies

CSIR-NEIST developed a new strategy to synthesize optically active aminohydroxyl acid derivatives bearing two stereogenic centers via chiral Bronsted acid $\text{Rh}_2(\text{OAc})_4$ cocatalyzed three component reactions of diazo acetates with alcohols and imines. A matched reaction system was identified to give the products in moderated diastereoselectivity and good enantioselectivity. The desired product aminoalkoxy ester was isolated with 58% yield with a dr of 46:54 and the enantioselectivity is 20%. In order to enhance the enantioselectivity, the reaction was studied using alcohol, a racemic Bronsted acid (BH) to activate the imine and tert-butyl diazoacetate. The reaction gave a slightly better result. The ratio to the desired syn diastereomer slightly improved from 37:73 (syn:anti) to 45:55 with a higher ee (49% vs 35%) of the syn isomer. The application of this methodology, is demonstrated in the efficient synthesis of a taxol side chain and (-)-epi-cytoxazone. This is first time that the highly efficient ylide-trapping process is applied for the synthesis of pharmaceutically interesting molecules.

Moreover, institute has also performed the pseudo four-component Biginelli-type condensation of barbituric acid, urea/thiourea and aldehyde in presence of 1 mol% of iodine under microwave irradiations. The corresponding symmetrical spiroheterocyclic compounds were obtained in excellent yields.

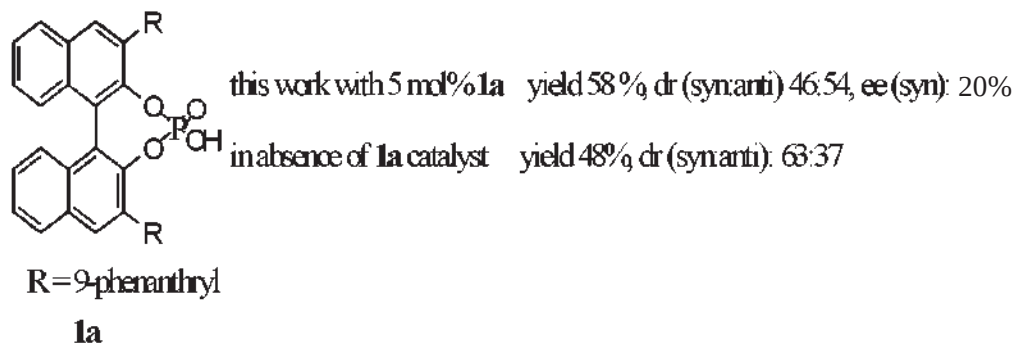
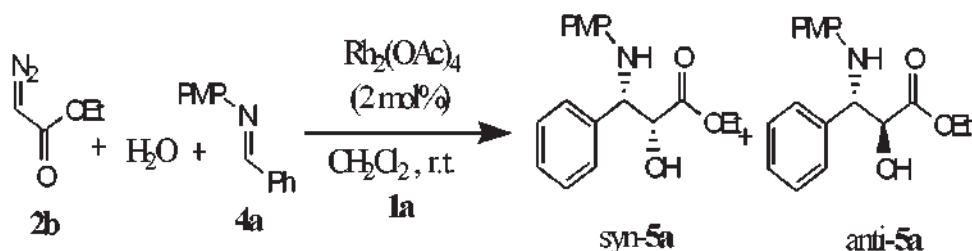
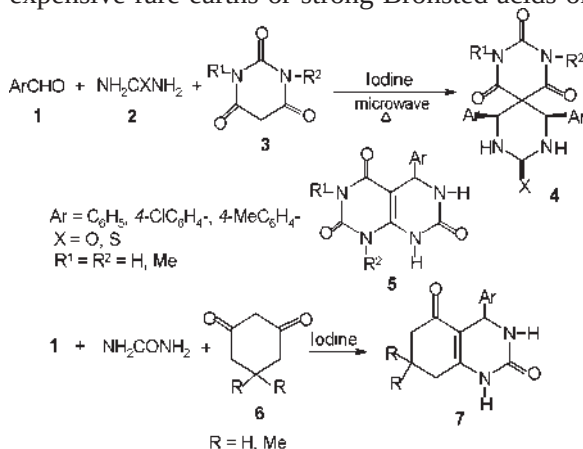


Fig.

This molecular iodine-catalysed one-pot synthesis of spiro heterocycles is therefore simple, high yielding, time-saving and environment friendly process. Moreover, CSIR-NEIST is not using expensive rare earths or strong Bronsted acids or



Scheme 1

Fig.

costly metal salts like indium rather it employs inexpensive catalyst like iodine.

Synthesis of novel pyrimidine derivatives biological significance based on inter and intramolecular cycloaddition strategy

5,8-dihydropyrido[2,3-*d*]pyrimidine **9** formed directly without the formation of any intermediate.

CSIR-NEIST got a breakthrough when uracil amidine **1** was reacted with 2-amino-substituted acrylonitriles **8** in PEG-400 and in presence of 10 mol% of K_2CO_3 at room temperature. The reaction was generalized by taking different amine substituents in **8** and observed that cyclic secondary amines like morpholine, piperidine and pyrrolidine leads to generation of the same product

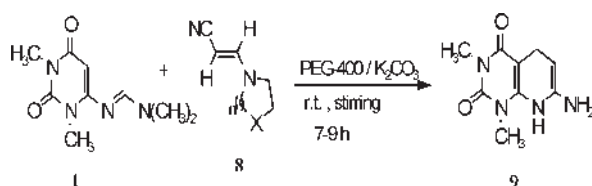


Fig.

after elimination of the amine moiety. However, when *N,N*-diphenyl amine was taken as the substituent, the reaction did not proceed at all despite long reaction time and the reactants were quantitatively recovered. This could be due to the large steric hindrance offered by the phenyl groups that renders the initial step sterically unfavorable. Institute carried out a three component reaction also between uracil amidine **1**, an aldehyde and acetyl acetone **10** in acetic acid and refluxed for appropriate time to get the products. The structure of the compound **12a** was assigned from its

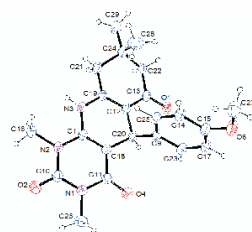
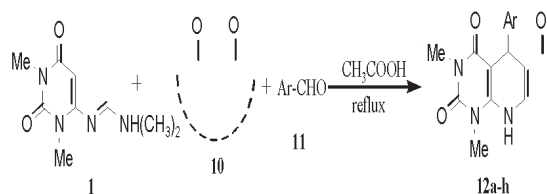


Fig.

spectral analysis and finally by X-ray crystallography.

New analogues of Drugs & Intermediates

Indium catalyzed tandem hydroamination/hydroalkylation of terminal alkynes: The first direct intermolecular hydroamination/hydroalkylation of terminal alkynes catalyzed by $\text{In}(\text{OTf})_3$ under one-pot conditions leading to the formation of conjugated ketimines in good yields and in absence of any other additive and/or co-catalyst has been investigated by CSIR-NEIST. A range of arylamines and alkynes were studied and good yields of the products were obtained. This methodology offers a new approach for the synthesis of conjugated ketimines from simple starting materials with excellent atom-economy.

Molecular Understanding on the Enhancement of Thermal Conductivity by Carbon Nanotube Based Nanofluids

Classical molecular dynamics (MD) simulation has been carried out by CSIR-CLRI on model systems composed of ethylene glycol (EG) and carbon nanotube (CNT) in water (WAT) medium to gain insight into the interaction between them. The analysis of the MD results reveals that the EG molecules aggregates around CNT expelling water molecules due to the hydrophobic-hydrophobic interaction. Hydrogen bonding (H-bonding) interaction between two EG molecules increases in the presence of CNT. Further, the presence of CNT decreases the solubility of EG in water. The analysis

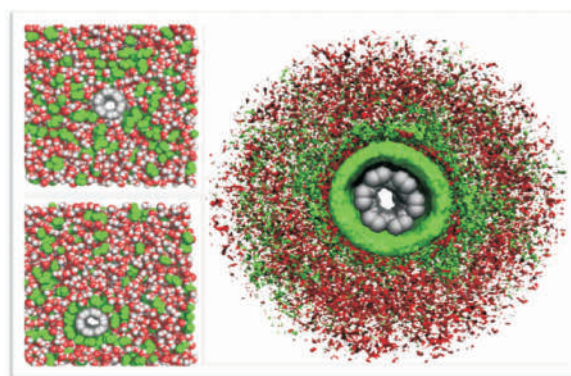


Fig. Initial and final snapshot of the CNT-EG-WAT system and Spatial Distribution Function (SDF) of EG(green) and WAT(red) around the CNT(grey) during simulation

of dihedral angle of EG reveals that the CNT induces conformational changes in EG. Specifically, a fraction of the gauche form of EG is converted into trans. In addition, electronic structure calculations have also been carried out on model systems which also coerce that the trans form of EG has a more favorable interaction with CNT than its gauche counterpart. These findings on the distribution of EG and WAT in the presence of CNT and the conformational change in the EG due to the addition of CNT has important implication in understanding the application of nanofluid composed of CNT as an excellent candidate for preparing thermally conductive cooling fluids.

An unusual oxidation of imidazolyl ring in a cobalt terpyridyl complex Inorganic Cool Colorants

CSIR-CLRI synthesized inorganic cool colorants of cobalt oxide and Chromium oxide. Cobalt oxide nanoparticles were synthesized on starch template in the size range of 15-30nm. The formation mechanism involves complexation with starch, Co^{2+} ions have been preferentially bound to starch, resulting in clathrate cages. A controlled preparative methodology which involves initial drying at a temperature of 80–90°C, removed a large number of water molecules to provide for a solid rigid network, in which the metal ions remained segregated. Subsequent calcination and sacrifice of the template resulted in mono-dispersed nanoparticles of around 20 nm.

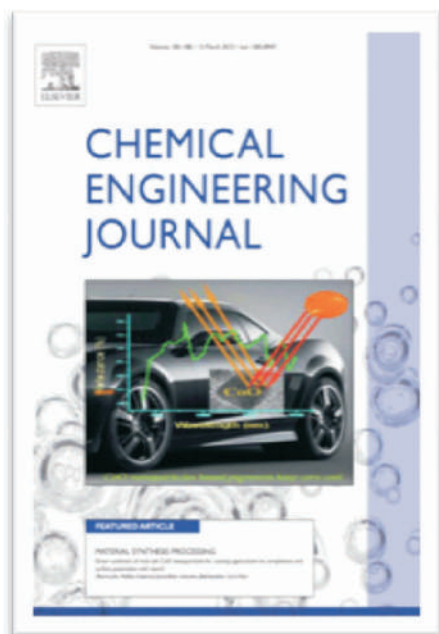


Fig. An unusual oxidation of imidazolyl ring in a cobalt terpyridyl complex

Design of acid-responsive microcapsules for targeted drug delivery application

CSIR-CLRI prepared acid responsive microcapsules using functionalized carbon nanotubes and ytterbium triflate. FESEM pictures showed that packing of the carbon nanotubes and

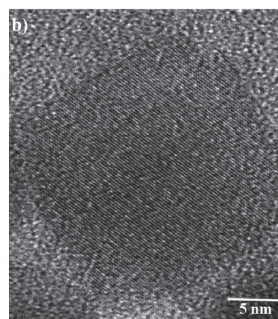


Fig. a. TEM images of the synthesized CoO nanoparticles in the size range of 15-30nm

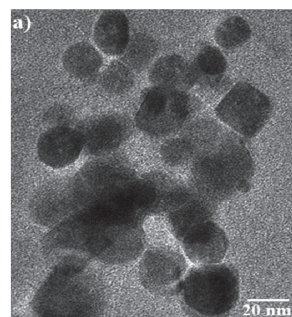


Fig. b. HRTEM image of a CoO nanoparticle

formation of holes in the microcapsules are acid dependent. While filming the action of acid on microcapsules under microscope, an interesting phenomenon was observed, where the microcapsule can be opened up for certain time using an acid that can close after some time spontaneously (“zip-unzip” phenomenon?). Several model compounds were loaded in the microcapsules and released later by the addition of aqueous acid. The methodology can be applied

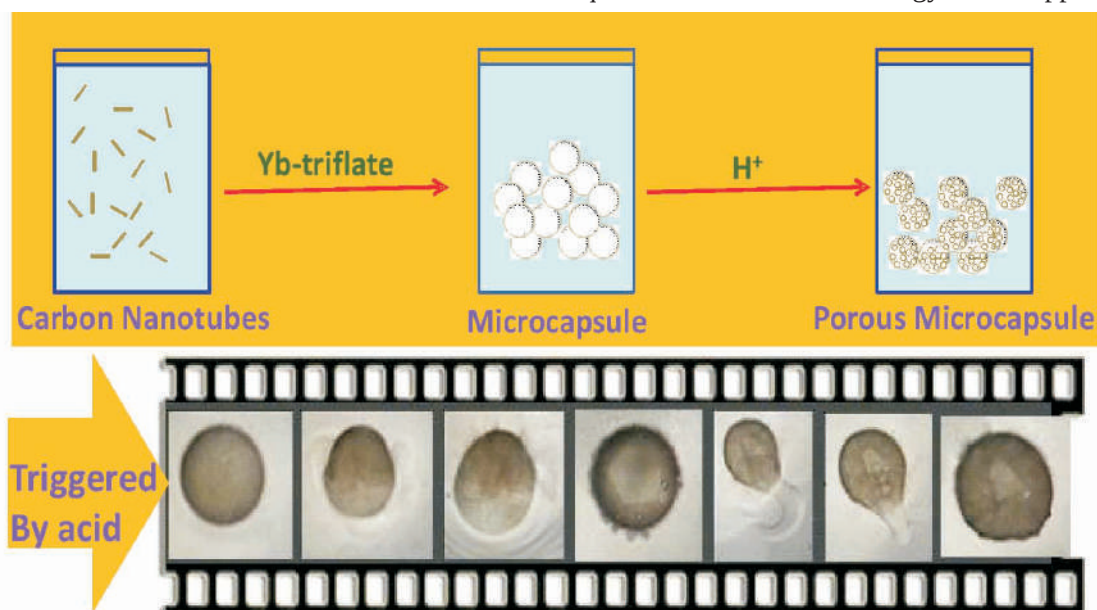


Fig. Schematic presentation of the synthesis of microcapsules followed by introduction of porosity with acid. Pictures on filmy strip show the sequential states of microcapsules after controlled acid addition, viewed by microscope.

for pH-driven targeted drug delivery at the specific site of the body.

Solid waste for the treatment of liquid waste

CSIR-CLRI used solid waste for the removal of pollutants from liquid waste wherein, the fleshing, a solid waste (biopolymer) emanating from leather industry has been used as an adsorbent for removal of dyes from wastewater. Fleshing has been cross-linked with glutaraldehyde to stabilize it against degradation. About 90% dye removal has been achieved by treating 100 mg/L dye solution with 12 g/L of glutaraldehyde-cross-linked fleshing. The possibility of reusing the dye loaded fleshing as a reductant in the manufacture of a tanning salt, which is used in leather industry for tanning of leathers.

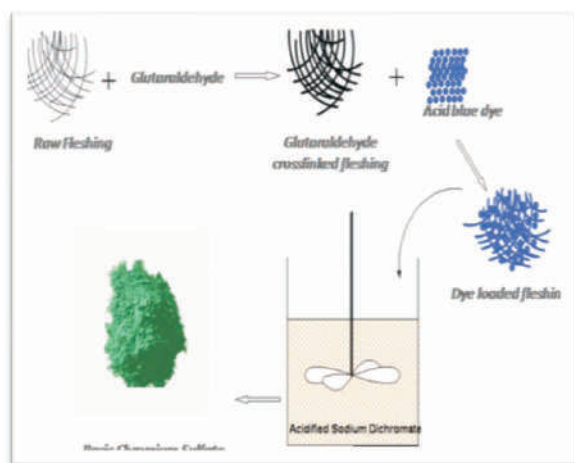


Fig.

Mineral Free Eco-Benign Tanning

Conventionally most of the skins and hides are stabilized through mineral tanning agents predominantly using chromium salts. However, due to the ecological and safety concerns associated with chromium salts and other mineral tanning systems there arose a need for an alternative tanning system. Disposal of used leather products has also come under surveillance for their eco-compatibility posing challenges to choice and designing of novel tanning systems.

Emerging criteria for such new tanning systems are environmental safety and easy biodegradability of leather products after use. Vegetable tanning agents based on poly phenols of plant materials which were in vogue prior to advent of mineral tanning are re-emerging as principal tanning materials to offset the perceived concerns of mineral tanning. This calls for overcoming the inherent shortcomings associated with the traditional vegetable tanning agents and processes. The major limitations of the vegetable tanned leathers are poor physical characteristics and their high susceptibility to fungal growth. In order to overcome short comings of vegetable tanning, use of multifunctional material(s) of plant origin has been developed by CSIR-CLRI. *Jatropha curcas* seed oil provides a possibility for its use in tanning as an adjunct along with poly phenols. This oil when used as a co-tanning agent along with vegetable tannins eliminates most of the drawbacks associated with conventional tanning. The novel tanning process using *Jatropha curcas* seed oil along with vegetable tanning agents can emerge as a viable tanning system based on replenishable resources.

Properties of Apparel Leathers and Natural Fabrics

In the area of leather product research, sewability of sheep nappa leathers was measured in terms of seam efficiency and was correlated with related mechanical properties. Seam efficiency was found to be between 44 and 99% for the sheep nappa leathers employed in the study carried out by CSIR-CLRI. Among the various mechanical properties studied, elongation at break seems to influence the seam efficiency significantly as evidenced from the correlation coefficient value of 0.99. In another study, non-mulberry silks such as eri, muga and a blend of eri and muga fabrics were combined with goat suede leather for apparel application. The results of this study suggest that the selected silk fabrics can be used for making apparel as well as other variety of products in combination with leather.

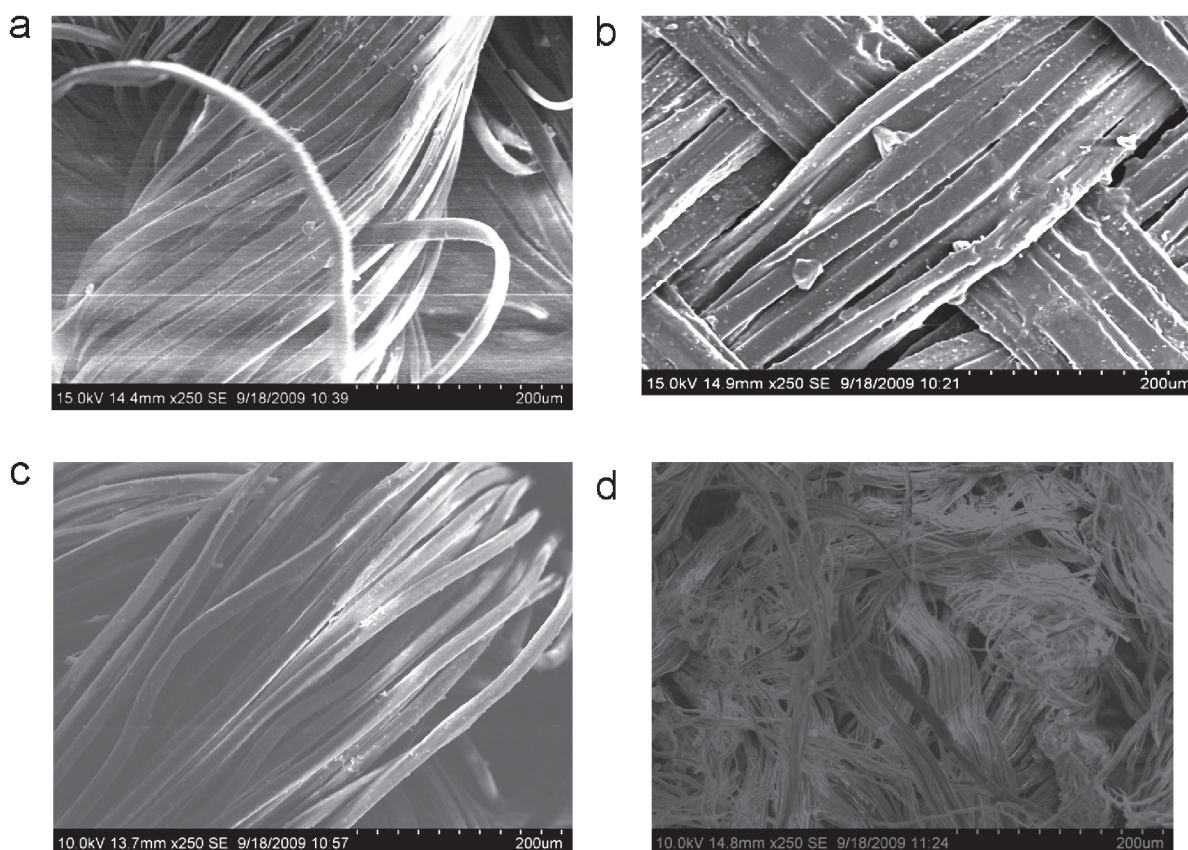


Fig. Scanning electron micrographs of silk based fabrics and goat suede leather showing the grain surface at a magnification of 250x. (a) Eri fabric; (b) Muga fabric; (c) EM blend fabric; (d) Goat suede leather.

Preparation and application of Ice Cool Biomaterial

To avoid zero hour inflammation and burning sensation, a new biomaterial with ice cool property

has been prepared by CSIR-CLRI based on collagen and alginic acid. Ice cool biomaterial displayed fast healing and significant reduction in IL1 and IL6

Duplex DNA binding of photoactive RuII-polypyridyl complexes

The duplex-DNA binding properties of a non-intercalating polypyridyl ruthenium(II) complex that incorporates a linear extended ligand with a catechol moiety has been probed by CSIR-CSMCRI with a variety of photo and biophysical techniques. These studies reveal that the complex groove binds to DNA sequences biphasically, and displays binding constants equivalent to those of high-affinity metallointercalators. The complex also displays preferential binding to AT-rich sequences. Changes in the structure of the coordinated catechol ligand and the incorporation of intercalating ancillary ligands into the complex

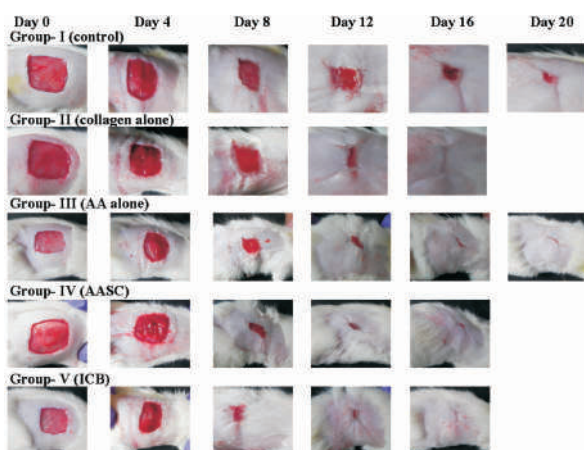


Fig.

were found to modulate both the optical-binding response and binding parameters of the system, which indicates that the catechol moiety plays a crucial role in the observed enhancement to binding affinities.

Task-Specific, biodegradable Amino acid ionic liquid surfactants

CSIR-CSMCRI synthesized and characterized Versat AAIL Surfactants: Biodegradable, chiral amino acid ionic liquid surfactants (AAILs) with a very high surface activity. The AAILs can be applied as task-specific ionic liquids; two examples given are the mitigation of harmful algal blooms from sea water and the shape and size-specific synthesis of nanomaterials.

Effect of fuel choice on nanoparticle emission factors in LPG-gasoline bi-fuel vehicles

Nanoparticle and gas-phase emission factors are presented by CSIR-IIP in collaboration with University of Alberta for a liquefied petroleum gas (LPG) passenger vehicle and are compared to gasoline operation. A bi-fuel LPG-gasoline vehicle certified for use on either fuel was used as the test vehicle so that a direct comparison of the emissions



Fig. DMS is the only available equipment which can be used for on-road particle size distribution measurement

could be made based on fuel choice. These values were considered along with previous studies to determine the relative change in particulate emissions due to fuel choice over a wide range of vehicles and operating conditions. The vehicle

examined in this study was tested on a chassis dynamometer for both steady-state and transient conditions. Transient test cycles included the US FTP72 driving cycle, Japanese driving cycle and modified Indian driving cycle while steady-state tests were done at vehicle speeds ranging from 10-90 km/hr in various transmission gears. Exhaust particle size distributions were measured in real-time using a differential mobility spectrometer (DMS50), and particle number and particle mass emission factors were calculated.

For both fuels, the majority of the particles ranged from 5 to 160 nm in terms of particle diameter, with typically more than 85% of the particles in the nucleation mode (between 5-50 nm). In most cases, the vehicle produced a greater number of larger (accumulation mode) particles when fuelled on LPG. Using the data in the literature as well as the data in the current study, gasoline fuel produces 4.6 times more particles in terms of number and 2.1 times more particles in terms of mass.

Process for dodecane fraction from straight run kerosene

Reprocessing of spent nuclear fuel is an indispensable process for the economical use of actinides in the nuclear energy production. Such process involves the separation of reusable actinides from unwanted fission products by solvent extraction. The commercially used process employs tri-butyl phosphate (TBP) diluted with normal dodecane fraction as solvent for the extraction.

Normal dodecane (n-C12) constitutes in an approximate weight percentage of 25-30 in straight run kerosene fraction boiling in the range 212-225°C with the rest being non-normal C12 components and minimum of lighters and heavies. Presently the whole demand of normal dodecane fraction is being met by import only due to non-availability of indigenous technology. CSIR-IIP is the only institute in India extended its research expertise for the development of process for the production of normal dodecane fraction from straight run kerosene. The developed process



involves finely tuned dry urea adduction methodology to separate straight chain paraffins from straight run kerosene. The fraction obtained meets the required specifications to use as solvent necessary for spent nuclear fuel processing.

Organic Synthesis

Iodocyclization and Prins-Type Macrocyclization: An Efficient Formal Synthesis of Leucascandrolide

The formal total synthesis of leucascandrolide A was achieved by CSIR-IICT in 20 steps from a known epoxide with overall yield of 11.5% following a recently developed strategy for the construction of trans-2,6-disubstituted-3,4-dihydropyrans and a Lewis acid catalyzed intramolecular Prins-cyclization of aldehydic homoallylic alcohol to generate the tetrahydropyran ring with three stereogenic centers and macrocycle concomitantly.

Total synthesis of Z-isomer of phomolide B

CSIR-IICT achieved the synthesis of Z-isomer of phomolide B during its investigation towards the effect of protecting group on the outcome of ring-closing metathesis reaction. The other key reactions involved are cis-selective partial hydrogenation, Sharpless asymmetric epoxidation, Yamaguchi esterification and following 12 longest linear sequence with 18.5% overall yield starting from a known intermediate 20.

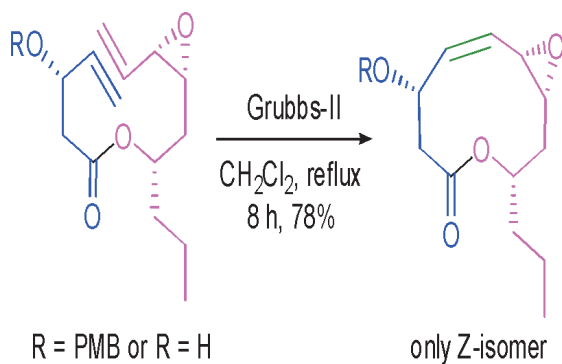


Fig.

Formal Total Synthesis of Cyanolide A

Formal total synthesis of cyanolide A, aglycosidic dimeric macrolide is accomplished by CSIR-IICT. The compound was found to be an efficient molluscidal agent. The key reactions involved are asymmetric acetate aldol reaction, CBS reduction and Shiina's lactonization.

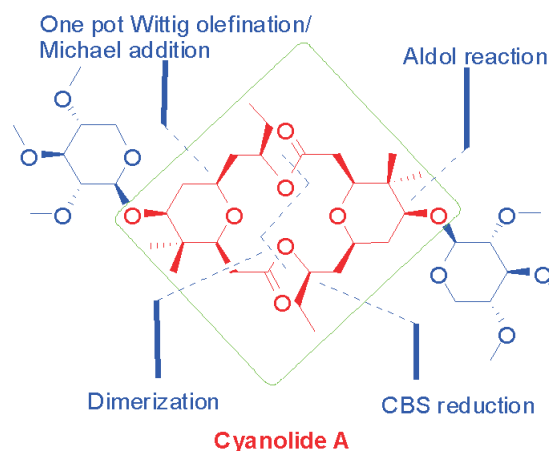


Fig.

Iodocyclizations: Novel Strategy for the Total Syntheses of Polyrhacitide A and epi-Cryptocaryolone

Highly stereoselective total syntheses of polyrhacitide A and epi-cryptocaryolone have been achieved by CSIR-IICT in 11 steps with high overall yield of 24% and 28%, respectively, following a recently developed strategy for the

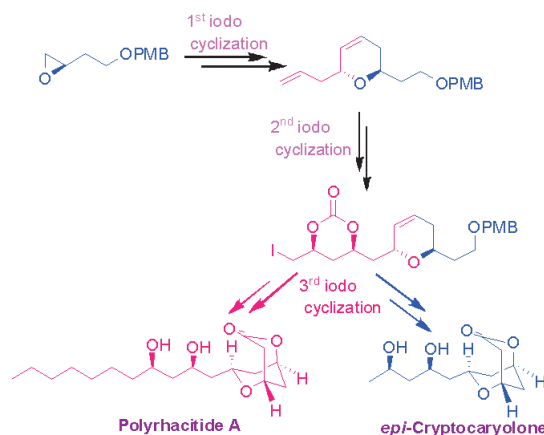


Fig.

construction of trans-2,6-disubstituted-3,4-dihydropyrans. The versatility of iodo-cyclization for the total syntheses of polyrhacitide A and epicyptocaryolone is demonstrated.

Stereoselective Total Synthesis of (+)-Oploxyne A, (-)-Oploxyne B and their C-10 Epimers and Structure Revision of Natural Oploxyne

The first total synthesis of recently isolated diacetylene alcohols oploxyne A, oploxyne B and their C-10 epimers was accomplished by CSIR-IICT. The structure of natural oploxyne B has been revised. The target compounds displayed potent cytotoxicity against neuroblastoma and prostate cancer cell lines

A facile synthesis of substituted dibenzoxepines using an acid-catalyzed tandem reaction

Dibenzoxepine is an important structural motif in various pharmaceuticals with remarkable diverse biological activities. Synthesis of 11-substituted dibenzoxepine derivatives has been demonstrated by CSIR-IICT via an acid-catalyzed tandem nucleophile addition/ Friedel-Crafts cyclization reaction. The reaction of O-benzyloxy salicylaldehyde with various nucleophiles (10 mol-% I_2) or O-benzyloxy phenol with aromatic aldehydes (10 mol-% $BF_3 \cdot Et_2O$) has provided the desired products in good yields.

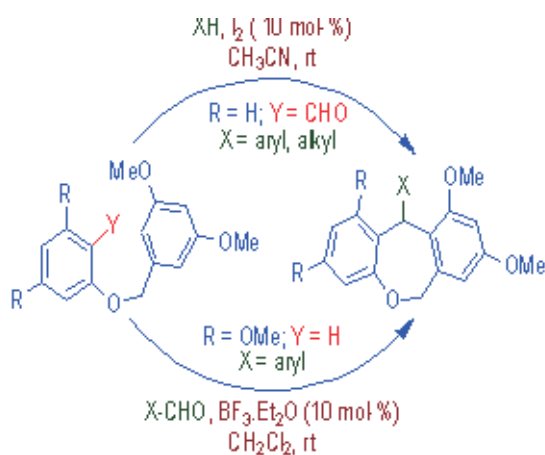


Fig.

Derivatives of Embelin, a Natural Product with Proapoptotic and Anticancer Properties

The synthesis of new derivatives of embelin, a natural of X-linked inhibitor of apoptosis protein (XIAP) is achieved by CSIR-IICT. The design of these new molecules involved introduction of aromatic groups directly linked to the benzoquinone core. A new strategy to provide greater flexibility in the nature and the length of the added chain was developed. The strategy involves first a Suzuki–Miyaura reaction with functionalized aromatics, yielding a first generation of molecules. Then, by appropriate use of the functional groups, a second generation of representative embelin derivatives is prepared.



Fig.

Towards chemical libraries based on heterocyclic scaffolds with monofluorinated and difluoroalkyl side chainscarbohydrates

Focused chemical libraries, based on five and six-membered heteroaromatic systems with mono and

Chemical Libraries of fluorinated heterocycles by automated procedures

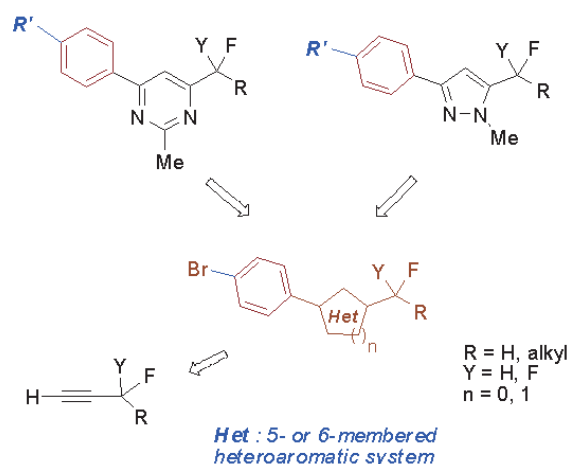


Fig.

gem difluoro alkyl sidechains, is developed by CSIR-IICT. Four heterocyclic scaffolds with a p-bromophenyl group have been prepared from readily available propargylic fluorides. Starting with these scaffolds, palladium-catalyzed reactions have been performed by automated procedures, to prepare libraries of molecules designed for biological applications.

Waste Utilization through Biohydrogen

Solid phase microbial fuel cell (SMFC) for harnessing bioelectricity from composite food waste fermentation

CSIR-IICT is working on the design and evaluation of a single chambered solid phase microbial fuel cell for production of bioelectricity through solid state fermentation of composite waste.



Fig.

Solid phase microbial fuel cells (SMFC; graphite electrodes; open-air cathode) for the potential of bioelectricity production by stabilizing composite canteen based food waste. The performance was evaluated with three variable electrode-membrane assemblies. Experimental data depicted feasibility of bioelectricity generation from solid state fermentation of food waste. Distance between the

electrodes and presence of proton exchange membrane (PEM) showed significant influence on the power yields. SMFC-B (anode placed 5 cm from cathode-PEM) depicted good power output (463 mV; 170.81 mW/m²). Sodium carbonate amendment depicted marked improvement in power yields due to improvement in the system buffering capacity. SMFCs operation also depicted good substrate degradation (COD, 76%) along with bio-ethanol production. The operation of SMFC mimicked solid-state fermentation which might lead to sustainable solid waste management practices.

Enhanced of petroleum sludge degradation in bio-electrochemical system with simultaneous power generation

CSIR-IICT has evaluated the simultaneous removal of soluble (aliphatics, aromatics and NSO (nitrogen, sulfur and oxygen)) and insoluble (asphaltenes) fractions of petroleum sludge apart from power generation using a specifically designed bio-electrochemical treatment system (BET). BET documented effective degradation of real field petroleum sludge over the conventional anaerobic treatment (AnT). BET operation showed enhanced total petroleum hydrocarbons (TPH) removal over AnT. Aromatic fraction visualized higher removal (75.54%) compared to other TPH fractions viz., aliphatics, asphaltenes and NSO (nitrogen, sulfur and oxygen) during BET operation. Higher ring aromatics (5–6) documented easy degradation in BET, while AnT was limited to lower ring (2–3) compounds. Voltammetric analysis evidenced simultaneous redox behavior during BET operation due to presence of graphite electrode as electron acceptor, while AnT showed extended reduction behavior only. BET documented higher charge/capacitance (2810 mJ/1120 mF) than AnT (450 mJ/180 mF). Power output corroborated well with observed results supporting BET performance as fuel cell.

ITO films by a Jet Nebulizer Spray (JNS) Pyrolysis technique

Nanocrystalline ITO thin films were deposited on glass substrates by a new spray pyrolysis route,

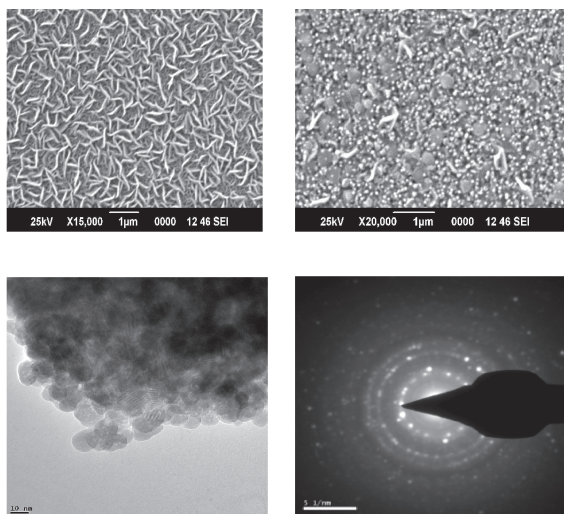


Fig. SEM and TEM image and SAED pattern of ITO film deposited at 400°C.

Jet nebulizer spray (JNS) pyrolysis technique, for the first time at different substrate temperatures varying from 350 to 450°C using a precursor containing indium and tin solution with 90:10 at % concentration. The optical band gap values calculated from the transmittance spectra of all the ITO films showed a blue shift of the absorbance edge from 3.60 to 3.76 eV. SEM and TEM results showed the nanocrystalline nature with grain size about 12-15 nm. The electrical parameters like the resistivity, mobility and carrier concentration are found as $1.82 \times 10^{-3} \Omega \text{cm}$, $8.94 \text{ cm}^2/\text{Vs}$ and $4.72 \times 10^{20} \text{ cm}^{-3}$, respectively for the ITO film deposited at 400°C.

Nitride-based multilayer coated 316L SS AS A human body implant

CSIR-CECRI prepared and characterized multiple layer of TiN/TiAl N, T,N / NbN, TiN/VN and Ti-Si-N nanocomposite coating by reactive dc magnetron sputtering in Ar-N₂ gas mixture. The coatings were uniform with columnar surface morphology. The load-indentation depth curves analysis for steel substrates, single- layer TiN, Si₃N₄ and Ti - Sn - N nanocomposite coatings. A maximum hardness value of 39GPa was observed for Ti-Si-N. Multilayer coatings had better hemocompatibility than single layer and bare AISI 316LSS substrates. The attachment of bacteria on multilayer coatings was found to be very minimum

and without colonization. The multilayer coated 316L surfaces showed a significant reduction of the presence of bacteria, and this fact could probably be important in the decrease of the inflammation of the peri-implant soft tissues. The increase in charge transfer resistance (R_{ct}) and decrease in double layer capacitance (C_{dl}) value shows the better corrosion resistance for the coated sample. Potentiodynamic polarization curves showed that the positive shift in E_{corr} and decrease in I_{corr} values for multilayer coating signifies that it exhibits higher corrosion resistance than single layer and bare substrate in simulated body fluid. It is concluded that by using the transition metal nitride based multilayer coated 316L SS as a human body implant, improvement of corrosion resistance as an indication of biocompatibility could be obtained.

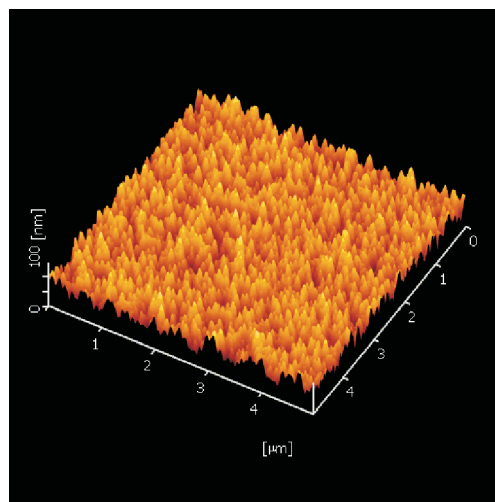


Fig. AFM 3D image of TiN/NbN multilayers

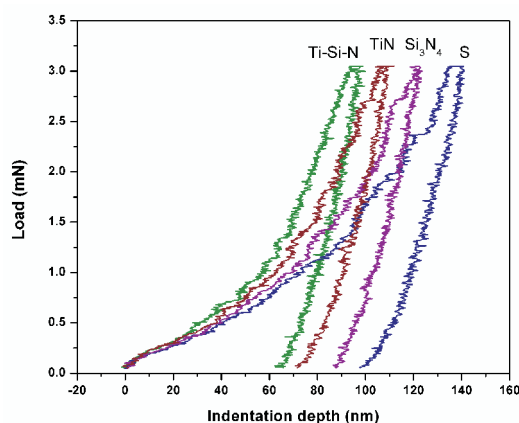


Fig. Typical load vs. displacement curves for the Ti-Si-N nanocomposite coatings at 3 mN load

Attogram sensing of trinitrotoluene with a self-assembled molecular gelator

Trinitrotoluene (TNT) is a widely used explosive in landmines and military operations that contaminates the environment and groundwater, posing a threat to human health. Achieving the detection of explosives at a sub-femtogram level using a molecular sensor is a challenge. Further, detection of this explosive is of utmost importance due to illegal transport and terrorist activities. CSIR-NIIST demonstrated that a fluorescent organogelator exhibits superior detection capability for TNT in the gel form when compared to that in the solution state. The gel when coated on disposable paper strips detects TNT at a record attogram (ag, 10^{-18} g) level (~ 12 ag/cm²) with a detection limit of 0.23 ppq. This is a simple and low-cost method for the detection of TNT on surfaces or in aqueous solutions in a contact mode, taking advantage of the unique molecular packing of an organogelator and the associated photophysical properties.

Technology Developed

Pharma Grade Synthetic Anionic Clay

CSIR-CSMCRI developed a knowhow for pharma grade synthetic anionic clay commonly known as synthetic hydrotalcite which is basically a magnesium aluminium hydroxyl carbonate.

Magnesium aluminium hydroxide octahedral forms positively charged layers and balancing anionic carbonate ions are located between the layers as interlayer anions. The Institute standardised a process to convert hazardous effluents to value added product and the knowhow for the preparation of synthetic hydrotalcite from effluent streams generated in the dye (copper phthalocyanine green) manufacturing plant of M/s Heubach Colour Pvt. Ltd., Ankleshwar was successfully transferred. The effluent mainly contained aluminium chloride and ammonium carbonate. The source of magnesium was bittern- the mother liquor left out after recovery of salt from brines. M/s Heubach installed a commercial plant of 1000 TPA based on CSIR-CSMCRI's knowhow.

Microsurfacing using chrome shavings as filler

Large quantities of solid and liquid wastes of toxic nature generated in tanning industry may percolate into the soil and contaminate the ground water. The biological solid waste such as chrome shavings- the chrome tanned collagenous scrap, a refuse, cause pollution upon the degradation of the organic matter with subsequent release of inorganic chromium. Degradation of chrome shavings could be arrested by encapsulating using hydrophobic (water repelling) bituminous binder. A bituminous mixture containing chrome shavings as one of the ingredients could be an alternative road



Fig. Inauguration of 1000 TPA SHT plant set up by M/s Heubach Color Pvt. Ltd; Ankleshwar

construction material to provide a sustainable pavement layer.



Fig.

An experimental road stretch with Chrome Shaving as alternate filler was used by CSIR-CLRI in micro-surfacing as protective layer in the busiest road namely Sardar Patel road, Chennai having traffic volume of more than 1500 CVPD (commercial vehicles per day). Another test track was laid in the university premises of Anna University, Chennai where the traffic volume is less than 1500 CVPD, using conventional concrete mixer. By utilizing the highly voluminous chrome shavings in road construction, the problem of waste disposal can be solved. The bituminous mixture containing chrome shavings of spongy nature would provide a rattle free road with possible skid resistance. The bitumen encapsulated chrome shaving in the bituminous mixture would not release any chromium into the soil.

Salt Free Tanning

Given the total volume of hide or skin processed in India to a level of 2300 tonnes/day, the amount of salt used and discharged in the effluent is about 200 tonnes/day. The tanneries employ membrane separation like Reverse Osmosis in effluent treatment systems for removal of chlorides to meet discharge standards. The cost associated with the treatment and the disposal of huge quantities of reject arising from the RO plants after treatment also cause of concern for the tanners.

To overcome these problems CSIR-CLRI has developed a novel tanning composition for effecting salt free tanning technology. This new technology not only eliminates salt usage, but also enables avoiding pickling of hides and skins and an operation called basification in mineral tanning where in neutralization of the tanning medium is carried out which also contributes to the generation of large amounts of neutral salts and total dissolved solids in tannery effluents.

Hollow fibre ultrafiltration membranes

Process of preparation of hollow fiber ultrafiltration membranes using polysulphone / polyacrylonitrile was licensed to M/s Uniqflux Membranes LLP, Pune. A commercial unit has



Fig. HF membrane modules based on CSIR-CSMCRI knowhow prepared by M/s Uniqflux

been set-up and they have started commercial production of hollow fibre membrane modules. The photo depicts the module of different size.

Catalyst Thoxcat ES for sweetening of LPG

The presence of mercaptans in petroleum products like LPG, naphtha, gasoline, ATF and kerosene is undesirable due to their foul odor and highly corrosive nature. In commercial practice, the low molecular weight mercaptans present in LPG and light straight run naphtha (LSRN) are first extracted with alkali and subsequently catalytically oxidized to disulfides with air.

The technology for the production of catalyst Thoxcat ES useful in extractive sweetening of LPG



Fig. Main reactor in catalyst production unit at Lona Industries Ltd., Mumbai

and liquid-liquid sweetening of lighter petroleum fractions viz, light straight run naphtha (LSRN), light thermally/catalytically cracked gasoline has been developed by CSIR-IIP in collaboration with BPCL. Thoxcat ES catalyst is in liquid form containing catalyst active matter in dilute aqueous alkaline solution. This catalyzes the oxidation of mercaptans present in lighter petroleum fractions to less deleterious disulfides. This is superior to commercial catalyst being used globally in terms of activity, lesser cost and catalyst consumption rate.

Cobalt phthalocyanine disulphonates are being used as commercial catalyst for extractive sweetening of LPG. CSIR-IIP developed Cobalt phthalocyanine sulphonamide as a new superior catalyst for using in same process.

The users of the catalyst Thoxcat ES are petroleum refining industries. The technology for the production of Thoxcat ES was licensed to M/S Lona Industries Ltd, Mumbai. By using this

catalyst refineries have been benefited by savings in foreign exchange as the product is indigenous, lesser cost and consumption rate. BPCL R&D Centre is collaborator / partner for the development and commercialization of this catalyst. Figure shows the main reactor of catalyst production unit.

Conversion of waste plastics to fuel

CSIR-IICT developed a highly efficient process for catalytic conversion of waste plastic to fuel in collaboration with Harita-NTI Ltd Chennai, Tamil Nadu (a TVS associate). Polyethylene (LDPE, LLDPE & HDPE), and polypropylene, other plastics such as computer cases, car bumpers etc. can be used.

Process for fluoroelastomer Kel-F-800

Fluoroelastomer Kel-F-800 is a fluoropolymer used in defence as a coating material over ammunition in order to improve the shelf life in terms of moisture resistant, weatherability and plasticity. Fluoropolymer protects the ammunition much better than any other polymer or product, hence the storage time of ammunition can be enhanced by using Kel-F-800 based coating. Kel-F-800 is prepared from co-polymerisation of monomers such as chlorotrifluoroethylene (CTFE) and Vinylidene fluoride (VDF) in 3:1 ratio respectively. However, the monomers like CTFE and VDF are not available in India, and are also not available for import. CSIR-IICT designed and developed a process for both the monomers and their co-polymerisation to obtain Kel-F-800. The process for CTFE monomers is developed starting from 1,1,2-trichlorotrifluoroethane (CFC-113) via dehalogenation using metal catalyst by semi-

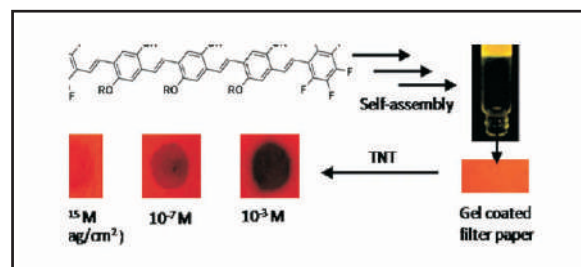


Fig.

continuous mode of operation in high yield. The process for VDF monomer was developed in two stages starting from 1,1,1-trifluoro-2-chloroethane (HCFC-133a) via halogen exchange reaction followed by dehalogenation in batch mode of operation. Both the monomers were further copolymerised under specific conditions and obtained fluoroelastomer Kel-F-800, a fluoropolymer. The uniqueness of process development for both the monomers is by using a specific catalyst, and indigenous process is available for Indian industries. The developed process was demonstrated to Ballistic Research Laboratory (TBRL), Chandigarh, a DRDO Lab.

Process for FEP-Resin

Fluorinated Ethylene Propylene (FEP-Resin), has strategic space research application, as coating material for cryogenic polyamide pipelines, rockets and missiles. Besides coating FEP-Resin also finds applications in, melt extrusion and impregnation. FEP-Resins are known for their excellent chemical resistance, superior electrical properties and high service temperatures of upto 200°C. FEP-Resins also provide outstanding low temperature toughness and unique flame resistance. FEP-Resin is prepared by copolymerisation of fluoromonomers such as hexafluoropropene (HFP) and tetrafluoroethylene (TFE) under specific conditions. The monomer HFP is made from different raw materials like HCFC-124, hexafluoropropylene oxide and so on. Presently, there is no techno economically feasible process for hexafluoropropene available in India or in overseas. CSIR-IICT developed a process for FEP-Resin by copolymerization of HFP and TFE under specific conditions in collaboration with M/s Hindustan Fluorocarbons Limited (HFCL), Hyderabad. The process was successfully demonstrated to ISRO/Vikram Sarabhai Space Centre (VSSC), Tiruvananthapuram.

Isolation of Tocopherols and Phytosterols

Tocopherols are natural antioxidants. Alpha and gamma tocopherols exhibit strong vitamin E and antioxidant activities respectively. Phytosterols

exhibit several pharmaceutical and nutraceuticals applications. Deodorizer distillate (DOD) is a by-product obtained during the refining of vegetable oils and is a good source for the isolation of phytosterols and tocopherols. Deodorizer distillate generally contains about 35-40% triglycerides, 40-50% fatty acids, 4-10% sterols and 3-8% tocopherols. Isolation of tocopherols and phytosterols from DOD results in value addition to by-products of vegetable oil processing industry. CSIR-IICT developed a process for the isolation and enrichment of tocopherols and phytosterols from soybean oil DOD for the first time in India. The process involves esterification and transesterification of DOD to fatty acid methyl esters (DOD-FAME). The phytosterols were separated from DOD-FAME by crystallization and tocopherols were enriched to required purity by separating the FAME using distillation techniques. The technology was transferred to M/s. Biopharma Pvt. Ltd., Hyderabad and M/s. Perfect Vitamins Pvt. Ltd., Mumbai.

Catalyst system for the preparation of Nitrotriazolone

Among the various energy materials, 3-nitro-1,2,4-triazol-5-one (NTO), a secondary high explosive of insensitive nature is mainly used in insensitive Munitions (IM). Conventionally, NTO is synthesized by nitration of TO using excess quantity of concentrated nitric acid. This process is associated with the disposal of hazardous waste (including residual nitro aromatic compounds) during the downstream processing. CSIR-IICT developed the green nitration process using solid acid catalysts for NTO. By using solid acid catalysts, most of these problems related to nitration are eliminated and the catalyst can be simply separated and recycled for subsequent use. The process was developed in collaboration with High Energy Materials Research Laboratory (HEMRL), Pune.

Bio-jet Fuels at CSIR-IIP

Bio-jet fuels are in high demand for several reasons. Firstly, it provides security to the Airlines



Fig. Bio-jet pilot plant at CSIR-IIP

against fluctuation in ATF prices as well as expected to reduce availability in the future. Also it can be used as a drop in fuel; the ASTM committee has now approved upto 50 % blend of bio-jet fuels with normal fuels. Several countries including the European Union is imposing carbon tax on airlines. CSIR-IIP is the first institute in India to produce 15 liters of high quality biojet fuel from *Jatropha curcus* oil. This fuel has been tested by both Indian Oil Corporation and HPCL and has been found to meet all specifications as per ASTM D 1655.

The large pilot plant has been built with a capacity of 20 litres per day and is in operation, it will produce enough fuel for testing in engine of Pratt & Whitney, Canada.

The technology involves pre-treatment of oil followed by hydro deoxygenation, hydro-cracking followed by hydro isomerization. The innovativeness of this technology is that all these

steps can be carried out by single catalyst. This invention is protected by several patents.

Unique New Facility

Centre for Chemical Biology

To facilitate primary screening of new chemical entities and target based screening, CSIR-IICT has established a dedicated Chemical Biology facility. The facility provides necessary infrastructure and

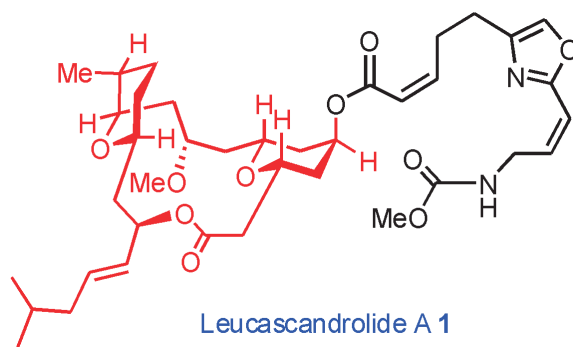


Fig. Lleucascandrolide A1

expertise for identification of chemical tools to study biological pathways and to discover lead compounds for the development of novel therapeutics, especially in the areas of diabetes, cancer, cardiovascular diseases and CNS disorder.

Centre for Semiochemicals

Considering the severe environmental pollution and serious health hazard problems caused by indiscriminate use of pesticides, it has been the endeavour of CSIR to look into various methodologies for pest control as alternative to pesticides. To this end CSIR-IICT, is the first Institute in India to utilise pheromones as an eco friendly alternative to pesticides. Insect pheromones, an important category of semiochemicals, are compounds released by insects for specific communication within their species. Having understood the versatility and the potential of insect pheromones to manage pest population in a given crop, CSIR-IICT launched an ambitious program to popularise Pheromone

Application Technology (PAT) for the benefit of the society. With support from governmental agencies, it is envisaged that this program would establish PAT as a popular and affordable agro-practice in India.

A New facility of HRGCMS has been setup at CSIR-IIP. The instrument is a double focusing magnetic analyzer with resolving power of 80000. The instrument is equipped with all glass heated inlet sample introduction system (AGHIS) for characterizing hydrocarbon types in petroleum components. It is also coupled with HRGC, direct insertion probe (DIP) and high temperature probe for organic compound analysis. The instrument utilizes various ionization techniques such as electron ionization (EI), chemical ionization (CI) and field ionization/field desorption (FI/FD). The functioning and all performance specifications of the instrument were demonstrated during the commissioning activity. Analytical method development for petroleum analysis is under progress.

New HPLC facility for the study of petroleum heavy end products, petrochemicals, different reaction products has been installed at CSIR-IIP. (HPLC Agilent Technologies, 1260 infinity, USA with ELSD, DAD & Florescence Detector)

1.3 ENGINEERING SCIENCES CLUSTER

Scientific Excellence

Glass-free LTCC tapes for microwave substrate applications

CSIR-NIIST developed Glass free Low Temperature Co-fired Ceramic (LTCC) tape of LiMgPO_4 . The tape casting slurry was prepared by dispersing LiMgPO_4 powder in ethanol/xylene mixture followed by the addition of organic additives such as binder, plasticizer and homogenizer. LiMgPO_4 ceramic powder of average particle size $1.1 \mu\text{m}$ and BET surface area of $2.7 \text{ m}^2\text{g}^{-1}$ was used for the slurry preparation. Tape casting slurry of LiMgPO_4 with typical

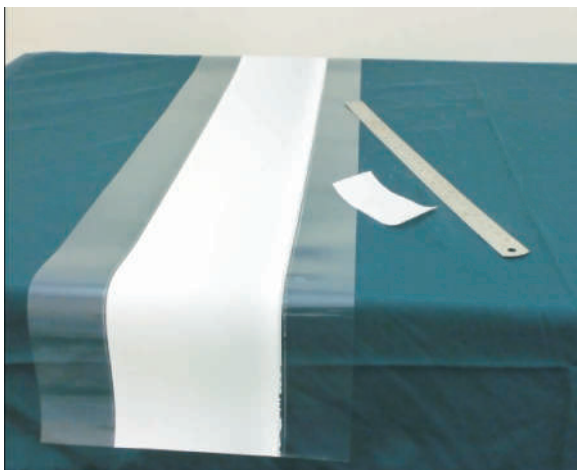


Fig. Cast LiMgPO_4 ceramics Green tape

pseudo-plastic behavior was cast into thin tapes of thickness $70 \mu\text{m}$ using the doctor blade technique. The green tape of LiMgPO_4 has a ϵ_r of 3.2 and $\tan \delta$ of 0.0688 at 5 GHz. The thermolaminated tape (4 layers) sintered at $950^\circ\text{C}/2\text{h}$ showed good microwave dielectric properties: $\epsilon_r = 6.4$ and $\tan \delta = 0.0002$. LiMgPO_4 ceramic showed a coefficient of thermal expansion of $10.5 \text{ ppm}/^\circ\text{C}$ and thermal conductivity of $7.1 \text{ W m}^{-1}\text{K}^{-1}$. The glass-free nature and the good microwave dielectric properties obtained for the final tape makes the newly developed tape casting formulation attractive for LTCC applications.

Mesoporous alumina thin films with hexagonal & cubic symmetries as catalyst support

Thermally stable ordered (2D or 3D) mesoporous alumina is of immense importance as adsorbent material, catalyst and catalyst support owing to its high surface area, narrow pore-size distribution and uniform pore structures. The development of this kind of materials with different symmetries in thin film forms on ordinary glass substrates is important because of easy maneuverability with reusability in catalysis. CSIR-CGCRI synthesized 2D hexagonal ($p6mm$ symmetry) and 3D cubic mesoporous alumina films with high thermal stability with the aid of triblock non-ionic surfactants, P123 and F127 respectively. The 2-D film acts as an efficient catalyst in the decomposition of aqueous KMnO_4 to MnO_2 .

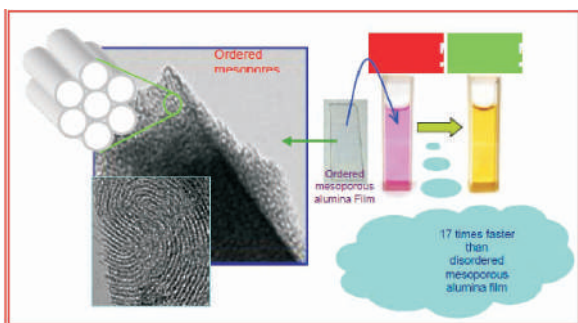


Fig. Schematic representation of the ordered mesoporous alumina film used as a catalyst for conversion of KMnO_4 to MnO_2 nanoparticles

nanoparticles. It showed ~ 17 times enhanced catalytic activity than that of the ill-organised disordered mesoporous alumina film of comparable thickness and porosity.

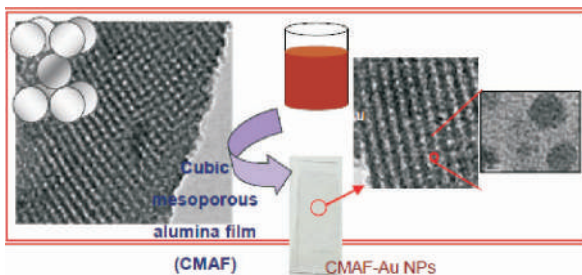


Fig. Highly ordered cubic mesoporous alumina film containing Au nanoparticles used as a catalyst for reduction of 4-nitrophenol. Highly ordered cubic mesoporous alumina film containing Au nanoparticles used as catalyst for reduction of 4-nitrophenol.

Further cubic mesoporous alumina films (3-D) incorporated with Au nanoparticles (CMAF-Au NPs) were found to be potentially very active as a reusable catalyst in the reduction of 4-nitrophenol to 4-aminophenol using aqueous NaBH_4 at 25°C . The reaction does not proceed in absence of catalyst.

Fabrication technology of advanced glasses: an important step forward

Advanced glasses are being used increasingly in a host of applications such as touch screen mobiles, tablet computers, i-pads, ultra slick cameras, remote sensing, healthcare, green energy, space, and strategic sector technologies. Being a brittle solid, glass is prone to suffer from contact damage-

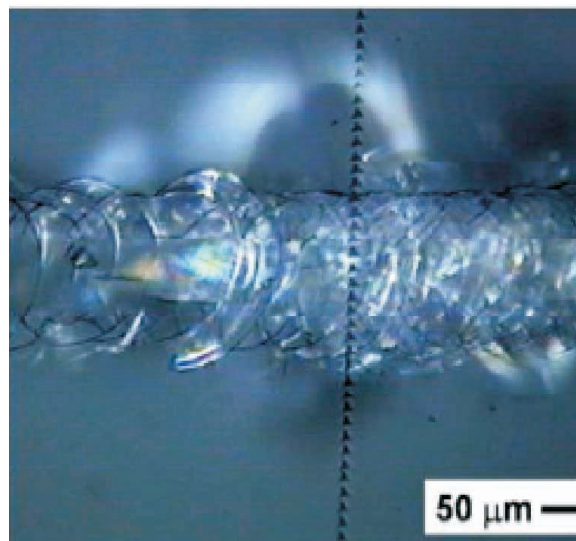


Fig. Nanoindentation across scratch groove of SLS glass

induced brittle fracture. While the advanced applications of glass require very accurate grinding and polishing that involves controlled removal of glass, the material removal mechanisms are not well understood which impairs further technological advancement. CSIR-CGCRI has conducted unique combination of nanoindentation and microscratching experiments. The results show, for the very first time globally, that local degradation in nanohardness (H) and Young's modulus (E) in the scratch damaged regions could be as high as ~ 30 -60% in soda lime silica (SLS) glass that is of significant technological importance. It was shown further that such a phenomenon could be explained in terms of the model of a micro-cracked brittle solid. Localized shear induced sub-surface deformations and microfractures were shown to have major roles in the material removal mechanisms.

Host mediated synthesis of cobalt aluminate/ γ -alumina nanoflakes

CSIR-CGCRI developed a simple, facile, and scalable synthetic procedure for the preparation of high surface area $\text{CoAl}_2\text{O}_4/\gamma\text{-Al}_2\text{O}_3$ composite nanopowder which can be used as self cleaning blue pigments. A stable cobalt aluminate has been synthesized at low temperature (500°C) compared to the conventional high temperature methods. It

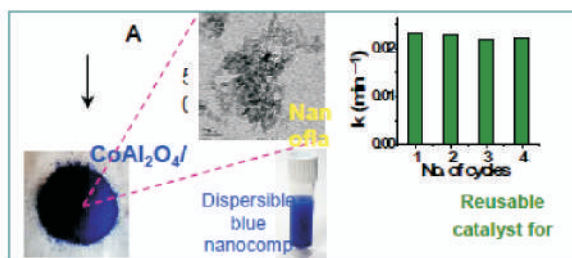


Fig. $\text{CoAl}_2\text{O}_4/\text{Al}_2\text{O}_3$ composite: an efficient catalyst for the decomposition of H_2O_2 .

has been established that when boehmite powders impregnated with Co salt was heated at 500°C , the conversion of boehmite to $\gamma\text{-Al}_2\text{O}_3$ facilitated the formation of isostructural (spinel) CoAl_2O_4 . For the first time it could be shown that the CoAl_2O_4 spinel composite could act as an efficient reusable catalyst for the decomposition of H_2O_2 for releasing oxygen that may oxidize a wide range of organic and inorganic pollutants.

TiB-TiN composite coatings for implant applications

Titanium and its alloys are widely used in aeronautical, chemical, defense and biomedical applications due to their high specific strength, excellent corrosion resistance and biocompatibility. The presence of TiN in combination with TiB in $\text{Ti}_6\text{Al}_4\text{V}$ alloy matrix is important as it

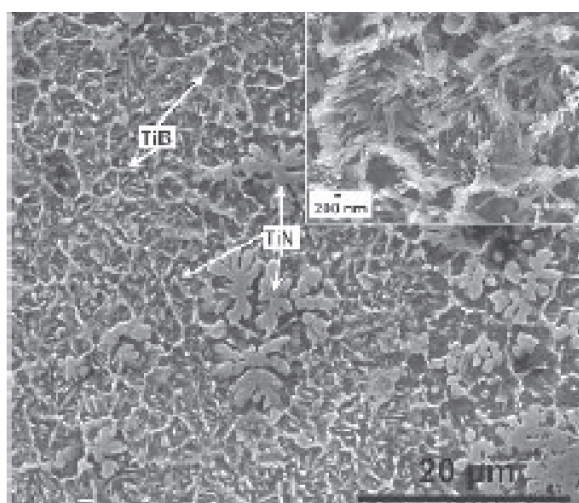


Fig. Laser processed $\text{Ti}_6\text{Al}_4\text{V}$ -5BN composite coating showing TiB and TiN phases; Magnified view (inset)

is expected to enhance the toughness and biological properties of these composites. However, no attempts have been made on laser processing of simultaneous in situ synthesized TiB + TiN reinforced composite coatings on Ti alloys.

Using Laser Engineered Net Shaping (LENS), a laser-based additive manufacturing technology, CSIR-CGCRI has made a novel attempt to create in situ formed TiB-TiN-reinforced $\text{Ti}_6\text{Al}_4\text{V}$ alloy matrix composite coatings on commercially pure (Cp) Ti. These hard composite coatings showed lowest *in vitro* wear rate of $1.90 \times 10^{-6} \text{ mm}^3/\text{N}_m$ in 15BN coating, which is an order of magnitude lower than 5BN coating and 2-3 orders lower than Ti substrate.

Large Scale Milling Process for Production of ODS Steel Powder

CSIR-IMMT, through, a mechanical alloying process of oxide dispersion strengthened (ODS) steel powder carried out in an indigenously developed dual drive planetary ball mill for the first time. The dual drive planetary ball mill consists of a gyratory shaft and four cylindrical steel jars, all are rotated simultaneously and separately at high speed. Such high-speed rotation of all jars and the shaft makes the balls to move rapidly, leading to large impact energy of balls that improves the alloying performance. This could result in reducing the milling time and production of larger batch of powder, which in turn result in better impurity control, more homogeneity and powders with close size range in addition to cost and energy saving. It was found that 5 h milling time, sufficed to reduce the particle size and convoluted structure of particle which is suitable for ODS steel powder preparation. TEM results revealed homogeneous distribution of nano Y_2O_3 in ferritic steel matrix at optimum milling time of 5h. The process of mechanical alloying using dual drive planetary ball mill was found to be very effective in reducing the milling time as compared to other high energy ball mills. The powders will be used for qualification testing for process optimization of ODS steel tube nuclear power plant.

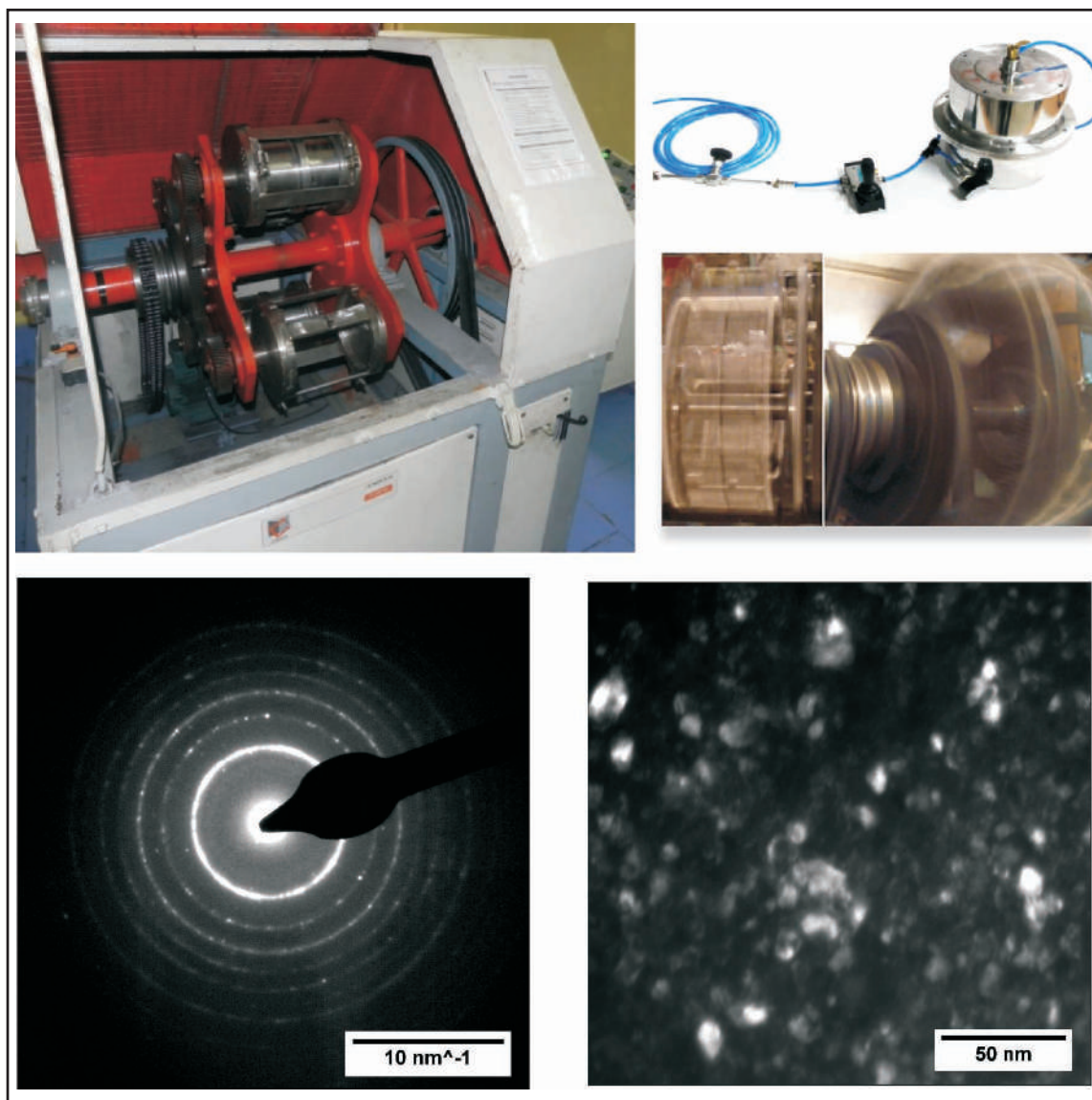


Fig. Dual Drive Planetary Ball Mill Unit with Gas Purging Jar Assembly(Capacity:1.5kg)

Novel $\text{Sm}_2\text{Ti}_2\text{O}_7/\text{SmCrO}_3$ composite for degradation of Rhodamine 6G dye

CSIR-IMMT studied the removal of R6G under its natural pH using $\text{Sm}_2\text{Ti}_2\text{O}_7/\text{SmCrO}_3$ composites prepared by solid state combustion method taking urea as a fuel. $\text{Sm}_2\text{Ti}_2\text{O}_7/\text{SmCrO}_3$ composites were synthesised by taking $\text{Sm}(\text{NO}_3)_3 \cdot 6\text{H}_2\text{O}$, TiO_2 , Cr_2O_3 and urea together by mechanical grinding in the presence of ethanol followed by calcination at 800°C for 4h. In these syntheses only Cr_2O_3 ratio was varied keeping the other three ratios constant

(Cr:Sm:Ti:urea = X:1:1:4). As prepared composites were abbreviated as 0.2STC (0.2:1:1:4), 0.5STC (0.5:1:1:4), STC (1:1:1:4), 2STC (2:1:1:4). Pure $\text{Sm}_2\text{Ti}_2\text{O}_7$ (STO) and SmCrO_3 (SCO) were prepared by keeping metal to urea ratio 1:2 under the same reaction conditions. The prepared catalysts are characterized by X-ray diffraction (XRD), UV-vis diffuse reflectance spectroscopy (DRS), Photoluminescence spectra (PL) and X-ray photoelectron spectroscopy (XPS). XRD patterns show the presence of both of $\text{Sm}_2\text{Ti}_2\text{O}_7$ and SmCrO_3 peaks thereby confirming

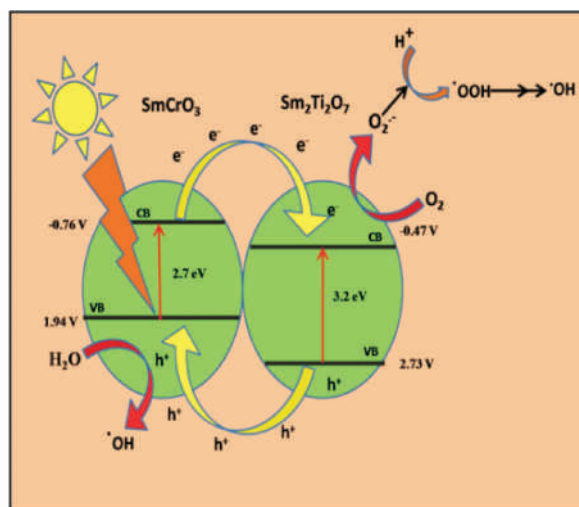


Fig. Illustrate the enhanced mechanism for the R6G degradation

the existence of both $\text{Sm}_2\text{Ti}_2\text{O}_7$ and SmCrO_3 phases. The rate of degradation of R6G dye by composites is higher than that obtained by single phase i.e. pure $\text{Sm}_2\text{Ti}_2\text{O}_7$ or SmCrO_3 . The composite prepared at (Cr:Sm:Ti=1:1:1) ratio degrades the dye faster among all the prepared catalysts. The photocatalytic degradation of R6G over STO and SCO is only 25 and 30 % respectively as compared to composites such as STC, 0.5STC, 2STC, 0.2STC which shows 70%, 59%, 50% and 44% degradation respectively.

High-strength Nano-Crystalline Mg-Al Powder Synthesized by Mechanical Alloying

CSIR-IMMT developed nanostructured Mg93.3 Al6.7 powder with crystallite size of 30 nm through mechanoalloying route. These material posses high specific properties, improved wear resistance and lower coefficients of thermal expansion. The nanostructured powder was then consolidated into highly-dense bulk samples through hot pressing followed by hot extrusion to give nanocrystalline specimens with crystallite size of about 80 nm. Phase analysis and microstructure investigations reveal that the microstructure of the consolidated material consists of gamma-Al₁₂Mg₁₇ particles with size below one micrometer homogeneously dispersed in a continuous Mg(Al) matrix. This microstructure leads to a remarkable mechanical behavior of the bulk

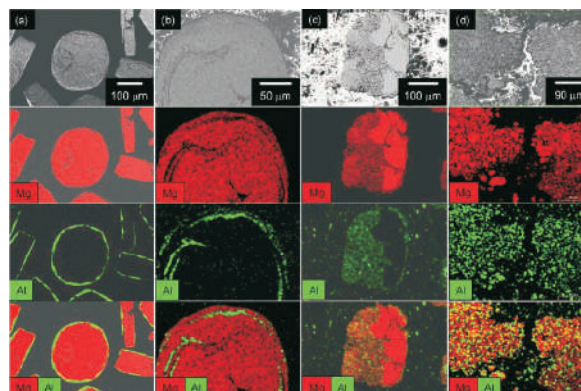


Fig. EDX-SEM compositional maps for the Mg-Al powder milled for (a) 5 hrs, RT (b) 40 hrs, RT (c) 100 hrs, RT (d) 100hrs, RT followed by 3 hrs Cryo milling.

specimens. Room temperature compression tests of the consolidated material reveal high compressive strength of about 690 MPa combined with plastic strain exceeding 9 %. These findings demonstrate that powder metallurgy is a suitable method for the production of nanostructured Mg-based materials characterized by high strength and considerable plastic deformation.

Nickel recovery from refinery electrolyte

The bleed solution of 150 m³/day from electrolytic cells contains nickel which amounts to 300 tpa is being processed as waste effluent. As India is not having any nickel plant with primary raw materials, it is essential to utilize the secondaries and wastes as a source of nickel. During refining of copper, the bleed solution obtained from liberated cells contains significant amount of nickel, arsenic and copper along with other minor impurities.

CSIR-IMMT developed a process to recover nickel values. The unit operations are neutralization, bulk hydroxide precipitation, dissolution of hydroxide cake, purification, cementation of Cu, solvent extraction of Ni and electrowinning of Ni. In order to reduce the volumes in the downstream unit operations such as purification and solvent extraction, bulk hydroxide precipitation with subsequent dissolution is suggested. Ferric arsenate precipitation is suggested for removal of arsenic using ferric sulphate. Ni was recovered as Ni cathodes of 99.9% purity after cementation of

Cu and solvent extraction of Ni. The overall recovery of Ni was 85%.

Ferromagnetic Shape Memory Alloys by Rapid Solidification Route using Melt Spinning Technique

CSIR-NML developed ferromagnetic shape memory alloys (FSMAs) in the form of ribbons by rapid solidification route and optimised heat treatment schedules to modify magnetic and structural properties. A series of $\text{Ni}_{55}\text{Mn}_{22}\text{Ga}_{23-x}\text{Al}_x$

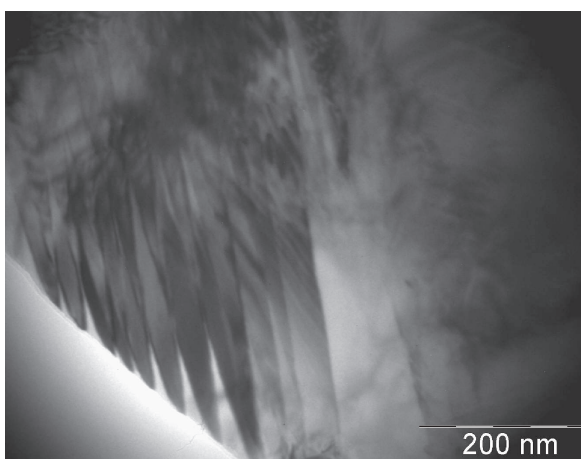


Fig. TEM of ferro-magnetic shape memory alloy showing equally spaced martensitic laths

($x=0, 0.5, 1, 2, 3, 5$) alloys have been prepared in the form of ribbons by melt spinning. The ribbons were found to be in martensitic state at room temperature. Transmission electron micrograph of a typical $\text{Ni}_{55}\text{Mn}_{22}\text{Ga}_{22}\text{Al}_x$ alloy ribbon annealed at 1073K/30 hours shows equally spaced martensitic lath. Magnetic field induced strain was measured for the melt spun ribbons using a system developed in the laboratory. The alloy with $x=1$ showed high magneto-strain of 482ppm.

Ultrasonic Technique for Surface Crack Detection of Semi HSS and HSS Rolls

Over the last few years, the use of work rolls for hot rolling of flat steel has changed. In the roughing stands, conventional high chrome steel (70 – 75 ShC) has been gradually replaced by new grades like carbide enhanced high chrome steel (75 – 80 ShC),

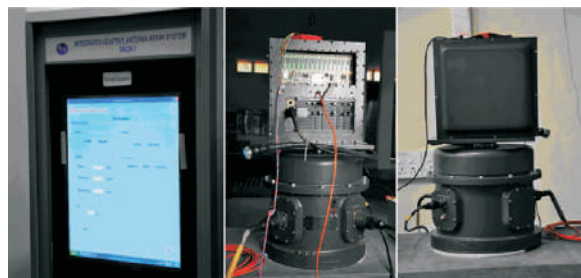


Fig. Adaptive antenna facility for simulation

ultra low carbon grades like Semi – HSS, matrix type HSS (80 – 90 ShC), Konkordia (Cr-based HSS) and a variety of other HSS grades (HSS 75 – 85 ShC). As the hardness of HSS reaches 80/85 ShC, it becomes crack-sensitive and the developed crack is usually oriented parallel to the roll axis but propagates in a non-radial direction. Usually after each grinding, non-destructive eddy current and Dye-penetrant techniques are used for checking of surface cracks. Eddy current technique is not successful in predicting fine surface cracks on HSS rolls. CSIR-NML has developed a surface wave based ultrasonic technique to detect fine cracks on the barrel surface of HSS rolls as well as to find the optimal grinding condition for a complete crack free roll surface. A joint patent has been filed and the implementation of the technique at the Hot Strip Mill of the Steel plant has reduced significantly the spall rate of the HSS rolls.

Diamond thick film for RF transparent window

CSIR-CGCRI has achieved a notable breakthrough by developing large area, uniform and high quality polycrystalline diamond thick films for Radio Frequency (RF) window component using

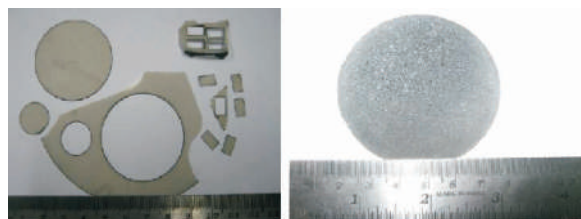


Fig. a

Fig. b (L) Translucent and (R) Opaque quality, large area sub-mm thick diamond plates

microwave plasma enhanced chemical vapor Fired tiles coming out of roller hearth during manufacturing deposition (MPCVD) process in a 915 MHz, 15 kW microwave cavity reactor. By suitable manipulation of the reactor parameters, it was possible to deposit whitish translucent quality freestanding diamond coating as well as to grow black color opaque quality thick circular plates of dimension 60 mm diameter/0.6 mm thick for thermal management and other high end applications.

Sputter Deposited Nano-structured Coatings for Tribological Applications

CSIR-NAL has made extensive efforts to develop superhard nano-structured coatings on small engineering components, including cutting tools for the machining of difficult-to-machine aerospace and other engineering materials.



- **200% improvement in endurance**

Fig. Nanostructured coatings for industrial drill bits

Performance evaluation tests of the coated tools on various engineering materials have shown considerable improvement in the tool life. The coating technologies developed by CSIR-NAL are at par with the technologies available elsewhere in the world. Other concepts such as plasma nitriding of tools, super-tough coatings and nano-structured solid lubricant coatings have also been developed to improve mechanical and tribological properties of various engineering components. These nano-structured coatings can be used in cutting tools, automobile, aerospace, biomedical, and other industrial sectors. In particular, the solid lubricant coatings based on metal-dichalcogenide

nano-composites hold great promise for aerospace applications.

Mg Alloys

CSIR-AMPRI synthesised Mg alloys using liquid metallurgy route. A specially designed electrical resistance melting furnace with a facility for the inflow and outflow of the protective atmosphere during melting has been employed for the purpose. The furnace can handle 30 kg of Mg at a time. Attempts have been made to produce different Mg-alloys like AZ91, AZ31 etc. and subject them to rolling and extrusion using optimised process parameters. The alloys have been analysed for their microstructural features and mechanical properties. The effects of rolling variables such as bite angle, temperature, strain and strain rate have been investigated. Another aspect of the studies is modelling the process of material deformation for a few Mg alloys with the help of processing and microstructure maps. Optimization of extrusion die profile and processing parameters like strain rate and temperature with the help of laboratory scale experimentation and FE simulation studies are envisaged to jointly lead to the development of a (process) model enabling safe deformation of the Mg alloys to fabricate good quality and defect free materials/components in actual practice.

Prototype portable capillary electrophoresis device

CSIR-AMPRI developed a simple and rapid method for determination of biogenic amines in lake water using micellar electrokinetic chromatography with fluorescence detection. Separation of fluorecamine derivatized biogenic amines was accomplished by using borate buffer of pH 9.5 containing 40 mM of sodium dodecyl sulphate. The method has been optimized with respect to fluorecamine concentration, reaction pH, reaction time, separation voltage and injection time. Detection was performed by using UG-11 excitation filter and 495 nm emission filter. The proposed method for histamine, tyramine and dopamine allowed their separation within 2 min



with detection limits in nmol L^{-1} range. The interday and intraday reproducibility of peak areas were less than 6.5%. Recovery of spiked samples ranged 95.76-116.31%.

Evaluation of Operational Efficiency of Highway Network Using Travel Time Reliability Measures

CSIR-CRRI made an attempt for selection of appropriate traveltime reliability indices for Indian Highway and evaluation of operation efficiency of roadway system by considering traveling time reliability measures. Reliable transportation System provides safe and accessibility and efficient movement of people and goods. Travel time variation on each road network occurs due to variation in traffic flow and therefore the travel time reliability on road link changes as the link flows changes. A stable condition is reached only when no traveller can improve his travel time reliability by unilaterally changes routes. This is the characterization of the reliability user equilibrium. This Rut characteristic have been studied by considering Rut base traffic assign algorithm discussed below for any transportation network.

Microscopic Traffic Simulation Model for Speed-Flow Equations and Roadway Capacity for High Speed Corridors

CSIR-CRRI attempted for the first time in the country to explicitly study the free speed profiles and speed-flow characteristics on various types of multi-lane highways covering four-lane, six-lane and eight-lane divided carriageways in plain terrain. Extensive data on Time Mean Speed (TMS) and Space Mean Speed (SMS) under free flow conditions coupled with traffic flow data was collected on sites spread over different regions of India. Microscopic traffic simulation softwares namely VISSIM and PARAMICS have been utilized. The simulation model is able to reduce the error (from 3 ~ 34% to 0.1 ~ 18%) as compared to traditional method. Further, capacity norms developed for these high speed corridors were also

evolved from the speed-flow equations. The estimated roadway capacity is 5574, 7733 and 9796 PCU/hr/Direction for four, six and eight-lanes divided carriageways respectively.

The lane change behavior affects roadway capacity on multi-lane highways has been assessed through microscopic simulation approach. resulting reduction of 3 to 9% in the estimated capacity. On a eight-lane divided urban expressway, PARAMICS software has been used to model vehicular behavior such as virtual lanes etc. The speed-flow equations developed and the estimated roadway capacity of eight-lane divided urban expressway, the impact of virtual lanes and lane change on capacity is assessed using developed simulation model. resulting 15% and 9% reduction in capacity due to the restriction of virtual lane and restriction of lane respectively. It can also be seen that free speeds are increasing only marginally. Finally, the Design Service Volume (DSV) for various multi-lane highways under the prevailing heterogeneous traffic conditions has been evolved with reasonable degree of confidence. The outcome from this study is expected to form an important input for developing Road User Cost (RUC) models, exclusively for multi-lane highways.

Assessment of Methodologies for Seismic Performance Evaluation of Structures

CSIR-SERC studied an ensemble of near fault earthquakes and the significant parameters like energy content, significant duration, etc. Investigations on the characteristics of various ground motions which give rise to critical response of structures were done. The experimental investigations on rectangular water tanks were continued for different types of earthquake time histories, namely near fault and far distance earthquakes on the 3D Shaking table. Experiments were done for single direction and three direction earthquake loadings for varying water heights. Two sets of ground motion records were selected for a range of acceleration levels and duration. It included artificially generated narrow band time



Fig.

history as well as ground motion record which involves near source effects. Out of the various parameters studied like accelerations on the tank walls and sloshing wave height, the hydro dynamic pressure on tank walls is found to assume importance as it is major parameter in the design of liquid tanks. It is found that a near field earthquake with three directional earthquakes loading produces the maximum hydro dynamic pressure on the tank walls. It is found that a near fault earthquake with a higher acceleration can produce almost six times the hydrodynamic pressure on tank walls compared to a normal earthquake.

Performance of concrete foundation for Turbo generator in power plants

The concrete foundation supporting turbo generator (TG) is a critical structure in a power plant. In addition to the static behaviour, dynamic behaviour of the foundation play an important role in ensuring normal operating conditions of the turbo-machine. Turbo generator foundation supports heavy equipment at a large height and hence seismic forces are significant for a proper and safe design of the TG foundation. The present design practice of performing the seismic design of machine foundations using response spectrum analysis, gives estimation of internal forces and

displacements due to seismic excitation, but does not consider the non-linear behaviour of the system. In order to consider the non-linear effects, CSIR-SERC attempted to perform the pushover analysis of the machine foundation. A 250MW TG foundation is modeled in SAP software. Machine weight is modeled as lumped mass. The TG consists of 14 columns connecting the sole plate to top deck, which is made of heavy beams. The sole plate is ignored in the analysis by considering the fixity at the base of the columns. The overall geometry of the TG foundation is $30\text{ m} \times 12\text{ m} \times 15\text{ m}$ high. The machine weight is around 1104 tons. The mass of the concrete structures is 1962 tons. Eigen value analysis is carried out to obtain the natural frequencies and mode shape. The default M3 hinges are assigned to both beam and columns. Pushover analysis is conducted in the weak direction (transverse direction). The lateral load is applied at the top deck level. The lateral load capacity in ADRS format is computed as 1.1g and the displacements are 0.5 mm and 4 mm at yield and ultimate stages respectively. Inference is that the lateral force capacity of TG foundation is large and the structure is not critical under seismic conditions.

Coastal Ocean Monitoring and Prediction System

CSIR-IMMT made an attempt to elucidate the trends of pollutants in the sea and also processes associated with land and sea interface. Sustainable management of coastal and marine resources is essential for long term economic growth and to ensure the equilibrium between economic development and the protection of the environment.

Higher bacterial load in water and sediment was observed in the shore stations which are probably due to anthropogenic activities. More abundance of bacterial population in low tide than high tide may be due to dilution of contaminated water during high tidal condition. Normally during monsoon high tide resuspension of bacteria from sediments by strong current movements gives

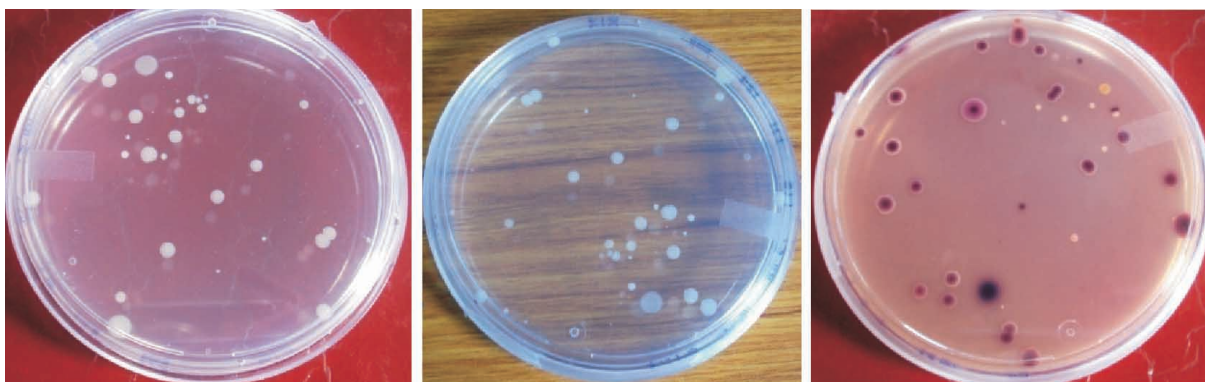


Fig. Total Viable Count (TVC)

***Streptococcus Faecalis* like**

***E.coli* like organism**

higher bacterial counts. However, there appeared to be no significant diel or time variation in bacterial abundance.

During the year, total 117 species of phytoplankton from Odisha coast and 85 species from West Bengal coast were recorded. Compared to West Bengal coast Odisha coast registered higher phytoplankton population and chlorophyll-a concentration. Blooms of *Asterionella japonica* were found along Paradip shore during the month of July '11. Pollution indicating species like *Pseudo-nitzschia*, *Oscillatoria* sp., *Prorocentrum*

micans, *Noctiluca scintillans* were identified from Paradip, Sandheads and Hoogly estuary. The winter diatom blooms and summer-early monsoon blooms were apparently driven by changes in nutrients, water temperature and turbulence, clearly demonstrating the role of river flow and climate variability.

Seasonal and diurnal Variability of Zooplankton population were also studied. Higher population was observed in premonsoon season than monsoon and postmonsoon. In off-shore regions higher zooplankton population and low biomass were

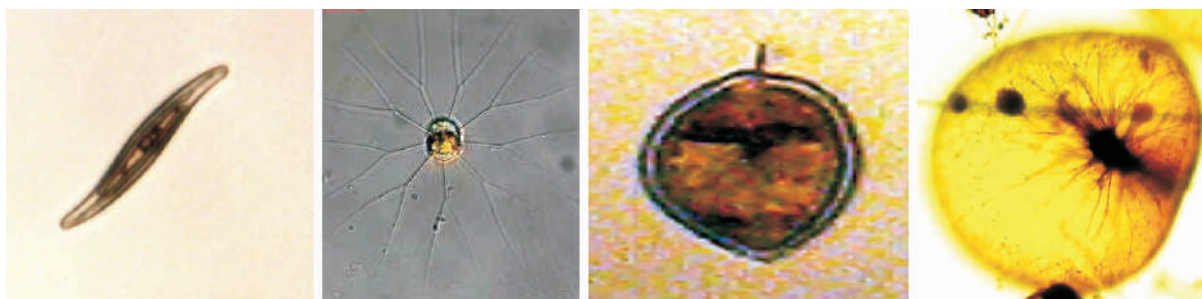


Fig. *Pleurosigma* sp.

Bacteriastrum varians

Prorocentrum micans

Noctiluca scintillans



Fig. *Polychaetae* larvap.

Hydrpza

Copepoda



Fig. Donax



Turritellidae



Turbinellidae

observed during high tide than low tide. Copepoda is the dominant group both in Odisha and West Bengal coasts. Polychaetae larvae as pollution indicating species were identified from Paradip, Sandheads and Hoogly estuary.

Similarly, Benthic population was also studied in the eastern coast of Bay of Bengal. Irrespective of seasonal variation Paradip coast always registered higher macro faunal abundance compared to West Bengal coast. Although the *Donax* species dominated over all other groups in every tidal sampling the highest population (87775 nos/ m²) of this particular Bivalve species occurred during early monsoon season of Paradip coast. This has occurred first time in Odisha coast.

Integrated process for mitigation of oxides of nitrogen – a potential global warming gas

Nitrogen oxides (NO_x) are formed by burning forming fuels, which have a negative impact on the environment. According to various international protocols, the NO_x emissions in India need to be reduced. Commercial technologies for NO_x emission reduction for stationary sources range from combustion modifications to flue gas treatments. The most widely used technology is Selective Catalytic Reduction (SCR), able to achieve NO removal efficiencies up to 90%. But drawbacks of this technology are the relatively high costs involved and environmental concerns about the use of ammonia. CSIR-NEERI explored the possibility of using an alternate technology for nitrogen oxides removal. In novel approach, a mixed denitrifying culture was isolated from an

inoculum of municipal sewage sludge consisting of three dominant organisms, including representatives of the genera *Citrobacter*, *Enterobacter* and *Streptomyces*. The enriched



Fig. Bench Scale reactor system for chemo-biochemical deNO_xing

mixed culture was used in a series of batch experiments in order to determine kinetic constants associated with biomass growth and nitrite denitrification in aqueous Ferrous EDTA/NTA solutions and Ferric EDTA/NTA solutions using ethanol as the organic electron donor. The maximum specific reduction rates of nitrite (present as nitrosyl adduct) in Ferrous EDTA and Ferrous NTA solutions were 0.041 and 0.043 mMoles L⁻¹d⁻¹mg⁻¹ biomass respectively while those in Ferric EDTA and Ferric NTA solutions were 0.022 and 0.024 mMoles L⁻¹d⁻¹mg⁻¹ biomass respectively. In case of Ferric EDTA/NTA solution, the kinetic constants associated with reduction of Ferric EDTA/NTA to Ferrous EDTA/NTA were also evaluated simultaneously. The maximum specific reduction rates of FeIIIEDTA and FeIIINTA were 0.0021 and 0.0026 mMoles L⁻¹d⁻¹mg⁻¹ biomass.

Hybrid chemo-biochemical process for biogas generation from complex industrial effluent

The existing biological processes for the treatment of distillery/tannery/pharmaceutical wastewater generate treated effluents with a residual COD of 30-40 % of the initial which requires appropriate value addition for economical and ecological gains. CSIR-NEERI explored the possibility of wet air oxidation (WAO) based pretreatment of complex effluent to selectively enhance the biodegradability (without substantial COD destruction) and facilitate biogas generation potential. A lab-scale wet air oxidation reactor with biomethanated distillery wastewater (B-DWW) as a model complex effluent was used to demonstrate the proof-of-concept. The studies were conducted using a designed set of experiments and reaction temperature (150–200°C), air pressure (6–12 bar) and reaction time (15–120 min) were the main process variables of concern for WAO process optimization. WAO pretreatment of B-DWW enhanced the biodegradability of the complex wastewater by the virtue of enhancing its biodegradability index (BI) from 0.2 to 0.88, which indicate favorable Biochemical Methane Potential (BMP) for biogas generation. The kinetics of COD destruction and BI enhancement has been evaluated along with activation energy estimation. Biogas experiments using pretreated wastewater indicated favourable potential for substantial biogas generation. A genetic expression based programming model has been developed and is able to capture the non-linearity of the pretreatment process.

HYDROPLUME – High Rate Circular Secondary Clarifier for wastewater treatment

In wastewater treatment, the conventional secondary clarifiers do not take hydraulic energy dissipation into account. They are either too large or often fail in giving the efficient solids-liquid separation. CSIR-NEERI developed a clarifier called HYDROPLUME, which ensures minimum suspended solids (SS) concentration in the treated effluent. It requires minimum hydraulic retention

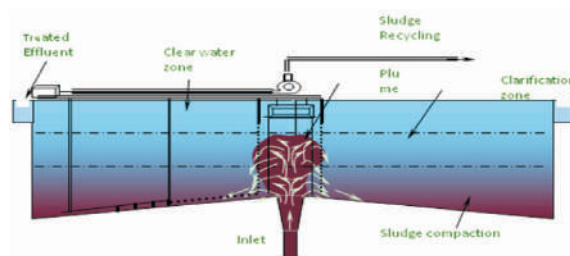


Fig. Functioning of HYDROPLUME® showing plume formation solids-liquid separation

time (1 – 1.5 hours) and saves 25 – 30% foot print area resulting 40% savings in capital and recurring costs. It produces excellent effluent quality (98 – 99% SS removal) and helps in attaining the treated effluent quality according to the prescribed discharge standards. High underflow solids concentration minimizes pumping rate, and maintains desired active biomass concentration in aeration tank. HYDROPLUME does not require a separate sump cum pump house for sludge recycling/removal, and also provides natural flocculation thereby saving capital and recurring costs.

Inter linkages of air quality, climate change and health with recourse to molecular modeling and tracking analysis of regional transport of air pollution

The air pollution and respiratory health investigation study has been carried out jointly by CSIR-NEERI and CSIR-IGIB on the children of various schools in Delhi. A questionnaire was designed based on the internationally parameters for respiratory illness. The respiratory health survey was approved by the Directorate of Education, Delhi. Schools were selected based on land usage pattern i.e. commercial (Chandni Chowk), industrial (Mayapuri) and residential (Sarojini Nagar) areas. Approximately 1800 students (600 / zone) of age 10 – 14 years participated in the survey which included spirometry tests also. Indoor and outdoor levels of SO₂, NO₂ and PM were also measured within the school premises as well as at outdoor locations. The questionnaire data showed that the students having respiratory disorder symptoms were

maximum in Chandni Chowk (66%) followed by Mayapuri (59%) and Sarojini Nagar (46%). Spirometry test results demonstrated that a significant population of subjects in Chandni Chowk (19%) had mild to severe pulmonary obstruction. However, the percentage of subjects with such conditions was comparatively less in Mayapuri (17%) and Sarojini Nagar (14%) area. Outdoor and indoor PM₁₀ concentrations at schools located in Chandni Chowk, were observed $815 \pm 354.45 \mu\text{g}/\text{m}^3$ and $337 \pm 85 \mu\text{g}/\text{m}^3$ respectively. In this commercial zone, the concentrations were found ten times above the permissible limits. The PM₁₀ concentration was lower in the industrial zone - Mayapuri ($694.6 \pm 322.9 \mu\text{g}/\text{m}^3$ and $274 \pm 78 \mu\text{g}/\text{m}^3$) and least in Sarojini Nagar ($534.3 \pm 94.22 \mu\text{g}/\text{m}^3$ and $197 \pm 48 \mu\text{g}/\text{m}^3$) which is a residential zone. However, levels of SO₂ and NO₂ were observed below the permissible limits in all three areas.

Traffic Studies for Junction Improvement on Major Road Corridors in Ahmedabad

CSIR-CRRI prepared a Junctions Improvement Plan for selected junctions on road network for Ahmedabad Municipal Corporation. Traffic surveys and preparation of junction improvement plans for 23 identified intersections based on traffic projections were conducted for the next 10 years, as per IRC guidelines. Various field studies undertaken include road inventory and traffic studies which were carried out to collect primary data to understand the existing problems and to analyze traffic demand. In addition, secondary data

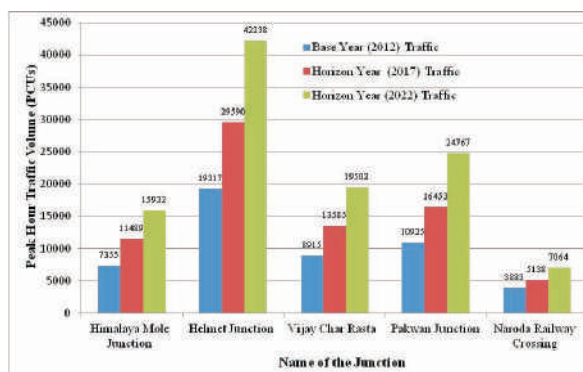


Fig.

information such as vehicle population, land-use data, ongoing and future envisaged developments in the surrounding areas were also collected. The projected peak hour traffic volume at the five intersections has been estimated for the horizon year 2017 and 2022 and is presented in Figure.

Evaluation and Monitoring of Rohari Steel Bridge in Katni-Manikpur Section of Jabalpur Division for Increased Axle Load of Freight Wagons

CSIR-CRRI evaluated Rohari bridge, Katni-Manikpur section of Jabalpur division, West Central Railway for possible increase in axle load of freight wagons. This bridge has one 33.45m long span of steel through truss type. Strain, deflections, temperature, accelerations etc. were monitored at critical locations by fixing several sensors in rails, couplers, superstructure, bearings and abutments of the bridge. After the installation of sensors, continuous monitoring was done by extending the cables of the various sensors up to the data acquisition systems. The bridge was tested under various loadings cases of Test train as well as prevailing trains. Theoretical analysis of the steel truss bridge superstructure was carried out using FEM based software. Dimensions and sectional details of the various members of the truss were taken from the drawings/details supplied by WCR officials. The 3-D model of the superstructure is shown in Structural analysis was carried out for the vertical as well as longitudinal loads due to the various loadings viz. HML, MBG, BGML, CC+8+2, and actual test train used for testing as specified by the Railways.

Economic Evaluation of Road Blockade due to Kaliasaur Landslide

Kaliasaur landslide is a complex slope failure case having more than one mode of sliding that has been creating crisis at Kilometer-147 on the strategic National Highway-58 of Garhwal region of Uttarakhand state, for last five decades. It has repeatedly activated many times (1952, 1963, 1969, 1972, 1984, 1985 and most recent in 2010).



Fig. Kaliasaur Landslide

Severity of failure of Kaliasaur Landslide during monsoon time which also coincides with the peak tourism period impedes transportation for several days thereby affecting basic amenities and infrastructural facilities in the region.

CSIR-CRRI has actively carried out R&D work at this slide area to investigate and understand landslide triggering mechanism. Monitoring work carried out by CSIR-CRRI indicated that landslide was prone for failure and surficial movement at many locations using GPS. The institute carried out estimation of indirect landslide losses due to reactivation of Kaliasaur landslide using unit cost estimation method. The estimation was based on traffic affected due to detouring due to blockage of National Highway-58. The total detouring cost for 45 days during September-October, 2010 has been estimated to be about ₹ 25 million.

Preparation of Guidelines for Construction of Roads, Culverts and Bridges in Cyclone prone Areas

CSIR-CRRI prepared 'Guidelines for Construction of Roads, Culverts and Bridges in Cyclone prone Areas' for National Disaster Management Authority (NDMA). Two interactive workshops were organized at Bhubaneswar and Visakhapatnam (Andhra Pradesh) to discuss various aspects of the Guidelines and fine tuning the recommendations. Engineers from state Public

Works Department (PWD) and Rural Works Department entrusted with the task of road works in cyclone prone areas participated in the workshops. Salient features of the Guidelines were presented in the workshop and CSIR-CRRI faculty interacted with engineers to get firsthand knowledge about problems associated with road works in cyclone prone areas. Field visits for the road works constructed in these areas was also undertaken. Based on the recommendations of the workshop, Guidelines have been finalized and would be published by NDMA.

Disaster Mitigation: Post-Earthquake Reconnaissance Survey – Sikkim Earthquake

An earthquake occurred in eastern Nepal near the Nepal-Sikkim border on 18 September 2011 at 18:11 IST, causing significant damage of the built environment in Sikkim alone, especially roads and buildings. At the outset of National Disaster Management Authority (NDMA), CSIR-CRRI scientists participated in Reconnaissance Team (PERT) to study (A) Structures damaged by the Earthquake (B) Collect perishable data related to the built environment in the affected area; (C) Identify vulnerable construction typologies and their performance; (D) Identify main reasons for damage to masonry, RC frame, traditional construction and other construction; and (E) Evaluate the performance of structural, non-structural and functional elements in major critical and lifeline buildings and facilities, such as hospitals, where feasible.

The built environment in hill areas affected by the earthquake includes mainly four type of building construction in the affected region, namely RC frame type with infill walls, R/R masonry with stone or wooden post and beam, RC buildings. Traditional houses (Ekra houses) built with a wood frame from sloping ground to roof level, light corrugated galvanised iron (CGI) sheet roofing supported on the wood frame, mud walls from plinth to sill level, and cross-woven Ekra or bamboo spilt matting plastered with mud or fine sand with lime as rest of the walling.

The traditional houses like Ekra and Shing-Khim performed significantly better compared to RC-frame / masonry buildings and suffered only minor damages at ground story level. Various monasteries all over Sikkim suffered extensive damages, wherein mainly random rubble (R/R) masonry laid in mud/lime mortar was used as construction material. Major civil-engineering projects in the area includes hydel power plants, steel and RC bridges, wherein no significant damage was observed.

The event prominently highlights the presence of vulnerable building stock in Sikkim and adjoining states. The lessons learnt from the event, aiming to proactive role in reduction of seismic damage are briefly bulleted herein:

- Use of good construction practice and quality of material;

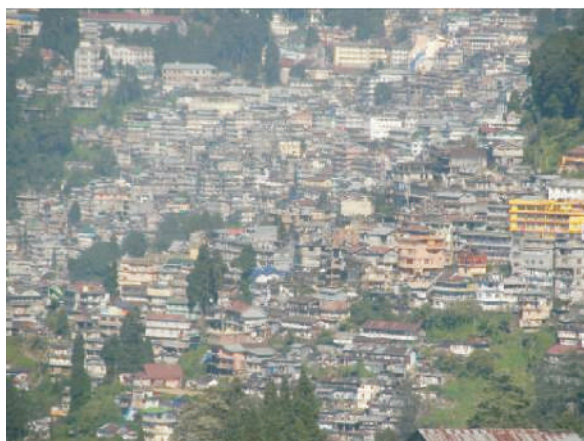


Fig. Typical urban landscape along hill slopes of towns, like Gangtok, Darjeeling, Kalimpong and Kurseong

- Development of typified designs keeping local architecture and use of locally available material reinstated and integrated with modern construction practices. Proven technology, which satisfy all the fronts like confined masonry shall be promoted;
- Compliance for seismic codes in design;
- Retrofitting strategies should be outlined specially for lifeline and heritage structures;

- Need to strengthen the activities of State Disaster Management Authority (SDMA) with a strong group guiding activities on development of technical and administrative personnel;
- Lack of earthquake engineering education of stakeholders and
- Capacity building for Masons, carpenters and bar benders need to be trained to undertake earthquake-resistant construction in high seismic regions; certified artisans should be given preference over their untrained counterparts to promote quality construction.



Fig. Damage due to Mudslide at Lachung

Failure Analysis of Metal Components

CSIR-NML, over the years, has developed expertise in failure analysis of aircraft wings, turbine blades rotor blades etc. During the year, the laboratory has provided its technical services to many areas, some significant ones are as below:

Low Pressure Turbine: Metallurgical investigation was carried out on failed aeroengine components to establish the cause of failure. The fractographic examination of the failed low pressure turbine (LPTR) blades showed generally intergranular fracture with secondary cracking. One of the LPTR blades that failed near the root showed clear signatures of fatigue related damage at the leading edge. This could be the primary cause of the failure of the particular LPTR Blade which

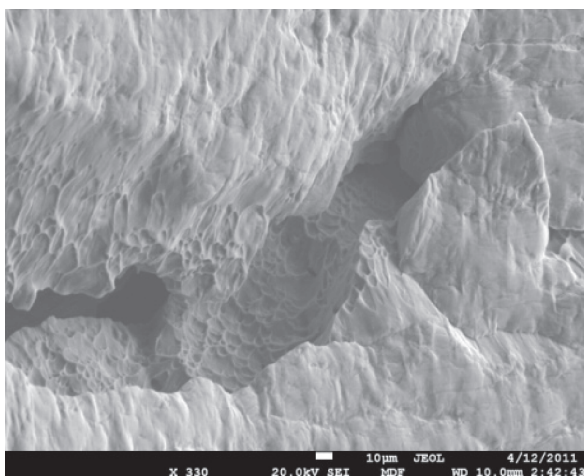


Fig. Dimples as well as shear type failure on the damaged surfaces

failed first causing subsequent secondary damages to other aeroengine components. The fractured LPTR blade rubbed on the nozzle guide vane casing, severely damaging the honey comb structure and puncturing the outer casing as well as damaging the trailing edges close to the root of the nozzle guide vane.

Compressor Blade: The stage-I compressor blade of an aeroengine got damaged at the leading edge. The metallurgical investigation involved microstructural analysis, material composition by EDS and fractographic studies. It was found by EPMA analysis that the blade was damaged due to impact of non-metallic foreign objects consisting of C, O, Mg, Al, Si, P.

Performance Evaluation of Fibre Reinforced Plastic (FRP) Strengthened Structural Elements

CSIR-SERC carried out the Performance Evaluation of retrofitted reinforced concrete beam-column joint under reverse cyclic loading. The investigation mainly focused on the performance of the beam-column joints designed for gravity loading and strengthened using two different methods for seismic loading. The methods adopted were:

- 1) Providing CFRP laminates in the compression face of the beam and CFRP wrap; and 2) Providing

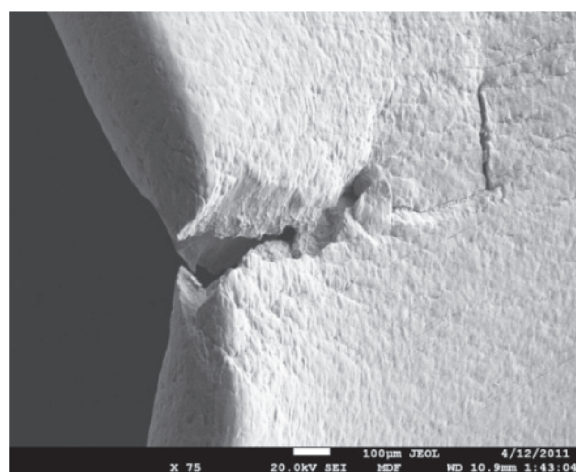


Fig. SEM fractography showing tearing on the damaged blade

additional reinforcement in the compression zone by cutting a groove and the same filled with non-shrink cementitious material and CFRP wraps in junction. The cyclic deformation behaviour predicted from the model using hysteretic energy



Fig. Test set for cyclic test on beam-column joint

and incremental damage compares well with experimental results. It is also seen that the damage parameter varies uniquely with non-dimensional parameter for both the repaired specimens. Hence, cyclic load testing under reversed cyclic loading is a good candidate for performance evaluation of various repair methods.

A compendium on repair methodologies has thus been brought out, which covers various types of deterioration that can take place in a concrete

structure, Non Destructive Evaluation (NDE) techniques, repair materials, tests on repair materials, besides guidelines to be followed during the strengthening process and various repair methods which can be adopted in field.

Smart energy harvesters from ambient structural vibration for seismic mitigation and health monitoring of civil infrastructure

Energy harvester applications of the smart materials which can be incorporated into structural infrastructures are established by CSIR-SERC. A suitable smart material which is flexible enough to integrate with the structure is identified and experiments were continued to explore its application domains. The experimental programme could realize some of the additional capabilities of the smart materials which were unknown earlier. It has been observed that the material holds

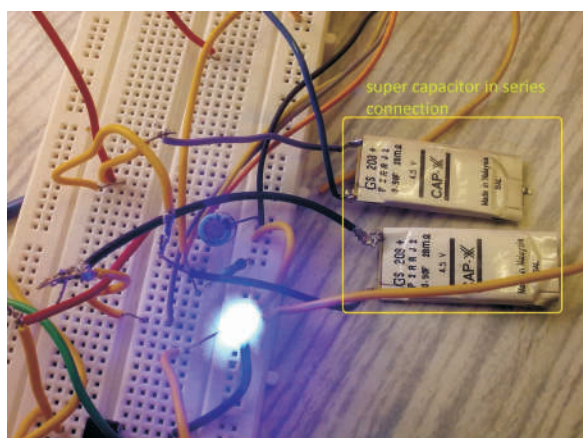


Fig. View of the energy storing experiment

excellent sensing capabilities almost equivalent with that of traditionally available materials.

The smart material is integrated with concrete and tests were conducted using concrete cylinder specimens. It was found that the polymer material can provide sensing signals and it is very much suitable for energy harvesting application. A low power start up voltage circuit has been designed and tested for harvesting purposes. The optimization of the power management circuit was carried out. Prior to this work, an ambient energy harvester has been designed, ambient wind energy

has been utilized for harvesting. A suitable miniature fan has been designed to collect ambient wind energy and the product is prepared which can give a power output of 90mW for powering the wireless nodes. This can also be combined with the vibration harvester for possible applications.

Book based on the report of CSIR-SERC-NDMA Project 'Development of Seismic Hazard Map of India'

National Disaster Management Authority (NDMA) in association with CSIR-SERC has been developing and refining the basic scientific and technological tools to assist the administration at the national and other levels to manage disasters, aided by appropriate technology. One of the important activities identified as an urgent need in the National Disaster Management Guidelines: Management of Earthquakes, brought out by NDMA is the development of a more realistic and scientific seismic zonation map of India. This PSHA report forms a part of the broad approach to Management of Earthquakes in India, and is an important milestone in the efforts towards

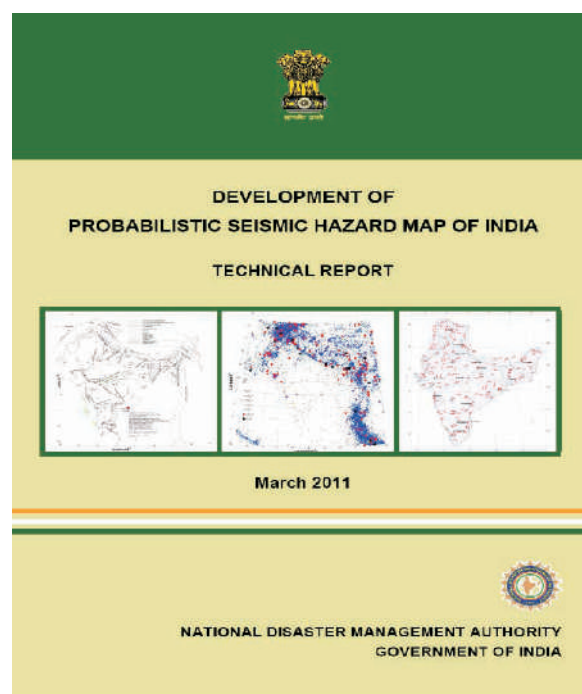


Fig. Cover page of the technical report on development of probabilistic seismic hazard map of India

systematic seismic risk reduction and to integrate the mitigation measures in the development plans. Availability of the PSHA for the Indian Landmass at 0.2° – 0.2° grid would provide the much needed scientific tool for strengthening the hands of various stakeholders involved in planning of future land use, compliance to building codes, optimum utilization and prioritization of the resources for new seismic mitigation projects, retrofitting of existing essential buildings, infrastructures etc.

Stress Analysis of 24" Dia. Gas Pipeline at proposed Coastal Road crossing at Dronagiri, Navi Mumbai

The City and Industrial Development Corporation of Maharashtra Limited (CIDCO) is constructing a 2H3 lane road of 39 m wide in 60 m wide acquired width of land. This road alignment is crossing the GAIL's MSEB – Uran GAIL 24" gas pipeline near Navnagar to Sector 63 at Dronagiri. which was likely to affect the safety of the pipeline. Detailed analysis was carried out by CSIR-SERC to evaluate the stresses developed due to the expected settlement of 1.5 m during ground improvement work. Also the stress developed due to the formation of road embankment was determined. Based on the analysis, remedial measures to protect the pipeline were designed.

Retrofitting of off-shore tanker terminal of Vishakapatnam Port Trust

Offshore-Tanker Terminal of Vishakapatnam port trust is nearly 30 years old structure, consists of seven spans. The deck carrying the oil pipeline has a width of 3.0 m for spans 5, 6 and 7 and a width of 5m for spans 1, 2, 3 and 4, and is supported over 2 numbers of prestressed concrete girders kept side by side. Based on the investigations carried out earlier by CSIR-SERC, span 3 was identified as distressed PSC girder.

An experimental investigation was carried out to assess the residual prestressing force of the two PSC girders in span 3. In each girder, ten locations



Fig. Investigated distressed PSC girder of span 3 of off-shore tanker terminal of VPT

were instrumented at the inner/outer side of the girder. Linear type electrical resistance strain gage of 30mm size were fixed at the selected locations using suitable adhesive and the gages were oriented along the longitudinal axis of the girder. Trepanning technique was applied and the strain release during the testing was recorded. From the



Fig. Assessment of residual prestressing force using Trepanning technique

strain release the existing prestress has been evaluated. From the measurements it is observed that the loss of prestress is around 40 to 50%. In order to make the structure to carry the design load, external strengthening measures have to be carried out in the distressed girder. In practice several strengthening measures are available out of which external prestressing was found to be suitable for strengthening the distressed girder. Design methodology for external prestressing has been worked out

Technology Developed

Five Seat General Civil Aviation aircraft (CNM-5)-the country's first public-private partnership in the development of civil aircraft

CNM-5, the five seat aircraft has the distinction of being the country's first public-private partnership (PPP) for development of civil



Fig. CNM-5 taking maiden flight

transport aircraft. It has been developed by CSIR-NAL in collaboration with M/s Mahindra Aerospace Pvt. Ltd (MAPL), Bangaluru. CNM-5 had its first test flight on the 1st September 2011 in Australia. CNM-5 is powered by a 300HP piston engine driving a 3-blade propeller cruising at a speed of 160 knots with a maximum AUW (All Up Weight) of 1525 kg; glass cockpit is a customer option. It is an ideal aircraft for air taxi, air ambulance, training, tourism and cargo. It is proposed to be certified first under the Australian Authority CASA. With the MAPL as a partner organization, there are ample opportunities to capture the global market.

Tejas Flight Simulation

The encounter of modern combat fly-by-wire aircraft with the wake of another aircraft during combat, formation flying or refueling is fraught with hazards. A simulation model of the fighter aircraft has been developed by CSIR-NAL incorporating the rigid body dynamics (airframe split into seven components for computing the forces and moments), air data system and flight control laws to clear Tejas for wake penetration

trials. The flight model was also incorporated into the ELS to enable the pilots to practice the wake penetration flight test profiles.

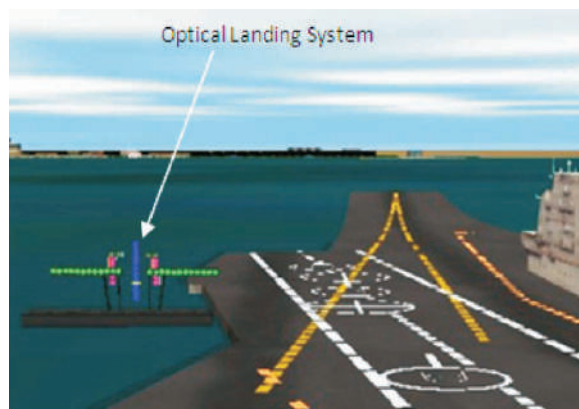


Fig. Naval Out-of-Window visuals with Optical Landing System

The ELS simulator was also used for evaluation of the auto-throttle mode, and for the Autopilot design and high-Angle-of-Attack studies. The figure shows the Fresnel Lens Optical Landing System incorporated in the visuals for LCA Navy.

SARAS Display System Suite

SARAS display system developed by CSIR-NAL consists of four Active Matrix Liquid Crystal Displays (AMLCD) with 1024 x 768 pixel resolution and state-of-the art symbology approved, certified and Technical standard ordered (TSO'd) by Federal Aviation Administration (FAA). Each display is capable of functioning as primary flight display, navigation display and EICAS on-pilot selection; there is also an auto reversion feature in case of critical failures. The project successfully completed the preliminary and critical Design Reviews and the engineering software build has been released; currently the symbology testing and verification is in progress. The electronic flight instrumentation system symbology testing has been carried out using the bench test facility and avionics suite. The performance of the bench test was satisfactory. The bench test set up and the avionics ground integration test rig is shown in Fig.

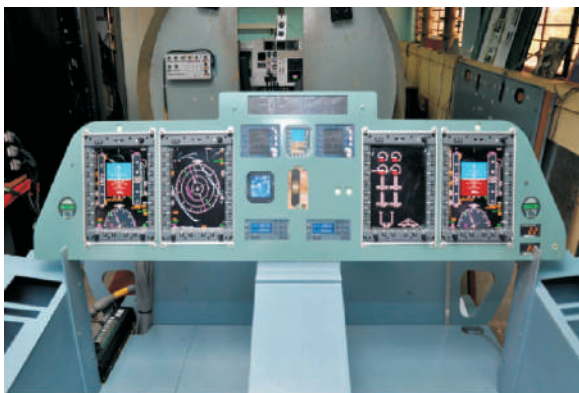
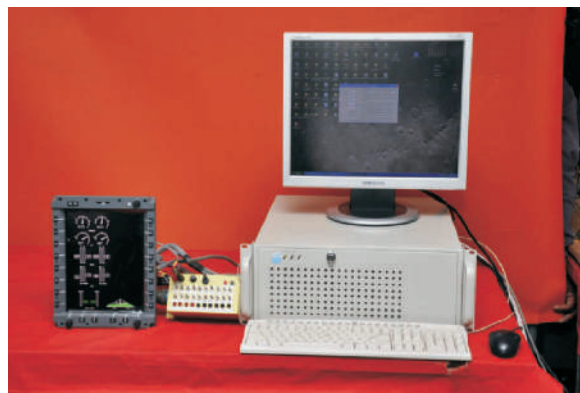


Fig. SARAS display system symbology test stations (Bench test rig and avionics ground integration test rig).



Manufacturing Technology for advanced composites

Composites offer a very attractive option in modern aircraft development because they are lighter than metal and just as strong. Tejas airframe is 45% composites (mostly carbon-epoxy) by weight contributing to its reputation as the world's smallest light weight fighter aircraft. CSIR-NAL successfully led the National Team for the composite wing development for Tejas and has pioneered the development and fabrication of 13 complex composite structural components for the Tejas (LCA) aircraft using innovative and cost-effective fabrication technologies including co-curing / co-bonding construction.

The manufacturing technology for composites for military aircraft has been earlier transferred to HAL and ADA. During the year CSIR-NAL has received a formal order from HAL, Bangalore amounting to '60 crore for the supply of twenty sets of critical CFC component (13 types) and a set of composite tools for series production program of Tejas (LCA) aircraft. M/s Tata Advanced Materials Ltd. (TAML), Bangalore is the production partner in this endeavour.

Radome (MKII) for 13m diameter Doppler Weather Radar

CSIR-NAL developed Radome technology transferred the technology to BEL on December 13, 2011 against '1.95 crore. Director, BEL

appreciated the quality of the product and congratulated the CSIR-NAL design and fabrication team. BEL team from Mumbai has undergone hands-on training at CSIR-NAL in connection with the fabrication of the fifth set of radome panels.

Jaguar Aircraft Nose Radome - TOT for manufacturing

A team of HAL Overhaul Division has undergone training for two months at CSIR-NAL in the manufacturing technology of the composite nose cone Radome of Jaguar maritime aircraft. The HAL team jointly worked with CSIR-NAL & hands-on training was provided in the activities like tool preparation, handling, E-glass preforms loading on core, tool assembly, preconditioning of resin system, liquid resin system injection using RTM machine, oven curing, de-moulding, post curing, trimming and surface preparation operations.

During the training period, two numbers of nose cone radomes were manufactured & bare radomes were also subjected to NDE and forwarded to HAL for integration/assembly with metallic parts like base ring, nose bullet and lightening strips. HAL has an order of 50-60 radomes for Jaguar aircraft from Indian Air Force (IAF) for which this training as part of TOT was of significant importance. CSIR-NAL is also helping HAL in equipping itself with the necessary facility to gear up for the production. CSIR-NAL received a technology transfer fee of '1.18 crore.

Demonstration of an Advanced Eco-friendly Energy Efficient Processes for Utilization of Iron Ore Resources of India

Suitable process flowsheets have been developed by CSIR-IMMT to beneficiate low grade iron ore fines containing 55-58% Fe from Odisha-Jharkhand region to produce a concentrate having 63-65% Fe that is suitable for sintering and pelletisation at an yield of 65-70%. A common flowsheet has been developed to beneficiate different low-grade ore fines. Laboratory scale results have been demonstrated at plant site by installing a 0.5 meter diameter column flotation unit at M/s JSPL, Barbil. It has been shown that a product with 64-65% Fe can be produced from a feed with 48 -52 % Fe at 32-40% yield.

Steel Plant Skelp Mill Mechanization

Skelp Mill at Durgapur Steel Plant, commissioned in 1968, is a continuous type of mill with roughing mill and finishing mill trains. There was a need to design and develop a system for automated fixing

designs, system analysis to detail design. The conceptual schemes were jointly evaluated by Durgapur Steel Plant and CSIR-CMERI. Conceptual design of the proposed system was done in solid modeling software and simulated in ADAMS (scale 1:1) to analyze its dynamics including all its drives. The five drives are 01) The Linear Guide drive (Motor M1), 02) Cross Slide Drive (Motor M2), 03) Vertical Drive (Motor M3), 04) Gripper Rotation Drive (Motor M4) 05) Transporter Drive (Motor M5). The designs for transporter assembly and clip fixing system have also been conceptualized.

Flow Sheets of beneficiation

CSIR-IMMT studied and prepared flow sheets for beneficiation of low-grade irons to many industries including: M/s. Rawmet Commodities Pvt. Ltd., Bhubaneswar; M/s. Jayaswal Neco Industries Ltd., Raipur; M/s. Sandur Manganese and Iron Ores Limited, Bengaluru; M/s. Shri Bajrang Power and Ispat Ltd., Raipur; M/s. Kalawati Ispat & Power Pvt. Ltd., Vandana Group, Raipur;

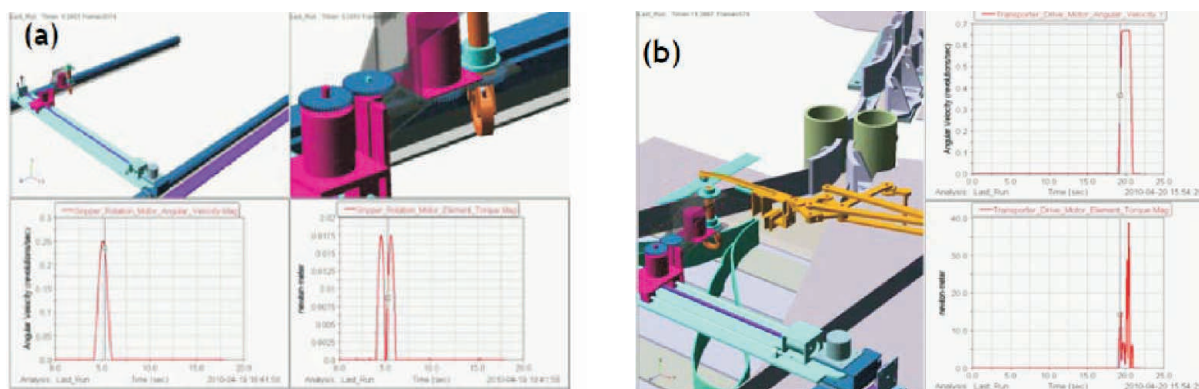


Fig. Multibody dynamic simulation (a) Gripper Rotation Drive (b) Transporter Drive

of the hot skelp coil tip in the CPR (skelp feeding) and automated fixing the clip (clip fixing) for increasing productivity and augmenting human safety in the current working condition.

CSIR-CMERI conceptualized the design of novel and unique automatic system for feeding hot skelp coil tip in CPR with vertical axis coiler covering all the engineering aspects, right from conceptual

M/s. Earthstone Group, Jakarta, Selatan; M/s. Pacific Iron ORe Manufacturing Ltd., Mumbai; and M/s. V.M. Salgaocar & Bro. Pvt. Limited, Goa.

Five Axis μ -CNC Milling Machine

CSIR-CMERI has developed five axis micro milling machine tools with gantry configuration



Fig. axis Micro μ CNC mill in operation



Fig. GUI of μ CNC mill Control System

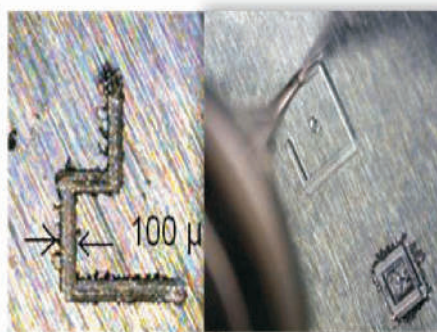


Fig. Micro Milling experiments

which is useful for micro- scale milling and drilling machining operations to generate small sized three dimensional complex geometries efficiently with reduced costs as well as with high resolution. Two rotary axes eliminate the error caused by the re-clamping and also useful for machining cylindrical shapes without X and Y-axis interpolation; therefore, precise machining can be easily performed. Finally, it helps to improve materials removal rate and improve surface finish.

Land treatment and disposal of effluent from Mahindra Vehicle Manufacturers Ltd. using High Rate Transpiration System (HRTS)

CSIR-NEERI provided a technological solution to M/s Mahindra Vehicle Manufactures Limited (MVML), Pune for treatment and safe disposal of its effluent using high rate transpiration system. The design of HRTS has been prepared and submitted to M/s MVML, Pune for



Fig. Implementation of HRTS at M/s Mahindra Vehicle Manufacturers Ltd. site, Pune

implementation at field level. The detailed composition of filter media which provides more surface area for interaction of pollutants and also removes the suspended solids present in the wastewater was also prepared.

Improving the Life Cycles of Expensive Crucibles

CSIR-NAL developed technology for carbon and pyrolytic carbon coating on their graphite crucibles being used by Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam through Chemical



Fig. Photographs of IGCAR's graphite crucibles coated with PyC coating

Vapour Infiltration (CVI) process. The process gives dense coating which sealed the surface pores. It not only increased the life cycle but also provided corrosion resistance, helping in reusability. Further, Institute also developed and stabilized BN/SiC interface technique using CVI process resulted in improved mechanical and oxidation resistance properties of panels of VSSC, Trivandrum and helped in meeting the requirements of flexural strength and fracture toughness.



Fig. Pilot Scale submerged arc furnace operation

Pilot scale smelting and pre-feasibility studies on nickel–chromium–cobalt bearing magnetite ores from Nagaland

The nickel – chromium – cobalt bearing magnetite deposits of the Nagaland is a rare type of occurrence associated with ophiolite. The largest deposit occurs in the North – Eastern most part of Nagaland – Manipur ophiolite belt, a part of the Indo-Burma ranges comprising the Arakan Yoma, Chin and Naga hills. The probable reserve in the North Block is 1.83 million tonnes while that in the South Block 2.966 million tonnes. The discovery of nickel - chromium – cobalt bearing magnetite in the Tuensang district of Nagaland assumes particular significance since India is totally dependent on imports with reference to strategic metals like nickel and cobalt. The technology has been developed by CSIR-NML in three stages (i) Laboratory scale (ii) Bench scale and (iii) Pilot scale making use of limestone as flux and petroleum coke as reductant.

The hardness of the product (Special Iron Alloy) is high (570 – 600 BHN). This iron alloy can be used for producing several value added products such as grinding media and automobile steels of EN-24 grade. A number of foundries in and around Nagaland in north east region can make use of this iron alloy. The process is ready for commercialization in small/medium scale (7.5 MVA/10 MVA) commercial Submerged Arc Furnace.



Fig. Metal tapping from submerged arc furnace



Fig. Sodium extraction by 500A closed cel

Closed Cell for Production of Sodium Metal by Fused Salt Electrolysis of Sodium Chloride

As a part of the indigenous efforts towards the development of sodium extraction technology for the Fast Breeder Reactor program of India, CSIR-NML has designed and developed a 500A closed cell. The cell was operated continuously for three days and about 1 Kg of sodium metal was collected through withdrawal system in the collection chamber. The produced collected Na metal was analyzed and it was about 90% pure. Efforts are on to modify the design of the 500 A cell and run it for a sustained period of 20-30 days to enable generation of design data for larger capacity commercial cells.



Fig. In-house system for chlorine handling during sodium extraction

Commissioning of the Bio-fuel Pilot Plant

A bioethanol pilot plant with a capacity process 80 kg of biomass per batch was designed based on the data obtained for the process for conversion of different selected biomass types to bioethanol. Material flows, volumes, methods of operation, process efficiencies and limitations, etc were all considered while designing a tentative process flow with approximate sizing of reactors. This design was provided to an engineering consultant- M/s Hitech Biosciences Pvt Ltd, Pune who refined the design in consultation with the CSIR-NIIST and prepared the engineering specifications and drawings for the pilot plant. The fabrication/ erection and commissioning of the plant was done by M/s Scigenics India Pvt Ltd, Chennai who



Fig. Pretreatment Reactor



Fig. 200 L Fermenter for bioethanol production

fabricated the reactors, did the piping and instrumentation, utilities and finally the pilot plant was commissioned for operation.

Assessment of Microstructural Degradation in 2.25Cr-1Mo Steel using Miniature Specimen Technique

CSIR-IMMT used Miniature specimen technique viz. small punch test (SPT) at room temperature in order to identify the parameters of SPT representing the microstructural degradation in 2.25Cr-1Mo steel. Microstructural degradation in this steel has been introduced as a result of thermal



Fig.

ageing corresponding to LMP values of 33,012, 35,402, 37,846 and 38,374. Optical and transmission electron microscopy were used to identify the carbide precipitates and examine their coarsening behaviour. Shape, size and distribution of precipitates have also been studied using TEM. Two of the SPT parameters viz. total area and area under the region of plastic instability of load-displacement curve have been found to decrease with increase in L-M parameters. Coarsening of carbide particles along with change of shape of iron carbides from platelets to spheres could be the possible reason for decrease in these SPT parameters with increase LMP values. The result indicated that small punch test could be successfully used to assess the degradation of microstructure in 2.25Cr-1Mo steel generated due to their exposure at high temperature service environment. This is a step forward towards the

application of this technique for failure analysis and life extension studies.

Moisture meters for detection of moisture in transformer oil

Transformer oil deteriorates gradually day by day and absorbs moisture from transformer winding and by adsorption from atmosphere which lead to gradual fall in dielectric strength and causes spark over. CSIR-CGCRI developed nanoporous thin film α -alumina based capacitive sensors with adequate sensitivity over the moisture range from 5 to 20 ppm for detection of trace moisture in transformer oil. The oxide α -alumina with its pore structure is the active material. When the water molecule enters the pores it changes state from moisture vapor to liquid increasing the overall dielectric constant and capacitance of the material. The developed sensors were calibrated by an electronic device for low range moisture measurement in hand held devices in connection with environmental and meteorological monitoring. A few moisture meters were transferred to M/s Nisha Engineering Corporation, Kolkata for field trials.

Improvement in MgO-C refractories to enhance the steel making convertor life

MgO-C refractory is used in the lining of primary steel making converters. Rashtriya Ispat Nigam



Fig. Upscaling of MgO-C Brick at Vizag Steel with modified Technology of CSIR-CGCRI.

Ltd. (Vizag Steel) produces this refractory at their captive plant. However, variations take place over time in the lining life of the converter from 4000 to 7000 heats. CSIR-CGCRI made an attempt to increase the converter life by improving brick quality at a techno-economically viable process. Institute intervened and improved the brick quality through changing the granulometry of MgO, combining fused and sintered MgO in optimum ratio and optimizing antioxidants like Al, Si, B₄C and their combination. The antioxidants inhibited carbon oxidation and subsequently developed high melting phases within MgO to improve Hot MOR (71 kg/cm² to 93 kg/cm²) and corrosion resistance (wear index reduced from 79 % to 47%) of the brick. Based on these major outcomes, upscaling is going on at the plant on MgO-C brick.

Green Technology for producing iron using hydrogen plasma

CSIR-IMMT developed a technology for reduction of hematite in the presence of pure hydrogen plasma. The involvement of highly energetic atomic and ionic states of hydrogen provides a very high driving force for reduction of ore into metal. The process is completely carbon free and hydrogen plasma alone acts as a reducing as well as heating source.

A 6kW microwave plasma reactor is employed for carrying out the reduction experiments. It is

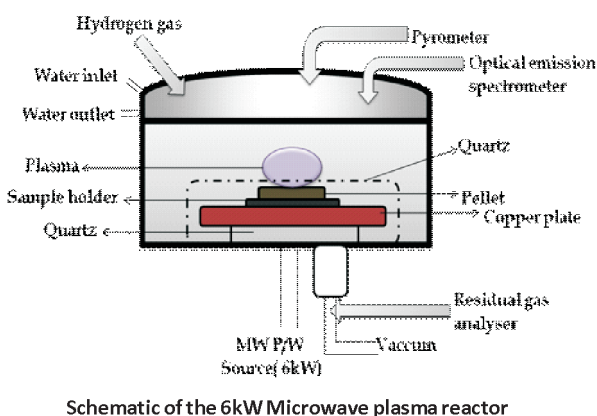


Fig.

coupled with a pyrometer, optical emission spectrometer and residual gas analyser for in situ measurement of temperature, plasma diagnosis and exhaust gas analysis respectively.

The chemical analysis of the product indicated around 90% reduction of the ore, the chemical analysis results are found to be complimentary to the XRD given in figure; indicating the removal of oxygen in hydrogen atmosphere and thus the formation of metallic iron.

Autonomous Intelligent Robotic Wheel Chair

CSIR-CMERI developed an Autonomous Intelligent Robotic Wheel Chair which is differentially driven model where two of the central wheels are used for power and other four are active suspension mounted casters. This design provides enhanced mobility and stability and capability to turn full 360° in any narrow corridor. It can also go up slant pavements, maintaining



Fig.

stability over all terrains offers enough maneuverability to navigate smoothly on small ups and downs. It offers high degree of maneuverability to navigate smoothly on ups and downs. Light weight components (main body and seating) decrease the overall weight without compromising on safety. A lead acid battery bank (24 V, 25 AH) with built-in chargers is provided

on board. Electronic soft touch control using joystick based commands, voice command and auto navigation facility is provided. Additional features include collapsible foot rest and interchangeable seating.

Micro-EDM Prototype Machine

CSIR-CMERI has developed micro-EDM prototype of micro-EDM machine. This test bed consists of three micro positioning stages with travel resolution of $0.1\mu\text{m}$ and travel length of 150 mm, which are used for precision travel in X, Y and Z axis. The RC circuit based pulse generator has been integrated for EDM power supply. The discharge voltages and currents have been

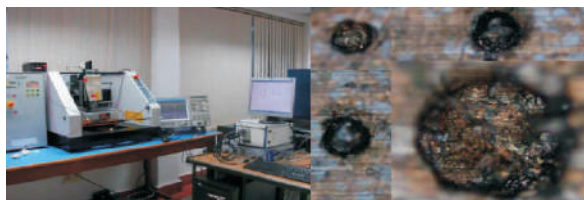


Fig.

measured using digital oscilloscope. The hardware systems were interfaced as a complete system, controlled through LabView. The approach and retraction movement of an electrode with respect to the work piece were programmed. The discharge voltage has been monitored to compensate electrode and work piece wear (as a result of material removal), so that constant spark gap between them could be maintained in successive discharges. Figure shows the current prototype and the craters of $300\mu\text{m}$ diameter machined on laser sintered Cu-Ni alloy. This first generation prototype is being modified to incorporate micro milling features and also integrated dynamically controlled electrode erosion compensation system, so that prototype can be used for micro milling and EDM operations.

Mobile Bridge Inspection Unit

CSIR-CMERI jointly CSIR-CRRI developed the first indigenously Mobile Bridge Inspection Unit

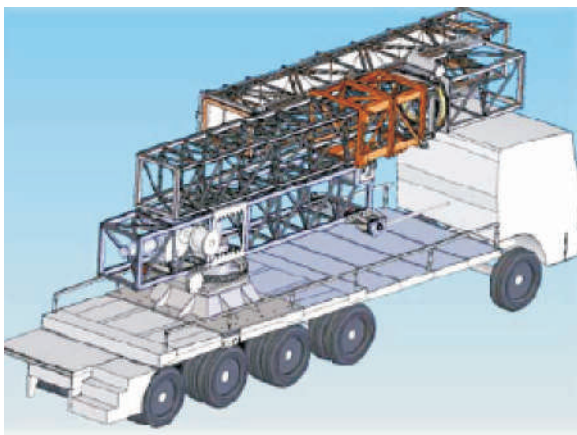


Fig.

(MBIU) for conducting bridge inspection systematically, scientifically and quickly. The machine is designed as per international safety standard. The unit is very simple to operate and comprises six mechanical joints, which are controlled through an automated PLC Control System by the operator.

The design of MBIU had conflicting requirements such as the truck must act as a rigid platform while inspection and it should be flexible while moving on the road. This conflict was resolved by



Fig.

installation of pneumatic suspension units in place of mechanical springs. When the air is exhausted in the pneumatic units, there would be metal to metal contact and thereby rigidity was assured. With this motion of 4", the two axles with wheels will be lowered on ground. Therefore during inspection 4 axles would support the off-centered load.

Electronic nose for monitoring of obnoxious odorous constituents generated from pulp and paper industries

The odorous emissions generated from pulp and paper industry have been the cause of nuisance since the inception of the industry. Reduced sulphur compounds generated from these mills have several health implications and the ever increasing population accompanied by other socio-economic factors leading to the development of habitat in the proximity of these mills is making it mandatory to monitor the emissions generated. Present available analytical techniques do not

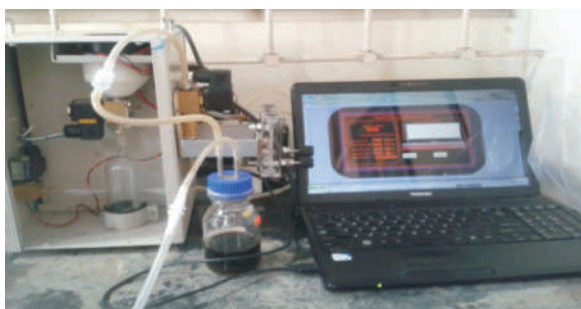


Fig.

depict clear picture of odor perceived, and are time consuming and expensive. Therefore, CSIR-NEERI has developed prototype of an electronic nose (e-nose) for monitoring sulphurous compounds emitted during pulping process from paper mills. The gas samples collected from industry were tested with the e-nose and an odor index was generated corresponding to varying concentration of compounds. The prototype e-nose has been calibrated using various odorous compounds such as DMS, H₂S, DMDS individually and in combination.

UNIQUE MAJOR FACILITIES

Parallel Computing Facility

The 7th fastest parallel computing facility has been established at CSIR-NAL. The HPC system Altix ICE 8400 with 192 dual socket nodes, 2304 Intel Xeon cores with 4.6 TB memory, 24 TFlops of



Fig. HPC system Altix ICE 8400

sustained performance, 30 TB parallel file system, Intel compilers and PBSPro work load management SW was established in collaboration with CSIR-C-MMACS. This has given a tremendous boost to the computing power available to the laboratory scientists. Several complex applications were run; CSIR sister laboratories also made use of the system effectively during the year.

Semi-free Jet Test Facility

A semi free-jet test facility has been established and commissioned at CSIR-NAL high Mach number applications. The test rig was designed for Mach number of 3.5, total pressure of 20 bar, total temperature of 1700 K and mass flow rate of 20 kg/s. In the connected mode the test rig can be utilized up to Mach number of 3.5, but in semi



Fig.

free-jet mode with Mach number of 3.5 at entry to the test section. The facility consists of 200 bar air compressor and storage vessels of 30 m³ capacity. The rig has two-step kerosene combustion heaters to heat the air up to 1700 K. The water-cooled nozzle accelerates the flow to a Mach number of 3.5 at entry to the test section. The scaled models can be mounted in the test section. The diffuser system was provided for diffusing the high supersonic flow to low subsonic flow. A state-of-the art data acquisition system has been installed in conjunction with the in-house developed control software.

This is India's first state-of-the-art scramjet facility, safety clearance from ISRO-HQ and other statutory bodies of Govt. India.

Augmented Engineering Environment

The Aircraft Integrated Development Environment or Augmented Engineering Environment (AEE), is an outcome of the collaboration with CAE Inc., Canada. Augmented Engineering Environment (AEE) simulator has been made operational at

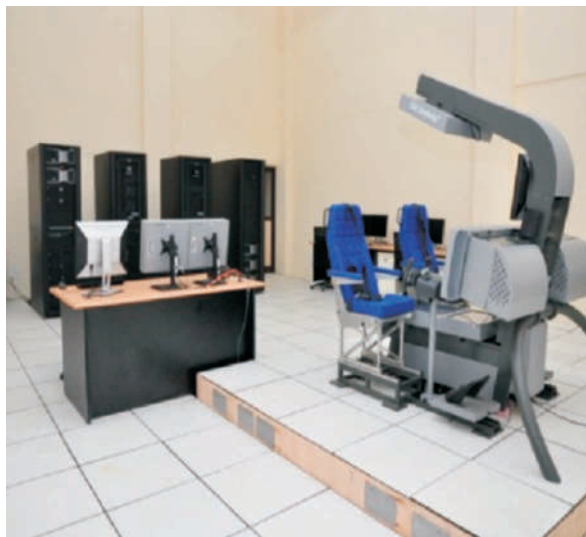


Fig. Augmented Engineering Environment Facility.

CSIR-NAL after integration of the hardware and software. The main focus to study the technologies which have high human interaction content, including Integrated Enhanced and Synthetic Vision Flight Control System, integrated Modular Avionics and Cockpit Ergonomics.

This facility is one of its kind in the country to address the Design and Development of Flight control systems for both the manned and unmanned airframes for civilian and military applications

Adaptive Antenna Facility for Simulation

The dedicated test bed for adaptive arrays which enables both indoor/outdoor Hardware developments has been established at CSIR-NAL. The facility can be used for strategic applications in X-band and active RCS reduction techniques, for stealth and low-observables. The facility can also be used for study of active cancellation in phased arrays, conformal and meta-material antennas. It is one of its kind facility in India.



Fig. FSS based design and development facility

FSS-based Design and Development Facility for Aerospace Applications

This is an exclusive dedicated FSS Facility (2-40 GHz) in the country. The facility was extensively used for CSIR-NAL-Boeing collaborative project related to EM material characterization of panels for Boeing 787-9 Dreamliner aircraft. This facility is essential for FSS design of Aerospace Structures. This is the only known dedicated FSS Facility (worldwide) 2-40 GHz.



LENS™ (Laser Engineered Net Shaping) (Model MR-7) from Optomec, USA

LENS™ process is a laser assisted direct metal manufacturing process, a kind of rapid prototyping technique specifically used for medical implants fabrication has been commissioned at CSIR-CMERI. LENS™ technique offers: Customized complex shaped functional implants with functionally graded porosity, composition and properties; Demand based manufacturing that hugely cuts cost and inventory and enable superior properties compared to traditionally manufactured counter parts.

1.4 INFORMATION SCIENCES CLUSTER

India, Science and Technology, 2010-11

CSIR-NISTADS brought out India S&T Report 2010-11. Innovation, which forms the base for current global economy, is the core concept for this report. The report could identify: a) the nature and extent of innovative activities in the country; b) the lacunae in the innovation support mechanism; and c) S&T interventions required in the policy matrix to enable India to be in the forefront on innovation activities. India S&T Report 2010-11 is organized under following five themes: (i) S&T and Human Resources, (ii) S&T and Innovation Support System, (iii) S&T and Industry, (iv) S&T Outputs and Patents, and (v) S&T and Rural Development Strategies. While the content and approach of these five themes differ from each other, innovation occupies the central stage in each of these themes. The report is targeted at a wide readership ranging from policy makers and advisors to academic readers as well as the common person.

Strategic Thinking

The book brought out by CSIR-NISTADS through Sage Publications provides an interpretation of strategy around an 'actor' rather than an organization. It views strategic action as being executed in a 'milieu' populated by power holders,

where the individual strategist actor holds centre stage, and where pursuits are obstructed by the countervailing threats of other power holders. The authors explain that the strategic 'milieu' is an intensely governed set-up where the relations and transactions between the power holders controlling key assets are under the governance of the current set of rules and institutions. The book shows how one can appreciate several contemporary business practices, especially under 'increasing returns', by focusing on the relation between the 'economics' and the 'governance' of an asset. Cooperation, as opposed to deterrence, informs such strategic acts under increasing returns.

Agro-biodiversity Conservation in Indian Central Himalaya: On Farm (*In-situ*) Practices

CSIR-NISTADS, through this book, discusses the loss of agro-biodiversity is threatening the food security and livelihood of smallholding poor farmers. Under such a scenario farmer-focused livelihood centre study on agro-biodiversity conservation. The real worth of agro-biodiversity cannot be realized by the farming community unless such bio-wealth is converted into income-generating enterprises by identifying and adding value. Agricultural biodiversity can only be saved if the country's path of development undergoes fundamental changes. Unless the new economic policies and the proposed changes in legal regimes governing agriculture are challenged with united action and alternative visions, concerns related to biodiversity, sustainability, and equity will remain subordinated to the lure of profit.

Gender and Science: Studies across Cultures Foundation Books, Cambridge University Press, India, 2012

The book brought out by CSIR-NISTADS covers data and findings across a few nations and reveals universal as well as a few diverse facts, such as vertical and horizontal gender segregation and a dramatic increase in the number of women getting into engineering in some nations. The fields of science, technology, engineering, and mathematics

drive economies Worldwide. The under representation of women at the highest levels of science, technology, mathematics, and engineering is a matter of concern in the era of knowledge-based economies. The book deals with the social, economic, political, socio-cultural and socio-psychological barriers to explain why science and technology remain 'gendered', transcending time and geo-cultural locations.

1.5 PHYSICAL SCIENCES CLUSTER

Scientific Excellence

Recruitment potential of a green alga *Ulva flexuosa* Wolfen dark preserved zoospore and its development

CSIR-NIO tested under different conditions the recruitment potential and the ability of *Ulva flexuosa* Wolfen zoospores to survive darkness. The dark preserved zoospore was cultured under a two-factor experimental design to test the effect of salinity and nitrate, effect of salinity and phosphate, effect of light and salinity, and effect of light and phosphate. The recruitment (germination and growth) of zoospores was significantly affected by light and salinity. The nitrate concentration of $20 \mu \text{mol.l}^{-1}$ was found to initiate the process of germination and its subsequent growth and, its effect appeared greatest under 25 psu condition. While nitrate enhances the growth of biomass more than phosphate, both show a positive interactive effect on biomass increase when crossed with salinity. The combined effect of 25 psu salinity and $8 \mu \text{mol.l}^{-1}$ phosphate exhibited higher biomass growth. There was a significant effect of light and salinity on the biomass of zoospore, though there was no significant interaction between the two factors. There was an increase in biomass of growing zoospores to increase in light intensity and $80 \mu \text{mol.m}^{-2}.\text{s}^{-1}$ of light intensity was considered optimal. Similarly, high light intensity condition favored higher biomass growth and there was significant interaction between light ($80 \mu \text{mol.m}^{-2}.\text{s}^{-1}$) and phosphate ($4 \mu \text{mol.l}^{-1}$) in high salinity (35 psu) condition. The result of this study showed

that dark preserved zoospores of *U. flexuosa* have the potential for recruitment and it gives us an understanding how different factors play a role in the process of recruitment.

Observational evidence of lower-frequency Yanai waves in the central equatorial Indian Ocean

Analysis of long time series of current meter data from a mooring at 77°SE and the equator during 2003–2007, along with mean sea level anomaly data, by CSIR-NIO throws light on the occurrence of the lower-frequency (24 to 40 day) Yanai waves in the upper water column of the central equatorial Indian Ocean (EIO) during the positive Indian Ocean dipole (IOD) years of 2003, 2004, 2006, and 2007 and its absence during the negative IOD year 2005. This result is in contrast with the earlier studies that observed only the higher-frequency (biweekly period) Yanai wave in this region. A new notion has been proposed for the generation of the lower-frequency Yanai wave in the upper central EIO owing to the positive IOD phenomenon. The strong meridional current shear created by the northward shifting and strengthening of the westward flowing south equatorial current associated with positive IOD and the eastward flowing southwest monsoon current provides energy for the generation of lower-frequency Yanai waves. Vertical stratification of the water column appears to be responsible for the trapping of the different frequency of Yanai waves, with only the higher-frequency Yanai wave in the region of lower pycnocline. During positive IOD the strongly stratified upper water column responds to the lower-frequency Yanai wave, while the deeper ocean (4000 m) exhibited a longer-period (47 day) oscillation. The expected surface signature of Madden-Julian oscillation seems to be suppressed by strong easterlies during the positive IOD years.

Processes controlling the surface temperature signature of the Madden–Julian Oscillation in the thermocline ridge of the Indian Ocean

During boreal winter, there is a prominent maximum of intraseasonal sea-surface temperature

(SST) variability associated with the Madden-Julian Oscillation (MJO) along a Thermocline Ridge located in the southwestern Indian Ocean (5°S–10°S, 60°E–90°E; TRIO region). There is an ongoing debate about the relative importance of air-sea heat fluxes and oceanic processes in driving this intraseasonal SST variability. Furthermore, various studies have suggested that interannual variability of the oceanic structure in the TRIO region could modulate the amplitude of the MJO-driven SST response. In a study carried out by CSIR-NIO, observations and ocean general circulation model (OGCM) experiments were used to quantify these two effects over the 1997–2006 period. Observational analysis indicates that Ekman pumping does not contribute significantly (on average) to intraseasonal SST variability. It is, however, difficult to quantify the relative contribution of net heat fluxes and entrainment to SST intraseasonal variability from observations alone. Therefore a suite of OGCM experiments were used to isolate the impacts of each process.

Autonomous profiling device to monitor remote water bodies

In tropical climates, most freshwater reservoirs, dams and lakes are prone to annual summer stratification during which bottom water layers near the bed become hypoxic (<2 ml/l) with very low concentrations of dissolved oxygen (DO). This

has serious implications to human health, and requires frequent and effective monitoring, particularly during summer months when water consumption is highest. These water bodies are frequently located in remote areas away from human habitation, making it logistically difficult to access and monitor their water column properties on a regular basis. The need for monitoring temporal changes in freshwater ecosystems is addressed CSIR-NIO for use in both coastal and freshwater bodies. The AVP was used in experiments to satellite transmit complete time and location referenced high-resolution profiles of temperature, phytoplankton concentration, turbidity and DO from the remote Tillari Dam - a freshwater reservoir near Dodamarg, Maharashtra, India. The profiles were received without errors at the CSIR-NIO. The benefits of in situ time-series profiling with AVP captured the onset of developing hypoxia in early April 2011 over a 9-day unsupervised profiling experiment. A similar 5-day experiment tracked diurnal changes in phytoplankton concentrations through night and day, suggesting a possible interplay between recycled production and photoinhibition.

A study of lead and cadmium speciation in some estuarine and coastal sediments

Chemical speciation of lead (Pb) and cadmium (Cd) in the coastal and estuarine sediments along the central east coast of India was studied by applying sequential and kinetic extraction methods. The results of this study suggest that concentrations of non-residual and dynamic complexes (which are good indicators of bioavailability) of these toxic metals gradually increase with increasing total metal loading in sediments. Increase in bioavailability of these toxic metals with increasing total metals concentrations in the sediments can be a potential threat to benthic organisms and aquatic biota in the system. The study by CSIR-NIO shows that total organic carbon (TOC) is one of the key factors which play a crucial role in controlling speciation of these toxic metals in sediments. However, distribution and speciation of these metals are influenced by their total metal

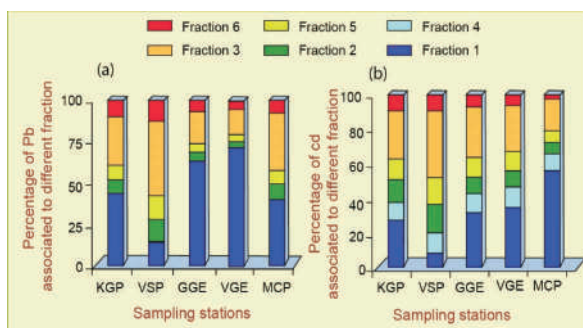


Fig. Chemical fractionation of (a) Pb & (b) Cd in five different sediment samples collected at five different environmentally significant sites KGP — Kalingapatnam; VSP — Visakhapatnam; GGE — Goutami-Godavari Estuary; VGE — Vasistha-Godavari Estuary and MCP — Machilipatnam.

loading and trace metal competitions rather than only TOC content in sediments. An attempt was made to identify the key factors which control speciation of these toxic metals in natural system and provides a better understanding to predict and control pollution of Pb and Cd in coastal and estuarine sediments.

Bio-prospecting of a few brown seaweeds for their cytotoxic and antioxidant activities

Methanolic extracts (MEs) of seven brown seaweeds occurring in the Indian coastal waters were screened by CSIR-NIO for their cytotoxic and antioxidant properties following various assays. The methanolic extracts of seaweeds in the order of *Dictyopteris australis* > *Spatoglossum*

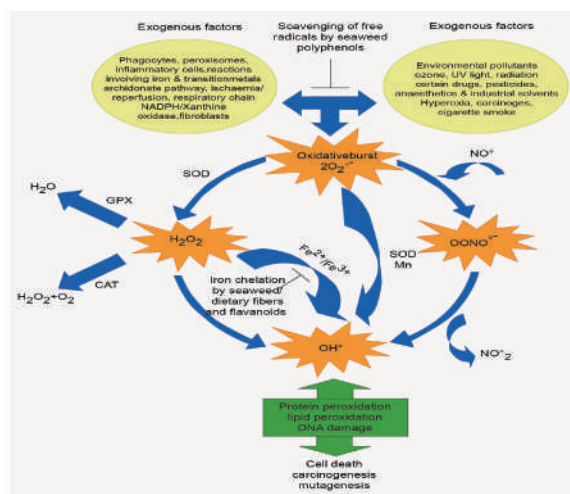


Fig. Brown seaweeds and their role in the prevention of ROS-mediated cascade of events

variabile > *Stoechospermum marginatum* > *Spatoglossum asperum* showed significant cytotoxic activity. A very high DPPH radical scavenging activity was exhibited by the methanolic extracts prepared from *St. marginatum*, *Padina tetrastomatica*, *Dictyopteris delicatula* and *S. asperum*. The total phenolic content of the MEs varied from 13.19 ± 0.32 to 25.29 ± 0.445 gallic acid equivalents (mg g⁻¹ of methanolic extract). The reducing power assay indicated a dose dependency, at concentrations of 0.1, 0.5 and 1.0 and 2.0 mg mL⁻¹ of MEs and decreased in the

following order: Butylated hydroxy toluene > *P. tetrastomatica* > *D. delicatula* > *S. asperum* > *S. variabile* > *S. marginatum* > *D. australis* > *S. marginatum*. Furthermore, *D. australis*, *S. asperum*, *S. variabile* and *S. marginatum* demonstrated good metal ion chelating properties. This suggests that the antioxidant compounds found in brown seaweeds scavenge free radicals through effective intervention. This decisively promotes them as a potential source of natural antioxidants.

Intra-annual variability of carbon and nitrogen stable isotopes in suspended organic matter in waters of the western continental shelf of India

Intra-annual variations of d13C and d15N of water column suspended particulate organic matter (SPOM) have been investigated by CSIR-NIO to understand the biogeochemical cycling of C and N in the Western Continental Shelf of India (WCSI). The key issues being addressed are: how the d15N of SPOM is affected by seasonally varying processes of organic matter production and respiration and how it relates to the d15N of sedimentary organic matter that appears to show a decreasing trend despite an apparent intensification of seasonal oxygen deficiency over the past few decades? A secondary objective was to evaluate the sources of organic carbon. Elemental carbon and nitrogen concentrations, C/N ratios in SPOM, along with ancillary chemical and biological variables including phytoplankton pigment abundance were also determined on a seasonal basis (from March 2007 to September 2008), with the partial exception of the southwest (SW) monsoon period.

Screening marine organisms for antimicrobial activity against clinical pathogens

Bacterial resistance to existing antibiotics has led to the search for new therapeutic agents. With this aim, antimicrobial activity of extracts prepared from forty species of marine organisms belonging to different phyla and collected from Mandapam, south-east India, (9° 16'N; 79° 12'E) and

Kanyakumari coasts, south India, 8° 4'N; 77° 34'E were evaluated. The extracts were screened against clinical isolates of bacteria including multi-drug resistant (MDR) strains and fungi. The sponge, *Ectyobatzella enigmatica*-extract was quite promising as bactericidal agent especially against MDR *Streptococcus pyogenes* and except for its ineffectiveness against *Pseudomonas aeruginosa* and *Klebsiella* sp. it was as effective as standard streptomycin against each of the bacteria tested. Besides *E. enigmatica*, *Spongia officinalis* and the echinoderm *Pentacaster affinis* extracts also exhibited good activity against MDR strains of *S. pyogenes* and *Acinetobacter* sp. An unidentified ascidian extract effectively inhibited the growth of *Shigella flexneri* and the soft corals, *Sinularia* sp.(iii) and *Sinularia kavarattiensis* were weakly active against some of the bacteria tested. Both the sea grasses (*Halodule* sp. and *Halophila ovalis*) were antifungal but not anti-bactericidal. Follow up studies showed that except *Ectyobatzella enigmatica* where the activity was distributed in all the fractions, the activity of the other extracts were concentrated mainly in the low polar hexane and chloroform fractions. Among the 7 fungal pathogens used in the study, *Fusarium* sp. was sensitive at varying degrees to 12 marine extracts while 17 extracts were weakly fungicidal against *Nocardia* sp. The extracts were practically inactive towards the remaining fungal strains. The standard antibiotic (ketoconazole) used was moderately effective only against *Cryptococcus neoformans* and *Aspergillus niger*.

CSIR-NIO team consisting of the five members participated in the Indian Arctic Programme during 16 May to 6 June 2011. The participation was to initiate a joint research programme between CSIR-NIO and NCAOR for “Long-term physical-biogeochemical measurements in the Kongsfjorden Fjord for Climate Change Studies”. The team carried out physical-biogeochemical measurements at 16 stations in the fjord. During 27-28 May CNN-IBN team took video shoot of Indian research in Arctic and this was telecasted on 6 June 2011 in CNN-IBN channel as a part of the climate change study of Arctic.

Seismically Active Zones in Indian Peninsular Shield

Ten stations of the broadband seismic network operated by CSIR-NGRI, connected to a central recording station at CSIR-NGRI through VSAT for online data analysis, recorded 410 earthquakes with $M_d \geq 4.5$ during 2009-2012 periods. Several of the events were located using data from these stations.

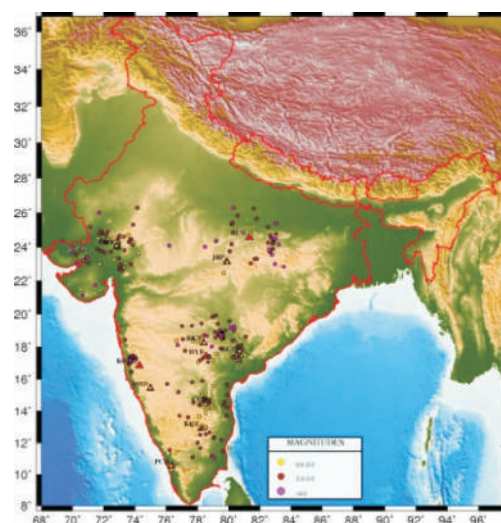


Fig. Epicenters of earthquakes recorded by the Broadband seismic network in the Peninsular shield of India during January 2009 to March 2012

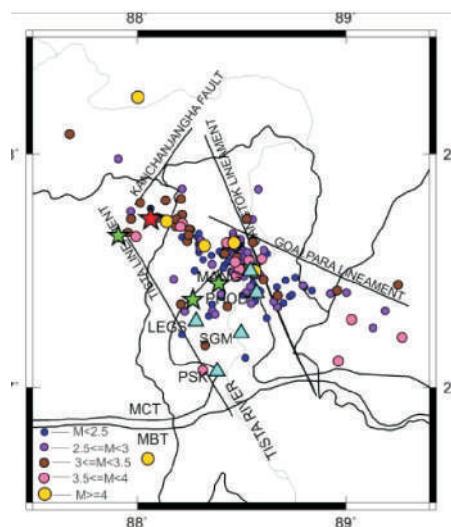


Fig. Locations of the seismic stations (triangles) of the CSIR-NGRI seismic network and epicentres of all the aftershocks recorded by at least three stations.

The epicenter map prepared for the Peinunsular India clearly brings out the moderately active nature of the Indian shield which is typical Stable Continental Regions of (SCR). The earthquakes are confined to well-known tectonic regimes like the Godavari graben, Cuddapah basin, eastern margin near Ongole, north of Moyar-Bhavani shear, Koyna, the southern margin of Aravallis, Kutch and around Rewa along the Narmada-Son Lineament.

Tectonic Implications of the September 2011 Sikkim Earthquake and its Aftershocks

Spatial patterns of 292 aftershocks of the Mw 6.9 Sikkim earthquake of September 2011 were studied by CSIR-NGRI accurately locating them through analysis of three component waveforms registered by a five station broadband network operated immediately after the occurrence of the quake. Refined hypo-central parameters achieved through application of the hypoDD relocation scheme reveal tight clustering of events along a NW–SE trend with focal depths reaching ~60 km. These trends viewed in conjunction with the strike–slip mechanisms of past earthquakes in Sikkim, including the main shock, affirm the predominance of transverse tectonics in this segment of the Himalayas where the Indian plate convergence seems to be accommodated by dextral motion along steeply dipping fault systems.

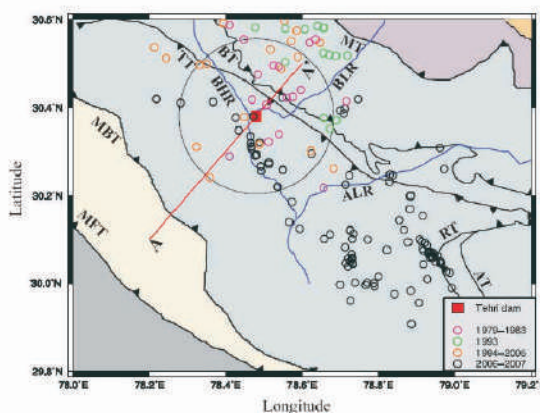


Fig. a. Distribution of earthquakes recorded by various network

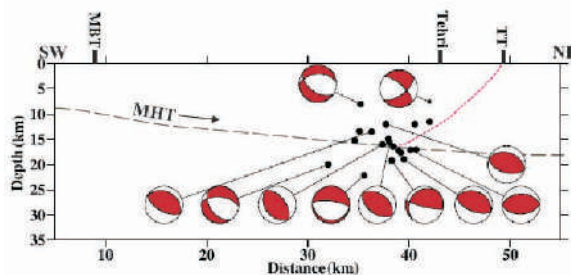


Fig. b. Depth distribution of the earthquakes occurring within 20 km along the SW-NE cross-section through the Tehri dam

Active Fault Beneath the Tehri Dam, Garhwal Himalaya- First Seismological Evidence

The first seismological evidence of an active fault beneath the Tehri Dam has been identified by CSIR-NGRI through mapping of the earthquake distribution in the Kumaon-Garhwal Himalaya. The earthquake distribution shows a significant EW trend in the Lower Himalaya following the Tones fault in west and the Ramgarh thrust in the east. The Tehri dam is situated in close proximity of the Tones thrust. Twenty earthquakes (mag 1.6 to 2.8) were recorded in the 20 km radius of the dam which mostly have thrust mechanism. Figure 3b shows the depth variation of earthquakes (and FPSs), within 20 km on either side of the SW-NE cross-section through the Tehri dam. These earthquakes fall either on the south dipping Tons fault or where it meets the Main Himalayan Thrust (MHT).

This is perhaps the first seismological evidence of an active fault beneath the Tehri dam. The study reveals that the tectonic loading on this active fault may generate earthquake(s) and provide additional seismic risk in this critically stressed region.

Fe and S isotope Compositions of Hydrothermal Sulfides from the Northern Lau Basin

Massive sulfides belonging to the extinct hydrothermal field of the North Lau Basin were studied by CSIR-NGRI for their Fe and S isotope compositions. Sulfide samples belonging to pedestal slab peripheral chimneys (remnants of white smokers; Fig. 4b) and oxide precipitates filling the hollows of pillowed basalts were studied. Detailed mineralogical and geochemical

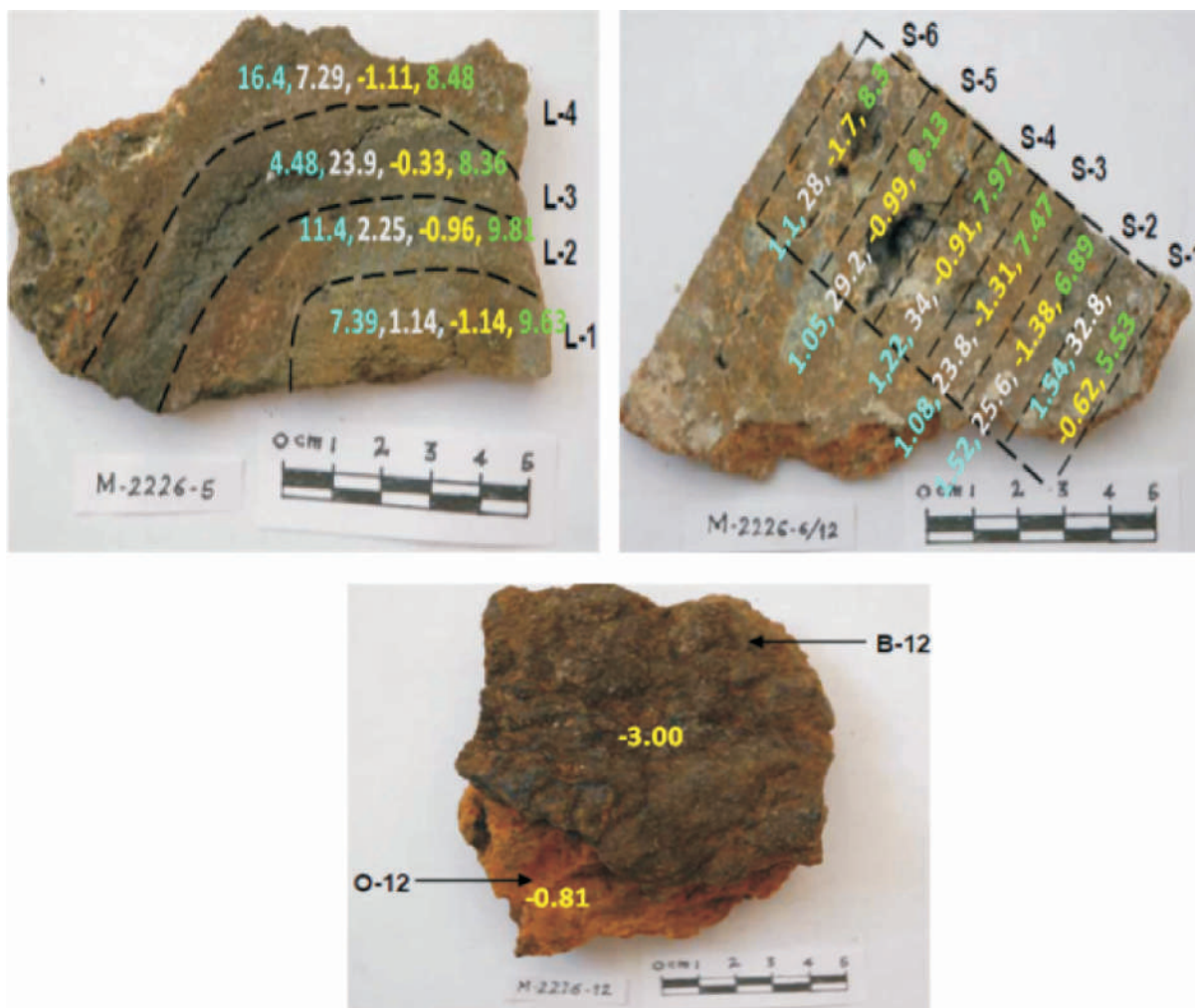


Fig. (a) Pedestal slab, (b) peripheral chimney and (c) oxide precipitates of sulfide and oxide samples from the extinct hydrothermal field of the northern Lau Basin. The numbers indicated on the diagram represent concentrations of Cu (blue) and Zn (grey), and ^{56}Fe (yellow) and $\delta^{34}\text{S}$ (green)

studies on the same set of samples indicated the similarities between the Lau hydrothermal field and the Trans-Atlantic Geotraverse (TAG) active mound. The sulfides of pedestal slab mainly consisting of chalcopyrites and pyrites with minor barite and sphalerite show $\delta^{34}\text{S}$ values between 8.4 to 9.6 ‰ (V-CDT). The major constituent of sulfides belonging to peripheral chimney is sphalerite, while pyrite and chalcopyrite form minor constituents. The $\delta^{34}\text{S}$ values range from 5.5 to 8.3 ‰. These $\delta^{34}\text{S}$ values are very similar to those of TAG hydrothermal sulfides. Such high $\delta^{34}\text{S}$ values for TAG hydrothermal sulfides were interpreted as a result of mixing of sulfur of sulfate reduction origin and that of the hydrothermal fluids. The high $\delta^{34}\text{S}$ values in case of Lau Basin also corroborate the influence of sulfate reduction.

The sphalerite-rich sulfides of the peripheral chimney have slightly depleted $\delta^{34}\text{S}$ values when compared to the pedestal slab indicating increased effect of hydrothermal solutions in them.

The $\delta^{56}\text{Fe}$ values of samples belonging to pedestal slab show a range between -0.3 to -1.1 ‰ (IRMM-014), while those of the peripheral chimney vary from -0.6 to -1.7 ‰. The oxide precipitates show maximum fractionation in Fe isotope compositions having $\delta^{56}\text{Fe}$ values of -0.8 and -3.0 ‰. Among the oxide precipitates, the MnO-rich top layer is characterized by lowest $\delta^{56}\text{Fe}$ value indicating the influence of temperatures. Further, role of redox conditions can be envisaged in controlling Fe isotope compositions based on the correlation between $\delta^{56}\text{Fe}$ and Ce anomalies.

Seismic quality factors across a bottom simulating reflector in the Makran Accretionary Prism, Arabian Sea

The hydrate-bearing sediments above the bottom simulating reflector (BSR) are associated with low attenuation or high quality factor (Q), whereas

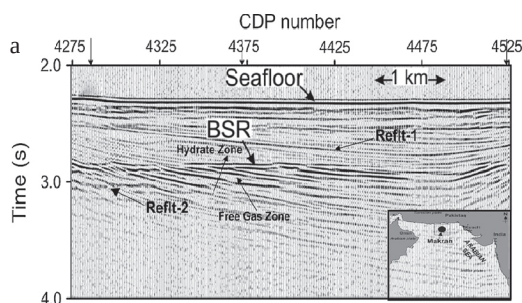
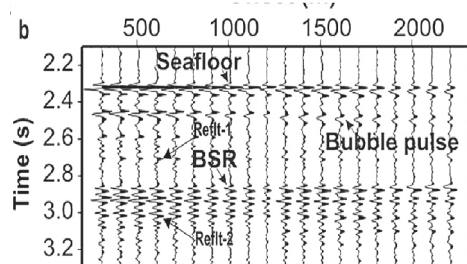


Fig. (a). Seismic stack section along a north-south seismic line (inset shows the study area (box) in the Makran accretionary prism). Amplitude spectra have been calculated around four reflectors: seafloor, reflect-1, BSR and reflect-2. (5) NMO corrected CDP gather at CDP 4372, showing the reflections at various offsets from the said four reflectors.

underlying gas-bearing sediments exhibit high attenuation. Hence, estimation of Q can be important for qualifying whether a BSR is related to gas hydrates and free-gas. This property is also useful for identifying gas hydrates where detection of BSR is dubious. Here, the interval Q for three submarine sedimentary layers bounded by seafloor, BSR, one reflector above and another reflector below the BSR at three locations with moderate, strong and no BSR along a seismic line in the Makran accretionary prism, Arabian Sea were calculated by CSIR-NGRI for studying attenuation (Q_1) characteristics of sediments. Interval Q for hydrate-bearing sediments (layer 2) above the BSR are estimated as 191 ± 11 , 223 ± 12 , and 117 ± 5 , whereas interval Q for the underlying gas-bearing sediments (layer C) are calculated as 112 ± 7 , 107 ± 8 and 124 ± 11 at moderate, strong and no BSR locations respectively. The large variation in Q is observed at strong BSR. Thus, Q can be used for ascertaining whether the observed BSR is due to gas hydrates, and for identifying gas hydrates at places where detection of BSR is rather doubtful. Interval Q of 98 ± 4 , 108 ± 5 , and 102 ± 5 , respectively, at moderate, strong and no BSR locations for the layer immediately beneath the

seafloor (layer 1) show almost uniform attenuation. Thus, besides characterizing the sediments, the estimated Q can be used for designing an inverse Q filter to compensate the effects of attenuation for producing improved structural images of shallow submarine sediments including the BSR and other reflectors



Gravity and Magnetic Studies over a part of K-G Basin

Gravity and magnetic (G-M) surveys were carried out by CSIR-NGRI for the delineation of subsurface structural features over a part of onshore Krishna Godavari basin. A total of 2532 gravity and magnetic observations were recorded in and around the area. After applying the

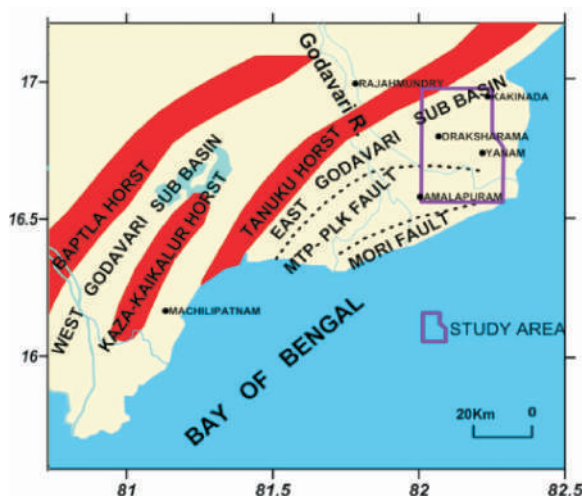


Fig. Tectonic element of KG basin showing location of the study area



necessary corrections to the observed data, Gravity and magnetic anomaly maps were prepared for digital analysis and quantitative interpretation. The Bouguer gravity anomaly map of the region shows prominent NE-SW trending highs between Draksharama and Yanam due to the basement up warps referred as “Draksharama/Yanam ridge” and lows on either sides due to basement depressions recognized as “Polavaram and Mandapeta trough” towards SE and NW respectively. Magnetic anomaly map shows well defined NE-SW trending lows associated with gravity high of Yanam ridge whereas the short wavelength and large amplitude magnetic anomalies are interpreted due to presence of varying thickness of Deccan traps overlying the Cretaceous sediments. Modeling of NE-SW trending linear magnetic low associated with basement up warp (Yanam ridge) requires remnant magnetization (Incl= -480 and Decl=450) in the basement rocks which is similar to measured palaeomagnetic directions of Charnockites of Eastern Ghat terrain. Therefore, it is inferred that Charnockite constitutes the basement in this region. While interpretation of the short wavelength magnetic anomalies requires remnant magnetization (Incl= -500 and Decl=3300) for the source which corresponds to the normal polarity chron (29N) of Deccan stratigraphy which matches with the measured palaeomagnetic direction of Deccan basalts from Rajahmundry.

Joint modelling of gravity and magnetic anomalies using constraints from available seismic and borehole information shows significant undulations in the basement (Figure). It reveals basement as shallow as 2.5 km between Draksharama-Corangi and Endamuru and as deep as 6.5km in the south between Mummidivaram and Polavaram and 6.25 km in the NW corner to the north of RC Puram. It may be emphasized that in spite of non-uniqueness in potential field modeling, the depth section presented in this report appears to be more plausible due to constraints provided from seismic section and borehole information. The structural faults derived from vertical and horizontal gradient of gravity map coincides with the major discontinuities in the basement. These

faults are mostly aligned in the Eastern Ghat and the Pranhita-Godavari- Gondwana tectonic trends.

Delineation of Groundwater Potential Zones in Deccan traps covered -Godavari Rift Zone

Electrical Resistivity Tomography (ERT), studies were carried out CSIR-NGRI at twenty four sites for delineation of ground water potential zones at deep levels in the form of intertrappeans, faults and fracture zones within the Deccan traps and Gondwana formations below the traps. 2-D resistivity images obtained from inverse modeling of measured apparent resistivity data have indicated potential groundwater zones in the form of intertrappeans and fracture zones within the traps and Gondwana formations below traps. 2-D resistivity images for sites P34 and P37 reveal geological formation with resistivity value in the range of 15-30 Ohm m representing good aquifer, formations with resistivity values in the range of 30 to 40 ohm m represent moderately saturated aquifer. Formations with >70 Ohm m resistivity value represent dry massive basalts. ERI at site P30 near Budhla indicates two potential zones of groundwater the first zone between 195 m to 285 m distances and the second zone lies below 405 m distance. At this site, a borewell was drilled, which revealed that the interpreted litho units at this site are in close agreement with the litho units obtained from the borewell. ERI's of sites P28 near Ramgiri and P34 near Sasundri indicate a layer of water-bearing formation in the depth range of 40 m to 100 m along the entire length of the profile. This layer is overlain by massive basalt layer. ERI of site P37 near Kohali indicates water bearing layer up to a depth of ~50 m all along the profile. ERI of site P41 near Kohli indicates a water bearing formation bounded by two units of massive basalts. This formation is exposed on the ground surface between 180 m and 290 m. This zone could be a recharge site. At site P43, ERI indicates water bearing formation underneath a ~30-50 m thick layer of massive basalt. The thickness of the massive basalt is maximum around the central points and is minimum towards eastern side.

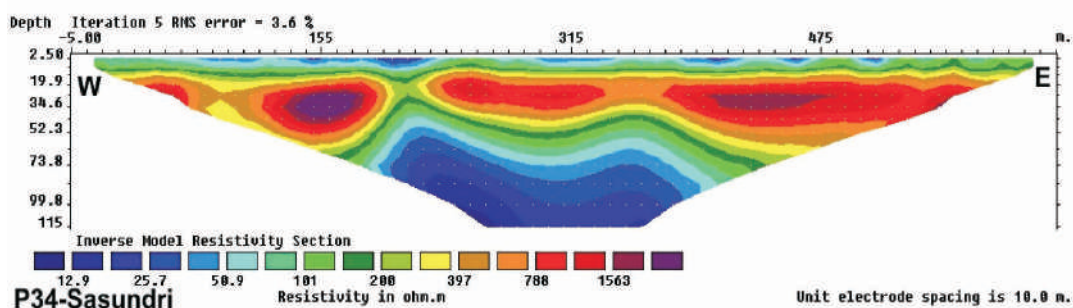
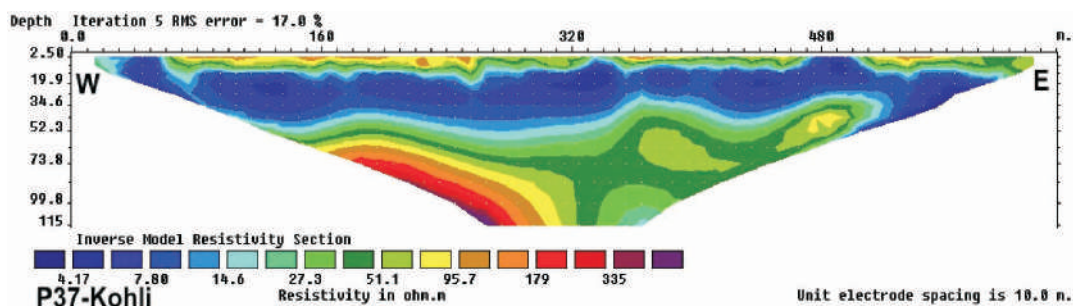


Fig. Inverse Resistivity Models for P34 and P37 sites

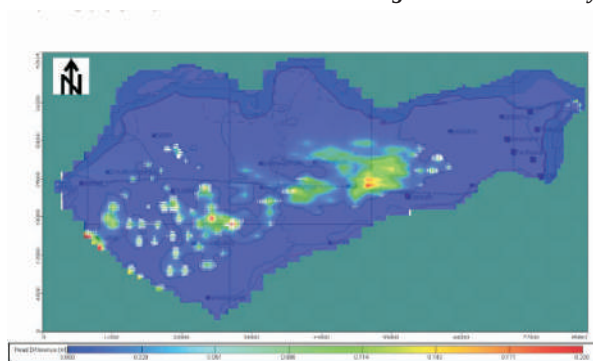


Fig. Head Difference scenario 2 for the year 2031

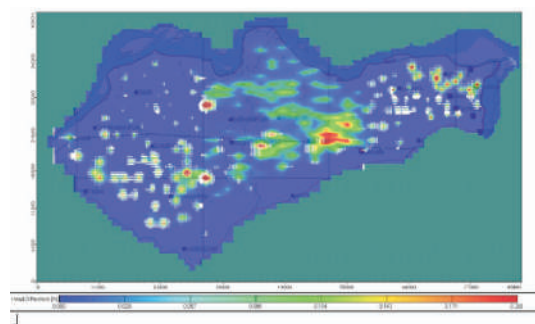


Fig. Head Difference scenario 3 for the year 2031

Geogenic Contamination through Arsenic in Groundwater in Western Bihar : A Sustainable Solution with the Application of Aquifer Modelling

CSIR-NGRI provided a sustainable solution using aquifer modelling to mitigate the arsenic contamination in groundwater of Western Bihar.

A four layered numerical model has been built with the first layer as an unsaturated zone, 2nd layer as the first and shallow aquifer, 3rd layer as aquitard consisting of clay and the 4th layer as the second and deeper aquifer consisting of medium to coarse sands. The model domain is bound by River Ganga,

Son and Thora (taken as a River Boundary) on its northern, eastern and south western side respectively. South eastern side is bounded by a road. The model after calibration for a period of ten years was used for predicting the multi-layer groundwater levels for a further period of 10 to 20 years i.e. up to 2031 for a number of expected scenarios. The principal indicator for the safe withdrawal of Arsenic free groundwater has been the reversal of leakage between the two aquifers. Hydraulic head of the second aquifer (Arsenic free confined aquifer) is higher than the groundwater table in the first (Arsenic contaminated) aquifer in the entire region and an upward leakage exists wherever the intervening clay layer is thin.

However, heavy and indiscriminate pumping from the second aquifer will create reversal in the leakage and will contaminate the second aquifer also.

Thus with the expected/projected scenarios, the groundwater levels in both the aquifers were predicted and difference between the two aquifer levels are drawn which predicts the upward leakages in red colour.

- Scenario 1: Domestic water utilized from second aquifer
- Scenario 2: Domestic and irrigation water utilization from second aquifer
- Scenario 3: If projected irrigation water utilization pump in monsoon season from 1st aquifer and during non-monsoonal season from 2nd aquifer

Seismic Hazard—Risk Evaluation & Earthquake Precursor related studies

CSIR-NEIST studied Seismic Site Amplification and shallow sub-surface lithology for Agartala city (N23.70° – 23.95°; E91.24° – 91.32°), and its suburbs cover 120sq km. For this purpose, short period, 3 component weak motion sensors and 3 channel seismic recorders were deployed to acquire ambient noise at 1.0 – 1.5 km grid interval covering an area 120sq km. The Ground Penetrating Radar (GPR) survey was conducted to delineate the shallow sub-surface structures and neo-tectonic signatures in all accessible areas including the City suburbs. The data contains a survey length of total 32 km recorded in several N-S and E-W profiles. It has been observed that the upper soil horizon within the 3.0 – 8.0m depth range is a highly deformed silty-sand layer, and it persists throughout the built environment of the city. Below this silty-sand horizon, the impervious clay layer extends up to a depth of about 16 m. The available information was incorporated to prepare the microzoning maps helpful in hazard zoning, land use and urban development.

Characterization, beneficiation and utility study of some graphite deposits from Arunachal Pradesh

CSIR-NEIST developed a beneficiation technology for a fixed carbon of 47.17% with 84.15% recovery by using 10% slurry concentration at pH 10 with 5 min settling time. On addition of different doses of sodium silicate viz 0.005 gm, 0.01gm and 0.02 gm on 10% slurry concentration at various pH no enhancement on beneficiation was seen as obtained from only distilled water at pH10. The highest fixed carbon of 44.66% with 77.60% recovery has been obtained by using 0.01 gm of sodium silicate to

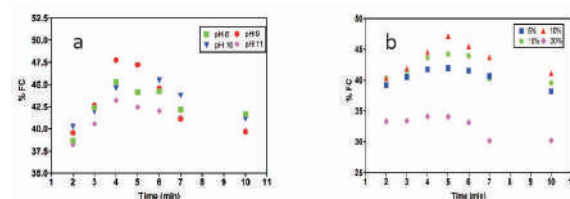


Fig. Variation of fixed carbon with time at (a) 10% slurry conc. at various pH and (b) Various slurry conc. at pH10

the 10% slurry concentration of graphite at 5min settling time and pH 10. Beneficiation of graphite by chemical leaching method at different temperature using different alkali has also been studied. A highest fixed carbon of 34.16% with 68.11% recovery of graphite has been obtained by this method using NaOH at 5% alkali concentration.

Technology Developed

Classification and authentication of unknown water samples using machine learning algorithms

CSIR-CEERI developed water sample classification and authentication, in real life which is based on machine learning algorithms. The proposed techniques used experimental measurements from a pulse voltametry method which is based on an electronic tongue (E-tongue) instrumentation system with silver and platinum electrodes. E-tongue include arrays of solid state

ion sensors, transducers even of different types, data collectors and data analysis tools, all oriented to the classification of liquid samples and authentication of unknown liquid samples. The time series signal and the corresponding raw data represent the measurement from a multi-sensor system. The E-tongue system, implemented in a laboratory environment for 6 different BSI (Bureau of Indian standard) certified water samples (Aquafina, Bisleri, Kingfisher, Oasis, Dolphin, and McDowell) was the data source for developing two types of machine learning algorithms like classification and regression. A water data set consisting of 6 numbers of sample classes containing 4402 numbers of features were considered. In this study, a PCA (principal component analysis) based classification and authentication tool was developed as the machine learning component of the E-tongue system. A proposed partial least squares (PLS) based classifier, which was dedicated as well; to authenticate a specific category of water sample evolved out as an integral part of the E-tongue instrumentation system. The developed PCA and PLS based E-tongue system emancipated overall encouraging authentication percentage accuracy with their excellent performances for the aforesaid categories of water samples.

42 GHz, 200 kW Gyrotron.

CSIR-CEERI developed indigenously design technology of low power and high power Gyrotron and further implemented in the other high frequency gyrotrons like 95 GHz, 120 GHz, 170 GHz Gyrotron.

The design of a triode-type magnetically tunable magnetron injection gun (MT-MIG) is presented for 1-MW 110-, 120-, and 127.5-GHz-frequency gyrotrons with the various operating modes. Some basic equations relevant to the problem available in the literature have been used to obtain the preliminary design. Computer simulation has been performed by using the commercially available code EGUN. The triode-type MT-MIG with the accelerating voltage of 80 kV, the beam current of

40 A, the average transverse-to-axial velocity ratio of the electron beam of 1.26–1.35, and the maximum transverse velocity spread of less than 5% has been designed.

System for detection of synthetic adulteration in raw milk

CSIR-CEERI developed system for detection of adulteration in raw milk (KSHEER-SCANNER) for on-line testing of the spurious milk. The system far excels than the presently available products and equipment available in the dairy industry or the Indian market. The system has capability to detect urea, salt, detergent, liquid soap, caustic soda, boric acid, hydrogen peroxide and sodium bicarbonate. On-line detection and checking has become necessary in the recent times because of the serious problem of adulteration. With the deployment of the system at village milk collection centers across the country would impact that the quality check of the milk becomes easier thereby improving the health standards of the people.

On-line Surface Inspection Module for Hot Rolled Steel Strips

In collaboration with R&D centre for Iron and Steel, SAIL, (RDCIS, Ranchi), CSIR-CEERI developed an online surface inspection module for inspection of hot rolled steel strips. The surface inspection module illuminates the surface of fast-



Fig. Online surface inspection module for hot rolled steel strips

moving steel strip with stroboscopic lighting, captures images of a portion of the strip width in synchronization with the strip movement, preprocesses and analyzes the images, detects surface abnormalities, identifies real defects like scratch, blister, rolled-in-scale and pseudo-defects like water droplets, and provides results under real-time constraints. The module and its functionality have been successfully demonstrated at Bokaro Steel Plant to the sponsoring agency. The collaborating agency, RDCIS, is taking steps to utilize the developed technology towards the development of a complete surface inspection system for hot-rolled steel strips. The novelty of the development includes (i) high-speed imaging of fast-moving, red-hot steel strips moving at speeds up to 20 meter/second, (ii) efficient algorithms for image pre-processing, defect detection and defect identification, (iii) image acquisition and analysis software implemented using multi-threading on advanced vision processor hardware to provide real-time performance.

NIRS Based On-line Instrument for Quality Assessment in Edible Oil Industry

CSIR-CEERI and CSIR-CFTRI alongwith and industrial partner M/s Kaleesuwari Refinery Pvt. Ltd. Chennai developed a Near InfraRed Spectroscopy (NIRS) based on-line instrument for quality assessment in edible oil industry. They



Fig. NIRS based on-line instrument for quality assessment in edible oil industry

investigated the relationship between NIRS and quality parameters such as Free Fatty Acids (FFA) & Peroxide Value (PV) and the development of a measuring system for on-line monitoring of these parameters in selective edible oils through chemometric techniques. The developed system was calibrated against samples collected from the industry and with analytical data derived from these samples by the CFTRI team. The technique is non-destructive, rapid and the system can accurately monitor even very low levels of free fatty acids (less than 0.25%). The system was tested in real time at the refinery and was demonstrated with all the features to the industry as well as to the sponsor. The system will be a great boon to the edible oil industry that is looking towards optimizing the production with greater product quality in order to comply with food safety act.

Immobilization of enzyme on long period grating fibers for sensitive glucose detection

Routine, yet sensitive diagnosis of glucose in blood is a critical parameter in healthcare. Most of the glucose biosensors approved by US Food & Drug Administration (FDA) are based on electrochemical techniques. Long period grating (LPG) fibers have been proved as versatile sensors for temperature, axial strain structural health monitoring and index of refraction measurements. Despite some significant advantages of these fiber grating based sensors, such as high sensitivity and low noise, little efforts have been made on their utilization for clinical analysis. In some published reports, unmodified LPG fibers for the non-selective analysis of very highly concentrated glucose solutions, e.g. 300 mg mL⁻¹ CSIR-CSIO proposed glucose oxidase (GOD) immobilized LPG fibers for the specific and sensitive detection of glucose. The treatment of LPG fibers with aminopropyl triethoxysilane has induced binding sites for the subsequent GOD immobilization. Field emission scanning electron microscopy, confocal laser scanning microscopy, infrared spectroscopy and Raman spectroscopy have provided detailed evidences about the

effectiveness of the adopted biofunctionalization methodology. The enzyme activity is conserved during the immobilization step. Fabricated LPG sensor was tested on different glucose solutions to record the transmission spectra on an optical spectrum analyzer. The wavelength shifts in the transmission spectra are linearly correlated with the glucose concentration in the range of 10–300 mg dL⁻¹. The fabricated sensor gives fast response and is demonstrated to be of practical utility by determining glucose contents in blood samples. Proposed technique can further be extended to develop LPG fiber based novel, sensitive and label free nanosensors for disease diagnosis and clinical analysis. Application of long period grating fiber for disease sensing offers highly sensitive detections. The developed technology may be utilized for routine and early screening of diabetes. The technique can further be extended for other immunodiagnostic applications.

Recovery of pure ZnO nanoparticles from spent Zn-MnO₂ alkaline batteries

Effective recycling of spent batteries has become a matter of global concern as most of the existing technologies generate low-value products.

CSIR-CSIO attempted to recover pure ZnO (zinc oxide) nanoparticles from spent Zn-Mn dry alkaline batteries. Spent batteries were dismantled to separate the contained valuable metals of the cell electrodes in the form of black powder. Treatment of this black powder with 5 mol L⁻¹ HCl produced leach liquor, primarily containing 2.90 g L⁻¹ Zn and 2.02 g L⁻¹ Mn. Selective and quantitative liquid-liquid extraction of Zn(II) was then carried out in three counter current steps by using Cyanex 923 (0.10 mol L⁻¹) in n-hexane. Zn(II) distributed in the organic phase as complex ZnCl(2)·2R (R = Cyanex 923 molecule). The metal loaded organic phase was subjected to combust at 600°C to yield pure ZnO nanoparticles (40–50 nm). Important characteristics of the synthesized nanoparticles were investigated by field emission scanning electron microscopy (FESEM), energy dispersive X-ray spectroscopy (EDX), X-ray

diffraction spectroscopy (XRD), and atomic force microscopy (AFM). The proposed technology of the economically beneficial recycling of the industrial waste may lead to better route of waste management. The recovered nanoparticle is pure and may find applications in several fields. The underlined technology may further be extended for the utilization of several other wastes.

Sensors and Instrumentation for Pesticide Estimation

CSIR-CSIO made an attempt to develop a rapid and sensitive fluorescence based enzymatic biosensor for specific and sensitive detection of organophosphorous pesticides in soil, food and water samples. Organophosphorus hydrolase has been employed extensively for catalysis based biosensor synthesis with optical, potentiometric and amperometric based detection mechanism. Institute determined the response of bioconjugates prepared by utilizing OPH and pH sensitive polyanionic fluorophore i.e. pyranine (8-hydroxypyrene-1,3,6-trisulfonic acid trisodium salt) in different molar ratios by the aid of electrostatic force. Two types of bioconjugates were prepared, one of them contained mature form of OPH obtained from *E. coli* cells expressing organophosphate degrading (opd) gene from a tac promoter, whereas the variant OPH6His, has 6x histidine tail at C terminus. The investigation was carried out utilizing the bioconjugates of different molar ratios prepared with both the enzymes and ratio showing maximum degree of labeling with pyranine was selected for the detection of organophosphates in standard samples. The lower limit of detection for paraoxon was ~20 ppb and for methyl parathion and coumaphos it was ~50 ppb under optimized conditions (55–60 °C) with the reaction time of 3 min. These features of the prepared conjugate make it a strong contender for the development of the field deployable biosensor for organophosphates estimation. The advantage of developing this analytical tool is to properly monitor and control the indiscriminate use of pesticides by the farmers.



Determination of degree of unsaturation of edible oils

Total unsaturation of oils and fats used in commercial food products acts as an indicator of their nutritional value. Iodine value, which is a measure of degree of unsaturation, is an important parameter to identify different edible oils. Iodine number represents number of centigrams of iodine absorbed by 1 g of edible oil or fat. Globally, the available instrumentation for determination of degree of unsaturation involved costly analytical techniques like NMR, FTIR, NIR, Gas Chromatography etc. CSIR-CSIO have been able to record a direct display reading of drop in potential across the sensing electrode and reference calomel electrode which represents the degree of unsaturation i.e. iodine value. The work carried out uses platinum–calomel electrodes electrochemical system for the determination of Iodine number. The change in potential, when platinum and calomel electrodes are immersed in 2% iodine mono-chloride solution (ICl) in acetic acid with respect to iodine mono-chloride solution containing edible oil, has direct correlation to degree of unsaturation of edible oils. Edible oils have a chain of carbon atoms with double bonds where addition of halogen reagent takes place. In this investigation iodine mono-chloride solution in glacial acetic acid reacts with edible oils and change in potential of reaction mixture with respect to ICl stock solution using platinum and calomel electrodes relates to the degree of unsaturation of edible oils. A portable system has also been fabricated in which potential change directly relates to iodine number of the edible oils, which is directly displaced on Liquid Crystal Display (LCD).

Long period fiber gratings based isolation filter

Wavelength division multiplexing (WDM) is one of the most suitable methods of increasing the transmission capacity of an optical fiber system. In a WDM based system, high isolation loss between adjacent channels is required so that there is less interference from source instability and very

little cross talk between neighboring channels. CSIR-CSIO designed and developed a wavelength tunable WDM channel isolation filter based on two concatenated chirped long period fiber gratings. An inter-grating space (IGS), deliberately introduced between the two gratings, provides an extra phase difference between the core and cladding modes. Changing this phase by heating the IGS without affecting the gratings tunes the channels. A theoretical account of the filter action is also presented and the results are found to be in excellent agreement with the experiments. Unlike the filters based on normal concatenated chirped LPGs without an IGS, the present filter shows a linear tuning over an increased spectral range.

Few studies have been reported based on two concatenated chirped LPGs. However, this design is based on two concatenated chirped LPGs with an inter-grating space (IGS) between them. The IGS provides an extra phase difference between the core and cladding modes, which can be changed by means of heating this space, without affecting the gratings and the filter channels can be tuned to any desired wavelength.

Quantum dots based molecular sensing

Fluorescence-based molecular sensing and immunohistochemistry based cellular imaging are commonly carried out with the application of organic dyes. Quantum dots (QDs), or the semiconducting nanocrystals, are better than organic dyes because they are brighter, size tunable, and more photostable than dyes. Most of the proposed QD-based biosensing systems involve elements of known toxicity, such as Cd and Pb. CSIR-CSIO developed biocompatible quantum dots based fluorescent bionanoconjugate for protein sensing. Successful bioconjugation was characterized with the absorption and emission spectra showing blue shifts of around 40 and 30 nm, respectively. Gel electrophoresis and particle size distribution studies further confirmed the mass increment of QDs after their functionalization with anti-BSA. Surface plasmon resonance spectrometry has been used to study the affinity

of QD-(anti-BSA) probes for bovine serum albumin (BSA). Photoluminescence quenching of the developed probe is observed in the presence of BSA. The proposed approach may be useful for realizing *in-vivo* applications of the quantum dots for disease diagnosis and cargo transport.

Major Facility

(a) An AWS on RV Sindhu Sankalp has been linked to INSAT-C which provides an hourly update of meteorological parameters (True wind speed & direction, air-temperature, air-pressure, humidity, solar radiation (SW, LW), ship heading, & rainfall along with Latitude, Longitude). Although AWS provides Latitude and Longitude, same is not being displayed in view of piracy and safety of the vessel. System has been tested for couple of months for its consistency and stability. Data from AWS are transmitted to the Ground Receiving Station at INCOIS and from there is it linked to the CSIR-NIO server. At CSIR-NIO, server based application script running keeps track of incoming data and update plots as and when new data arrives.

(b) For data collection on the coastline, a mobile laboratory by CSIR-NIO has been commissioned especially for the Ballast Water Management Program of India (BAMPI). The main aim of the mobile laboratory is to routinely collect data at least for the next 5 years at the major ports of India where the ballast water is released by the cargo vessels along with microorganisms that have likelihood of threatening our rich biodiversity. The mobile laboratory contains wet and dry laboratories wherein seawater and sediment samples can be analyzed for chemical and microbiological parameters as soon as they are collected.

1.6 CSIR 800

Granito Ceramic Tiles: A Success Story of Innovation by CSIR-CGCRI, Naroda

CSIR-CGCRI developed an alternate body mix for granito tiles production and thereby replaced the

expensive imported Ukraine clay with indigenous clay that has immensely benefitted the tile industries of Morbi, Wankaner and Himatnagar regions in Gujarat. Ukraine clay by nature is a combination of several minerals and possesses some unique properties. Unfortunately available raw materials in India individually cannot provide the same attributes. However, CSIR-CGCRI has shown a combination of sericitic pyrophyllite and Bikaner clay in suitable proportion could compensate for the same. About 75 trial bodies, two optimized compositions were selected and passed on to M/s Decolite Ceramics, Morbi for plant trial. The trials produced properties were found to be almost identical to those of the production body.

Seaweed farming

More than 100 BPL family in the districts of Ramnathapuram (Akkalmadam and Pamban), Pudukkottai (Kottaiappattinam) and Tanjavore (Chatram and Palakudi) of Tamil Nadu were trained by CSIR-CSMCRI regarding the offshore cultivation of *Kappaphycus* seaweeds and they were able to earn their livelihood from this cultivation. Based on our survey data, the Gujarat



Fig.

Livelihood Promotion Co. Ltd (A Gujarat government undertaking company) is planning to promote seaweed cultivation through Self Help Groups (SHGs) in Jafrabad coast of Amreli District in a big way.

Multi-institutional demonstration trials showing efficacy of liquid seaweed sap from *Kappaphycus alvarezii* and *Gracilaria edulis* on different crops

Kappaphycus and Gracilaria saps were tested by CSIR-CSMCRI at different centres of 22 Agricultural Universities and ICAR Institutes in India belonging to different agro-ecological regions and different soil types to demonstrate their efficacies towards improvement in production and nutritional qualities of different crops viz., rice, maize, sesame, soybean, green-gram, black-gram, sugarcane, fodder/grass and potato. Marked improvement in productivity of different crops was observed by application of Kappaphycus and



Fig. Sesame crop showing difference in the vigour and leaf colour due to Kappaphycus-sap application

Gracilaria sap over control (water spray + recommended dose of fertilizers). Application of Kappaphycus sap recorded yield improvement in rice of 8.4% (ICAR-CRRI, Cuttack centre), 18.2% (ICAR-CRRI, Gerua, Assam centre), 11.2% (at GKVK, Bangalore), 28.3% (Regional Rice Research Station, Navsari Agriculture University, Navsari, Gujarat). Yield improvements in maize of 15.9% (GKVK, Bangalore) and 25.8% (RAU, Samastipur) were recorded, while significant improvement in yield of potato by 14-18% with corresponding starch content improvement of 33.2% (TNAU, Coimbatore) and by 26.6% (PSB, Shantiniketan, WB) were also obtained. Sesame

recorded ca. 5% improvement in seed yield and oil content (TNAU, Coimbatore), while ca. 20% improvement in seed yield were reported at 2 different agro-climatic conditions (Nadia and Birbhum districts) of West Bengal. At TNAU, green-gram yield was increased by 10.3%, while the increases recorded at GBPUAT, Pantnagar and BCKV, W.B were 33.0 and 39%, respectively, over control. Gracilaria sap also responded favourably for many of the crops. Farmers in general were highly benefited through improved productivity of the food crops and have evinced tremendous interest in it.

Raising Social Awareness for Arsenic Prone Areas in West Bengal

It was observed that only 15 -20% of exposed individuals develop arsenic-induced skin lesions. A case-control study was conducted by CSIR-IICB scientists in West Bengal, involving 206 cases with arsenic-induced skin lesions and 215 controls without arsenic-induced skin lesions. Data infers that possession of at least one Met allele (Met/Met and Thr/Met) imparts significant protection towards the development of arsenic-induced skin lesions.

CSIR-IICB has organized 136 Medical Camps in last 7 years in Arsenic affected and unaffected areas in West Bengal and provided free essential medicine and suggestion through expert physicians to approximately 20,000 patients.

CSIR-IICB also extended active co-operation to the physicians in operating skin cancers of 56 arsenic cancer patients in last 7 years at free of cost to save their lives.

Installation of Iron Removal (IR) plants

Hand pump attachable IR plants based on the CSIR-NEERI's technology were installed at 66 locations by Public Health Engineering Department, Chhattisgarh in Rajnandgaon, Durg and Kanker districts. Raw water and treated water iron concentrations were 3-8 mg/L and less than



Fig. HP attachable iron removal plants installed in Durg district

0.1 mg/L respectively which indicate satisfactory performance of the plant. Capacity of the plant is about 1000 L/hr.

Solar energy based electrolytic defluoridation unit for potable water supply

Defluoridation technique based on electrolysis has been developed at CSIR-NEERI.

The performance of the plants is being monitored. The plants which are operated on batch mode have 2 reactors of 1000 L capacity each which takes about 4 hrs. to complete the process of electro-coagulation and settling.

Two solar energy based Electrolytic Defluoridation (EDF) demonstration plants were installed at village Usarvara, Balod Block, Durg District,



Fig. Installation of 25000 litres/day coal mine water reclamation plant in progress



Fig. Solar power based EDF plant at the Adiwasi Kanya Shiksha Parisar, Chhindwara

Chhattisgarh and Sargapur village in Seoni district and at the Adiwasi Kanya Shiksha Parisar, Chhindwara in Madhya Pradesh in collaboration with PHEDs. CSIR-NEERI has transferred the “Know How” to the following six agencies:

- M/s HES Water Engineers (India) Pvt. Ltd. Nagpur
- M/s L.TEK Systems, Nagpur
- M/s Nagpur Chemicals, Nagpur
- M/s.. SRE Senthil Engineering Company, Coimbatore
- M/s. Spectrapure Hi-Tech Concepts, Ranchi

Safe drinking water

The database created earlier by CSIR-NML on naturally occurring minerals for remediation of toxins (www.safewater.in) is continuously

A Brochure of Analytical Method for Fluoride Determination in the Field

Colour(x)	F ⁻ conc ⁿ , (ppm)
0	0
1	1
1.5	1.5
2	2
4	4
6	6
8	8
10	10

Salient features of the technique:

- Broad analytical range
- Simple and user friendly
- Rapid and sensitive
- Interference free
- Ideally suitable for drinking water

Fig. Colorimetric analysis of fluoride reference template

updated. Arsenic and fluoride information page has been added which contains various arsenic and fluoride related issues and its mitigation.

A plant of a 25000 capacity litres per day coal mine water reclamation procedures has been installed at Putki colliery Dhanbad which could be handed over to M/s. Bharat Coking Coal Limited, Dhanbad after completion of field trials.

A colorimetric kit has also been developed for field estimation of fluoride. Both quantitative and semi quantitative estimation can be carried out. This is a simple and user friendly protocol providing a broad analytical range. The method will be sensitive, interference free and would be ideally suitable for drinking water.

Pure drinking water

CSIR-CSMCRI fabricated & installed 65 domestic dearsenification units in the houses of Maslandapur, Ghoshpur and Merudandi villages of 24 pargans (N), West Bengal. Five community scale dearsenificating units with a production capacity of 250 litre per hour were installed and the units cater to healthy drinking water requirement of 50 families in the region. 250 arsenic test kits to check arsenic in drinking water were prepared and distributed to beneficiaries along with domestic and community scale dearsenificating units.

Two solar PV powered brackish water RO plants were installed in Bhopa ki Dhani and Solawata



Fig. Resin-based community scale arsenic removal units installed in mosques in W.B

villages of Ajmer district in Rajasthan in the year 2012. 6000 LPH seawater RO plant installed at Narayan Sarovar of Kutch region in Gujarat.

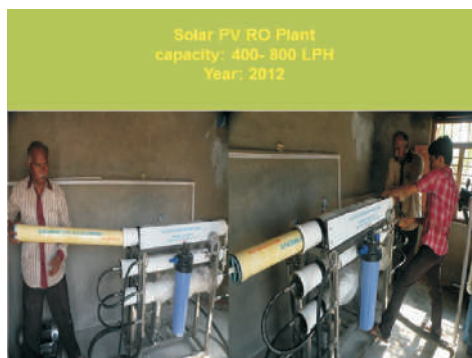


Fig. Solar PV powered brackish water RO plant installed at Solawata village

Anti-tarnishing lacquer coating for brasswares: Moradabad brass ckyster

A cost effective but efficient anti tarnishing lacquer has been developed by CSIR-NML. A new copolymer with very good corrosion inhibition properties for copper and its alloys was synthesized and was used for preparation of the lacquer. Field tests (outdoor and indoor exposure) of the partly coated brass panels reveal that the developed lacquer is very efficient to prevent tarnishing for long durations (AAC_4). Accelerated tarnishing test using ASTM B 809 procedure confirms that the developed lacquer is comparable or more efficient than INCRALAC, the internationally available lacquer. The lacquer was applied to all the brass panels attached to the doors of CSIR-NML building to maintain the luster of the panels (AAC_5). The lacquer was also produced in bulk scale (10 L) and was supplied to the brass artisans of Moradabad Brass Cluster, Uttar Pradesh for their use in collaboration with National Innovation Council of India.

Paving blocks from steel slag

CSIR-NML has set up a state of the art pilot plant for the production of paving blocks using a geopolymerisation process. This pilot plant is being used for the generation of large size of samples for limited market trials. The pilot plant

is operational and working with more than 95% efficiency. 1000 numbers of paving blocks are being produced every day (8 hours shift). More than 50 tons of product have already been produced which will be laid at different places for field evaluation. The process parameters and storage conditions has been optimized. Specifications of steel slag, granulated blast furnace slag and fly ash have been prepared. Studies on the shelf life of alkalies have also been completed. Rejection rate is less than 5%, and efforts to reduce it further are being made. The product complies with the USEPA (United States Environment Protection Agency) limit for leaching of toxic metals and is environmentally safe.

Family size compact anaerobic digester cum biogas plant

The anaerobic or biogas plants of small or medium sizes currently in use need large volumes of water and the solids are fed directly on or after grinding. Such plants discharge large quantities of effluent containing partially and undigested organic matters including fats and fatty acids with less than 5% solids. Management of such digesters is extremely difficult due to the voluminous discharge of effluents with malodour, and regular requirement of precious water.

The newly developed anaerobic digester by CSIR-NIIST is a complete treatment system for the biodegradable household wastes. The digester of 350 litre volume is sufficient to treat around 3 kilograms wastes a day. It produces 250 to 600 litre of methane rich biogas daily by loading of 1 to 3 kg wastes as input. The biogas produced



Fig. Household Wastes Digester cum Biogas plant

can be conveniently stored in biogas balloons, waste tubes or in the digester itself. There is no need of adding water or wastewater. Hard waste materials such as bones are fed through the attached crusher and its central axis rotated by hand for a few times to enable its thorough mixing with other biomass wastes. The wastes loaded through the inlet port travels more than 200 days in the digester before reaching the outlet. The horizontal design of the digester facilitates the slow movement of wastes, thereby enabling decomposition of large sized wastes materials. The digested discharge from the outlet is thick slurry free from acidic foul smell unlike the discharge from widely used household biogas plants. The discharged slurry can be easily collected and stored conveniently for direct soil applications upon requirement.

Decorative roofing tiles

CSIR-CGCRI has been applauded by from Secretary, Murli Clay Tiles Cluster Industrial



Fig. Decorative roofing tiles manufactured by K K Potteries in Murli Tile Cluster based on the CSIR-CGCRI formulation

Co-operative Society Ltd, Bankura (West Bengal) for successful implementation of decorative roofing tiles technology. The suggested formulation of locally available clay blended with fly ash curtailed the fuel consumption by 10 % in view of lightweight products that proved to be 40 % lighter.

Energy saving low mass kiln furniture: helping hand to ceramic MSMEs

CSIR-CGCRI's Outreach Centre at Naroda disseminated the low mass kiln furniture



Fig. Technology being disseminated to crockeryware

technology. About 22 ceramic industries of the Micro Small and Medium Enterprises (MSMEs) in Gujarat took the technical knowhow through the technology dissemination programme. A revenue of '1.65 lakhs was earned towards dissemination fees. The salient feature of the technology lies in the use of low cost locally available raw materials in crockery making.

Application of Ceramic Coating on Glass Fibre Fabric: Three participants of M/s URJA Products Pvt. Ltd, Ahmedabad joined a programme



Fig. Rural potters undergoing training

conducted by CSIR-CGCRI. The main objective of the programme was to demonstrate making of ceramic coating on glass fabric which would provide sufficient strength, stiffness and fumeless coating as compared to uncoated fabric to improve filtration properties during casting.

Programme for Rural Potters: Village artisans were given hands-on training by CSIR-CGCRI on various shape making techniques, various raw materials, process related matters along with firing, productivity and quality aspects of terracotta wares. The artisans were exposed to modern processing methods so that they would be able to pass on the knowledge gained to other artisans in rural ambience. The programme was sponsored by the Matikaam Kalakari & Rural Technology Institute, Gandhinagar

Glass Beaded Bracelet Making & Manufacturing of Beaded Jewellery

In India, about 4 Lakh people are engaged in the manufacture of glass bead/beaded products which



Fig. A view of the training programme at Village Harra, Meerut



Fig.

lead to annual export (direct /indirect) worth ‘1600 Crores. The uniqueness of this activity is that there is no institute or organization in the country for glass beaded jewellery making. Through programme CSIR-CGCRI helped to generate self employment for the backward and low income groups of population. This programme was held at Keymore, Katni, Madhya Pradesh.

CSIR-CGCRI provided hands-on training to artisans of Glass Beaded Jewellery Making, Glass Beaded Flower Making and Glass Beaded Bouquet making and fixing of Rhinestone for glass on sari and suits

Crop diversification in vetiver through intercropping for higher productivity

Oil of vetiver (khus) is used in high grade perfumery and flavouring products. Field studies were conducted at CSIR-CIMAP to study the production potential of vetiver intercropped with Sweet Basil, Tagetes, Mentha, etc. The cropping systems were highly productive in terms of land equivalent ratio (LER)-1.33, land use efficiency (LUE)-1.33% and monetary equivalent ration (MER)-1.58 and a net return of ‘ 2.50, -2.70. Results of intercropping of vetiver with Aonla orchard indicated that plant population of vetiver @ 1,11,000 plants/ha and application of 80:40:40 kg NPK/ha were suitable for achieving highest vetiver oil yield (13.5 kg/ ha).

Search for alternative to Jiget powder used in Agarbatti industry

Under a CSIR-National Innovation Council (NInC) joint initiative for cluster development, CSIR-CIMAP made an attempt to find out alternative for Jiget (bark of *Litsea glutinosa*) Tripura Bamboo Cluster, Agartala as dwindling supply of this essential ingredient used as ‘binder’ or ‘adhesive’ is posing a grave threat to the survival of about ₹3000 crores strong agarbatti (incense sticks) industry in India. Some potential combinations developed and tried by CSIR-CIMAP indicates the possibility of reduction of use of jiget and

improving the quality of agarbattis. Trial-cum-demonstration of one such combination of CSIR-CIMAP was organised during the year. at Agartala in which 25 women engaged in making of charcoal powder based agarbattis participated. The results of the demonstration indicated that there was a reduction of consumption of Jiget by about 9% in CSIR-CIMAP combination containing flower powder and jiget made in the ratio of 5:1 as compared to the traditionally used Agartala combination of charcoal powder and jiget made in the ratio of 3:1. Also, number of agarbattis made and burning time of the agarbattis made from CSIR-CIMAP combination was found to be about 25-30% higher as compared to charcoal powder based agarbatties. Being completely devoid of charcoal powder, the CSIR-CIMAP flower based combination was found to be ‘skin friendly’ by the women and also keeps their hands and work place clean.

Economic analysis of Menthol mint cultivation at farmers’ field

The study carried out by CSIR-CIMAP in the Barabanki district of Uttar Pradesh has shown that the major portion of operational cost in cultivation of menthol mint (*Mentha arvensis*) is shared by hired labour, interculture operations, distillation charges, irrigation and machine / tractor charge. The overall benefit - cost ratio has been found to be 2.55, which indicates a higher profit for farmers on less investment in mint cultivation. The independent variables like human labour, machinery, manures and fertilizer, irrigation charges and intercultural operations have shown a positive and significant impact on the returns of mint crop in the study area. The major problems faced by the farmers were high input cost, erratic supply of electricity, lack of adequate information, infrastructural facilities, regulated markets and energy - efficient distillation units.

Public Private Partnership model for contractual cultivation of *Artemisia annua*

The anti-malarial drug plant *Artemisia annua* variety ‘CIMAP Arogya’ was cultivated in more

than 1200 acres of land in different districts of Uttar Pradesh and Uttarakhand. The purchase of the dried herb was facilitated by M/s IPCA Lab, Ratlam signed consultancy agreement with CSIR-CIMAP for contractual cultivation of the crop. About 1100 tonnes of dried herb was produced during the crop season by about 800 farmers and company purchased and lifted the material worth about `360 lakhs from the farmers' field.

Development of north east ethnic material and leather combination products

The people of north east India make lot of products but, they are unable to reach the market and earn profit in large scale because of the lack of Aesthetic appeal and Standardisation. There is a need to transform this knowledge into wealth by increasing the value of the products without losing its real essence. CSIR-CLRI in collaboration with CSIR-NEIST carried out a comprehensive survey in the north eastern region. Based on the inputs from the



Fig. Artemisia annua crop in the farmer's field

survey, designers at CLAD Design Studio designed and developed new range of products. The handbags are crafted and designed with the ethnic materials of the northeast and the inspirations are derived from Ornaments, Dresses & Artifacts adorned by tribal folks of the northeast India. The products were displayed in various national/ international fairs and attracted many enquiries.



Ethnic based Products Designed



Fashion Hand Bag-Inspired from Head Gear



Cool Hand Bag



Fashion Bag

Fig.

Industrial grade Salt

Through the model salt farm established at Humma in Odisha the salt manufacturers of Odisha could visualize the importance of the production of good quality salt with double the productivity. Many salt producers of Humma region have already adopted the salt manufacturing methodologies being advocated by CSIR-CSMCRI and the society under whose premises the model was established and has earned additional revenue of '600 – 700/- per ton of salt. About 25000 acre of saline land has been identified in Odisha. If the entire area is fruitfully utilized for salt production activities the annual salt production in Odisha is expected to touch 6 lac MT whereas the present salt production of the state is 15 – 20 thousand MT per annum.

With the technical guidance of CSIR – CSMCRI 16 marginal salt producers of Rajula region in Gujarat could produce very good quality salt with > 99% NaCl and on an average the marginal salt producers could market their salt to user industries @ ' 700 – 1200/- per ton of salt as against ' 200 – 250/-.

Bio-degradable Nursery Pots from Forest Waste

CSIR-CBRI developed a new technology for making biodegradable nursery pots using forest waste. The prototypes of the developed product are shown in Figure. The characterization of the product is also carried out.



Fig. Prototypes of Developed Bio-degradable Pots

An additional product is also developed which is suitable for thermal insulation in buildings. This product is made by using the dried leaves

waste of the forest waste and bio-degradable. The prototypes are shown in Figure. The technology is available for transfer at laboratory level.



Fig. Prototypes of Thermal Insulation Sheets from Forest Dried Leaves Waste

Outreach programs for School Teachers preparedness for Natural Hazards

CSIR-NGRI has conducted several outreach programs for the teachers of south western Maharashtra under Western India Schools Earthquake Lab Program. Under this program, 85 low version seismographs were installed by CSIR-NGRI in schools spread over 8 districts in Satara, Sangli,



Fig. Teacher's training program

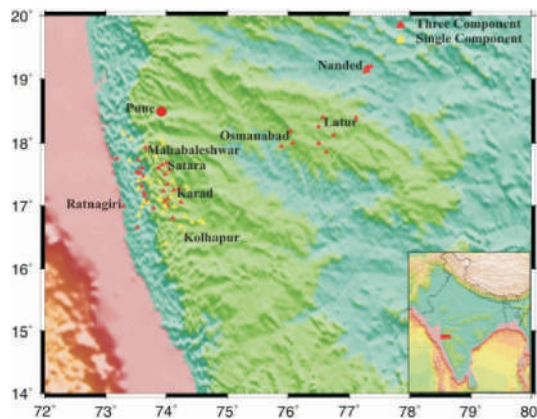


Fig. Locations of Educational Seismographs in Maharashtra



Kolhapur, Ratnagiri, Raigad, Osmanabad, Latur and Nanded. This project has been executed in south western and south eastern parts of Maharashtra due to protracted earthquake activity. The mission of the project is to create awareness about earthquakes and hazard mitigation among school children. Two courses were conducted during this year to train about 50 teachers and the educational seismographs were installed at 80 schools (Figure 11). The training included lectures on basic seismology, Earthquake preparedness and safety and Tsunami. The lectures were followed by practical training on operation of seismographs, seismic data retrieval and data analysis.

Facility

Sustainable remediation process for mitigation of arsenic contamination in groundwater

Arsenic in natural waters is a worldwide problem. In India, high concentration of arsenic in ground

water from the vast tract of alluvial aquifers in the Bengal Delta plains covering the eastern part of West Bengal, Assam, Uttar Pradesh, Jharkhand and parts of Chhattisgarh has been one of the most recent and major environmental issues in the subcontinent. CSIR-NEERI developed a household arsenic removal unit using Fenton's reagent. It is suitable for provision of safe potable water in arsenic affected areas. Arsenic removal unit is operated at domestic as well as community level.

The arsenic removal unit works on a simple principle of co-precipitation of arsenic with iron and adsorption of this precipitate on iron oxyhydroxides, followed by further retention of this precipitate in treated sand. Fenton's reagent used for arsenic removal works as a first level treatment to oxidise As(III) to (V), through the formation of the powerful oxidant $\text{OH}^\bullet$ radicals and Fe(II) is oxidised to Fe(III) which forms a precipitate that gathers all the As(V), followed by further retention of this precipitate in treated sand.



VI-B. CONSULTANCY DEVELOPMENT CENTRE

1. PREAMBLE

Consultancy Development Centre (CDC) is an Autonomous Institution of Department of Scientific & Industrial research (DSIR), Ministry of Science and Technology, Government of India which was set up in 1986 by DSIR as a Registered Society for Promoting and Strengthening Consultancy Capabilities Including Exports and Promote Cooperation with other Countries.

CDC was approved as an Autonomous Institution of DSIR by the Union Cabinet in 2004. During the past 25 years, the Centre has emerged as a nodal

agency for the development and promotion of consultancy capabilities in the country.

CDC is working closely with various ministries, Govt. organizations, Client organizations for the promotion and development of Consultancy capabilities within the country and abroad. CDC has been driving a number of activities for promoting consultancy in India such as capacity building, business promotions and education programs

During the year 2011-12, CDC carried out both developmental and revenue generating activities. Some of the new initiatives undertaken during the year are as follows:

Building Capacities for Use of Green Technologies Configurations, Architectures & Solutions for Habitat Eco- Systems

Defining Competency Standards, Process Capabilities and Development of Methods, Models and Learning Resources for Acquisition of Skills and their Certification for Business Process Automation

MSME operations & Lean ERP

Programme on Building Capacity for Infrastructure Development & Construction Engineering Services

Knowledge Management Partner Institutions (KMPIs)

National Knowledge Repository



2. ACTIVITIES/SCHEMES UNDERTAKEN USING PLAN SUPPORT

During the year, CDC initiated cluster approach towards beginning of XII five year plan. Plan support of ₹ 400 lakhs was provided by DSIR for carrying out the various schemes and activities which were grouped under following clusters:

CLUSTER 1: CONSULTANCY PROMOTION

i. Exposure of Consultants and Clients to International Practices Including Seminars & Conferences

During the year 2011-12, through the Scheme, support was provided to clients and consultants in the following international conferences:

- a) TCDPAP Annual Conference, Malaysia (25-26 April, Malaysia)
- b) TCDPAP Annual Conference, Sri Lanka (2-3 March, 2012)
- c) FIDIC Annual Conference, Davos, Switzerland (2-5 October, 2011)

ii. Scheme for Women Consultants

Support provided to two women consultant for participation in the:

- FIDIC 2011 Conference, at Davos, Switzerland from 2-5 October, 2011.
- Tech Transfer Summit North America in Bethesda, Maryland from 3-4 October, 2011.

iii. Scheme for Fellowship to Students of Academic Institutions for carrying out Live Consulting Assignments

CDC's Fellowship Scheme for students pursuing B.E. / B.Tech / MBA or equivalent courses from AICTE/UGC approved Institutions/Colleges and Universities, offers an opportunity to work on live consulting projects and learn consulting skills during their education programme and earn

fellowship amount of rupees 10,000. This programme was launched by the Centre in the year 2009 with the objective of encouraging professionals to venture into the field of consulting. Based on their domain expertise the professionals can seek employment opportunities in fast growing service sector or venture into professional entrepreneurship by setting up consulting firms.

During the year 2011-12, a total of 10 Project proposals were received. 9 Cases granted permission to carry out projects and 7 Fellowship (of ₹ 10,000) granted to successful students.

iv. Study on "Export Potential of Consultancy Services in Middle East Countries viz. Saudi Arabia, Bahrain, UAE, Kuwait"

Objectives

The objectives of the study are -

- To assess the potential for Indian consultancy export to four Middle East countries namely Saudi Arabia, Bahrain, UAE, Kuwait
- To suggest modalities of utilizing Indian consultancy expertise for export of consulting services from India to four identified Middle East Countries
- To find out and recommend mechanism to develop linkages with government agencies, prospective client organizations, local industry associations, trade missions, consultants (individuals and firms), associations, chambers of commerce, etc.

v. Study for Assessment of Consultancy Export potential in CIS Countries (Russia, Kazakhstan, Belarus and Ukraine)

Objective

- To assess the potential for Indian consultancy export to four CIS countries

namely Russia, Kazakhstan, Ukraine, and Belarus.

- To suggest modalities of utilizing Indian consultancy expertise for export of consulting services from India
- Recommend mechanism to bridge the gaps, develop linkages with Key stake holders in CIS countries

CLUSTER 2: SERVICES

i. Capacity Building Programmes

Highlights:

- CDC carried out 90 programmes in FY 2011-12 including programmes executed through TCOs on “Selection and Effective use of Consultants” and more than 2000 Sr. govt. officials of Central/state govt./ministries/ departments were trained.
- Interactions with Senior Govt. officials (Chief Engineer, Commissioner, Director, General Manager, Manager etc.) and sharing their practical problems that they experienced during the selection process of consultants.
- Feedback of the participants was well received and it was recommended that CDC should continue conducting more number of such programmes in future as well.

ii. Accreditation Scheme for Consultants & Consulting Firms

The objective is to prepare database of capable, competent and reliable consultants/consulting firms to meet the specific services requirements of client organisations

Highlights

- A total of 136 applications (includes both the categories: Individual Consultants &

Consulting Firms) received for Accreditation were scrutinized under the guidance of AAC (Accreditation Advisory Committee).

- 5 AAC Meetings were held for discussion on various aspects: Finalizing the decision regarding applicants to be considered for further evaluation, Finalizing the Evaluation Criteria and Evaluation Mechanism
- Based on the initial scrutiny, a total of 38 applications did not meet the eligibility criteria as specified in the Scheme and therefore were not considered for further evaluation. The remaining 98 applications shortlisted after preliminary scrutiny were put under consideration of the Committee for further evaluation.
- The Evaluation Mechanism, including the formulation of Self-Appraisal Forms for circulation to all 98 applications put under consideration of the Committee had been developed.

iii. Study on “Building of Consulting Practices–Experiences of Leading Consultants”

- The Draft Report has been prepared comprising of 50 case studies developed through both primary research and secondary research highlighting the professional experiences of Indian consultants
- The experiences cover various aspects: strategy for securing consulting assignment, difficulties faced during execution and how these were solved, the benefits of their consulting solution to client organization etc.

iv. Consultancy Business Opportunities (CBO)

CBO is an electronic version of fortnightly business information bulletin and include the following:



- Consultancy opportunities available at home and abroad
- Emerging opportunities both at home and abroad
- Major forthcoming events
- Any other information conveyed by CDC from time to time

CLUSTER 3: NATIONAL PROGRAMME FOR COMPETENCY DEVELOPMENT

i. Building Enterprise capability for managing costs for MSME

Objectives

- To design Training module, which may be used as a learning tool for building capabilities for managing costs in MSMEs
- To include live case studies from the companies in the training module, this would facilitate enhancing of the conceptual knowledge.
- To design assessment tools, which may be used to measure the impact of learning and effectiveness of the training

ii. Building Capabilities for implementation of Lean ERP/Automated Solutions in PSU/MSME

Objectives

- To build a generic framework for implementation of Lean-ERP taking CEL as an illustrative case, which may be used as a prototype for MSME units to enable them design and implement Lean ERP Systems.
- To design training module on Lean ERP framework that would help in disseminating knowledge through seminars/conferences to

build individual/ team competencies in MSMEs.

- To conduct 'Train the Trainer' programme for stakeholders that will enhance capabilities of participants for designing a model/framework for implementation of ERP in MSMEs.

iii. Development of a Knowledge Asset: Experiences of a Strategic e-governance Initiative (MCA21)

Objectives:

- To document MCA21 case study, which will serve as a reference, standards, motivation and learning tool for conceptualizing successful ICT efforts in e-governance
- To develop digital contents, which may be linked to CDC website/knowledge repository for wide spread knowledge dissemination on e-governance.

CLUSTER 4 : TRAINING, DEVELOPMENT & KMPI OPERATIONS

i. Course Development for Educational Programmes, Certificate, Diploma, Advanced Diploma & PG Programmes

Objective:

- To provide reading material to students to give better perception (insight) about various dimensions of the consulting.
- To help faculty to deliver the course in a comprehensive manner.

ii. Building capacities for consultancy development & Knowledge Management in Partner Institutions

CDC's business model for the 12th plan period focuses on creating value in the consultancy sector and to strategically leverage the networked and

collaborative capabilities and potential of the nations consultancy to provide exemplary quality of Consultancy services for Government Ministries and Departments, PSUs, Industries, Public funded Institutions and Organisations serving a public cause.

Some of the areas which the Knowledge Management Partner Institutes would focus are:

- Technology Development and Technology/ Innovation Management Programmes
- Competency Development and Capacity Building in identified Domain Areas
- Design, Development and Implementation of Business Automation Solutions
- Designing and Implementing Performance Management Solutions
- Implementation of Activity Based Costing
- Operations Management for Quality Assurance & Continuous Improvements
- Infrastructure, Asset and Facility Management Solutions

CLUSTER 5: TECHNOLOGY DELIVERY & TRANSFER; TECHNOPRENEUR PROMOTION AND COMMERCIALIZATION

i. Architectural configuration for use of natural lighting, temperature/climate control, water storage and utility and natural air movements

Objectives

- To build a reference compendium comprising of building construction practices for the energy conservation and use of local materials and best practices adopting architecture configuration for use of natural lighting, temperature/climate
- To build a policy framework for manufacturers of bricks to manufacture hollow bricks so that the usage of such technologies is enhanced for MSMEs.

- To device cost effective and green architectural solutions for Economically Weaker Section(EWS)
- To make the compendium in local language also so that, it would be beneficial for economically weaker section and enhance the usage of eco-friendly materials and Technologies in rural and semi –urban areas.

ii. Advocating Green Shelter and Energy Efficient Habitat Eco-Systems

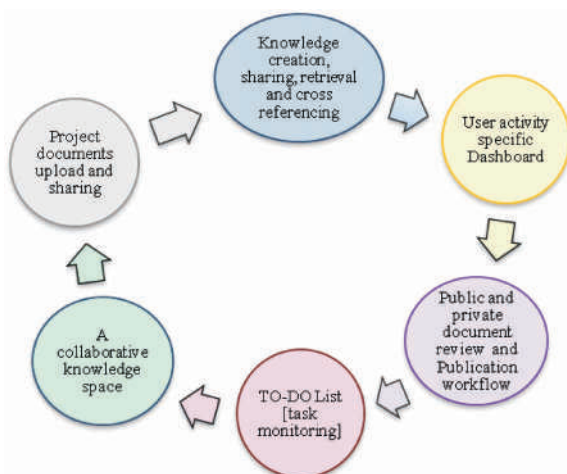
Objectives

- To design a handbook containing fundamentals of design and installation for the Solar Photovoltaic with specification, MTO and explanation of each item including balance of items for each configuration, explained with single line Diagram and Circuit Diagram will be useful guide for students, households and establishments including industry.
- To converse the handbook in e-book to provide ease for wide spread knowledge dissemination of solar technology.
- To design “Do-it yourself” tool kits like mobile charger, toys operated by solar energy, design circuits for electricity generation etc., which would enhance interest, awareness and utility of solar energy particularly among the students community.

CLUSTER 6 : DEVELOPING NATIONAL KNOWLEDGE REPOSITORY STANDARDS & CONTRIBUTION TO NATIONAL PROJECTS

i. Setting up of Knowledge Centre in CDC

CDC Knowledge management (KM) Application incorporates all the resources that empower an organization to create, disseminate, and utilize



knowledge, designed at augmenting its internal and external development. The application inspects all “intellectual assets” to ascertain unique sources, critical functions and potential bottlenecks that obstruct the seamless flow of knowledge. It safeguards intellectual assets from decay, enhances the decision making process, increases value and provides flexibility.

Apart from Knowledge sharing, the application also provides end users the added benefit of retrieving statistical information/ data in multiple sectors and subsectors for their use on decision making.

The primary objective of the Knowledge Management module was to store valuable knowledge resources such as project reports; case studies etc. and allow easy access to these resources.

Knowledge Repository receives its share of information from public users. CDC Project Management mechanism also generates resource information from multiple projects

CLUSTER 7: TURNKEY PROJECT MANAGEMENT IN INFRASTRUCTURE PLANNING & DEVELOPMENT

i. Programme on building capacity for Infrastructure Development & Construction Engineering Services

The primary objective of this programme is to develop strategies, approaches, methods, policies and tools for creating and managing the infrastructure, assets and facilities of an organization with a view to maintain all the relevant activities of the infrastructure leveraging technology and ICT solutions.

With the above goals in mind it is envisaged to nurture & build capacities in professionals, consulting agencies and clients of consultancy for creating or augmenting infrastructure, assets & facilities as also for implementing systems for effective management of such infrastructure.

As Phase I of the programme CDC signed a Memorandum of Understanding with CSIR-SERC, Chennai to work together and synergise their efforts in undertaking various activities, projects involving study, analysis, documentation, training etc.

CLUSTER 8: INTERNATIONAL COLLABORATION THROUGH CONFERENCES

TCDPAP

Technical Consultancy Development Programme for Asia and the Pacific is a programme promoted by UN-ESCAP for developing consulting capabilities at National, Sub Regional & Regional levels in the Asia and Pacific Region. The main objectives of the TCDPAP relate to promotion of local consultants in national and regional projects in the Asia and the Pacific Region by establishing, developing and continuously upgrading the consultancy capabilities and to operate as a regional apex body for the promotion of engineering design and consultancy services in the Asian and Pacific region. 13 countries of Asia & Pacific region are the members of TCDPAP. CDC is the Secretariat of TCDPAP since 1994 and has been carrying out various activities like information dissemination, publications, organizing training programmes/seminars in member countries and networking among member

consultants. It has provided active Secretarial support in organizing International Conferences, in addition to organizing General Council and Executive Committee meetings of TCDPAP during the past decade.

FIDIC

Over the years CDC has been working closely with FIDIC and has developed linkages, which has resulted in collaboration for organizing the FIDIC training and skill building programmes in India. TCDPAP is working in association with FIDIC-ASPAC for conduct of TCDPAP Annual Conferences.

3. FUNDED PROJECTS & ASSIGNMENTS

During the year, besides continuing ongoing projects of last years, following new projects were secured from various Government Ministries/ Departments:

a) Selection of Agency/Professional Consultant for Conducting Innovation Related (5) Studies of DSIR

- Facilitated in Selection of Professional Consultants for the five Innovation related studies.
- Conducted Brainstorming Workshop involving key stakeholders to ascertain the objectives, scope of work and deliverables for all the studies.
- The findings of these Studies would be of national importance in the area of innovation.
- Project completed.

b) Selection of Consultants for Five Irrigation related projects of KBJNL

Krishna Bhagya Jala Nigam Ltd (KBJNL), a Govt of Karnataka undertaking, assigned the work of Selection of Consultants for Irrigation projects

under Stage III of Upper Krishna Projects, in Krishna basin of Karnataka, Govt of Karnataka.

CDC facilitated KBJNL in selection of Consultant for consultancy work involving detailed survey, investigation, preparation of designs, drawings, cost estimates and DTP and Draft Land Acquisition proposals for the projects coming under UKP Stage-III, Govt of Karnataka.

c) System Study and Selection of Agency for Design, Development, Deployment & Maintenance of a Web Based Enterprise Solution for Information and Decision Support for Central Secretariat Service (CSS) Central Secretariat Stenographers Service (CSSS) and Central Secretariat Clerical Service (CSCS)

CDC facilitated DoPT for the project comprising of System Study & Selection of Agency for Design, Development, Deployment and Maintenance of Web-based Enterprises Solution for Information and Decision Support for Central Secretariat Service (CSS)/Central Secretariat Stenographers Service (CSSS)/ Central Secretariat Clerical Service (CSCS)

Highlights

- CDC carried out the System Study requirement and Selection of Agency for Developing a Web based System for Cadre Management of CSS of DoPT
- Project carried out in two phases:
Phase-I : A comprehensive System Study
Phase-II : Selection of implementation agency
- CDC submitted the Techno-Commercial evaluation report to the Ministry, which has been accepted in March 2012

d) Techno-Commercial Evaluation/ Vetting of projects of MEA on Retainership Basis for a period of 1 year



Ministry of External Affairs (MEA), assigned the task of Techno-commercial evaluation/vetting of projects of MEA received under the Line of Credit (LoC) on Retainership basis for a period of 1 year

Highlights

- Techno-Commercial vetting of proposals received under LoC from many countries of Africa in varied sectors
- First quarter completed and accordingly vetted and submitted reports of 14 projects received from MEA
- Project is ongoing.

e) Preparation of DPR for State SDIs (Spatial Data Infrastructures)—NRDMS Division, Department of Science & Technology, Ministry of Science & Technology

Objectives

- To initiate a process of creating a framework at State level through State SDIs (all the states) for integrating data sets from various departments with available spatial data or maps for transforming e-governance to appropriate geo-spatial governance (g-governance).
- To suggest the mechanism for digitizing the geospatial data by linking it with the attributes with the help of GIS that can be made accessible by the end users through the ubiquitous web for use in better delivery of e-governance services.
- To adopt and use the concepts of 'geo-spatial data/process standards' and metadata to facilitate spatial data integration in the states.

4. EDUCATIONAL PROGRAMMES

i. MS Degree Programme in Consultancy Management

- Consultancy Management is a 2 year Degree programme in collaboration with BITS, Pilani running parallel at 4 centres namely Delhi, Bangalore, Chennai and Pune.
- Unique feature of the programme is a live project for one full semester on a subject/problem identified by students from their respective organization, which accrue tangible benefits to the organization.
- The sixteenth batch of MS Degree Programme started during July, 2011 with 80 students.

ii. Certificate Programmes in Consulting

- 2 batches of Certificate Programme in Technical Consulting held with an enrollment of 34 participants and 2 batches of Certificate Programme in Management Consulting held with an enrollment of 49 participants
- A total of 83 participants were enrolled in both these programmes in FY 2011-12

iii. Franchised Delivery of Certificate Programmes in Consulting

- MoUs had been entered with 3 institutes namely: Dronacharya College of Engineering, Greater Noida, Dronacharya College of Engineering, Gurgaon and IIKM Business School, Chennai for delivery of CDC's Certificate Programmes on a franchised model
- The Certificate Programmes in Technical Consulting and Management Consulting in collaboration with Dronacharya College of Engg., Greater Noida were successfully rolled out in March 2012 with a total of 24 participants enrolled in both these programmes.

5. FINANCIAL PERFORMANCE

A Plan support of ₹ 400.00 lakhs was provided to CDC by DSIR for carrying out various activities relating to consultancy development and promotion. Expenditure of ₹ 593.98 lakhs was incurred and the total revenue generation from various programmes & activities during the year was ₹ 369.41 lakhs.

Revenue

The Centre generated its revenue from funded projects undertaken for client ministries, Govt. departments etc., training and capacity building

programmes and other revenue generating programmes and activities conducted during the year.

Expenditure

The expenditure of the Centre comprises of establishment costs, Administrative and office expenses.

The Establishment costs comprises of employee costs which includes salaries having fixed and variable components, contribution to provident fund, superannuation fund, gratuity fund and the employee insurance schemes.





VII. PUBLIC SECTOR ENTERPRISES

VII-A. NATIONAL RESEARCH DEVELOPMENT CORPORATION

1. INTRODUCTION

The National Research Development Corporation (NRDC) is a premier organization, under Department of Scientific & Industrial Research (DSIR), Ministry of Science & Technology, engaged in the development, promotion and commercialization of the R&D results/technologies emanating from Research Institutes/Universities/Industries, etc. The Corporation provides comprehensive technology transfer services and acts as a catalyst for transforming innovative research into marketable industrial products. The Corporation is a unique organization entrusted with the mandate of both promotional function of development/up-scaling of lab-scale technologies, promotion and inculcating the spirit of inventivity and commercial function of transferring/licensing these technologies to industry and making them commercially successful. During the operation for nearly six decades since its inception, the Corporation has developed strong links and network with various R&D organizations in the country as well as abroad for transfer of technologies. Its operations cover the entire spectrum of industrial technologies ranging from Agriculture to Agro processing, Chemicals to Metallurgy, Mechanical engineering, Electrical engineering, Electronics, Biotechnology and so on.

During the year 2011-12, the Corporation's total income was ₹ 1073.32 lakhs as compared to

₹ 959.46 lakhs in the previous year and the principal source of revenue i.e. Lumpsum Premium and Royalty on the licensing of technologies to industry was ₹ 566.78 lakhs as compared to ₹ 782.58 lakhs, in the previous year.

During the year 2011-12, the Corporation incurred Loss to the tune of ₹ 84.54 lakhs (before tax) as compared to Loss of ₹ 158.23 lakhs in the previous year. The Department of Public Enterprises's rating to the Corporation for the year 2011-12 is likely to be 'Good'.

2. ACHIEVEMENTS

2.1 Processes Assigned

The Corporation continued to lay emphasis on broadening and strengthening the technology resource base by nurturing long-term relationships with R&D institutions as well as universities, technical organizations, industries and also individual inventors. As a result, 32 new processes were assigned to the Corporation during the year 2011-12. Some of them are as below:

- Real time PCR for Dengue
- A deep soil volume loosener-cum-fertilizer applicator
- Anemia Detection Kit
- Development of Oligonucleotides for detection of XDR-TB

- A new Colour based method for detection of detergents in Milk
- A Process for Preparation of Formulation for the Management of Borers
- Ready to Serve Beverages of Amla, Banana, Grape, Mango Passion Fruit etc.
- Osmotic dehydration of Amla, Mango, Papaya etc.

2.2 Major Technologies Licensed

The Corporation managed to sign 33 licence agreements during the year compared to 40 no. of licence agreements signed in the previous year. Some of the major technologies licensed by the Corporation in 2011-12 were :

- A Process for preparation of Crop Specific Foliar Micronutrient Formulation for Banana
- A Process for preparation of Arka Vegetable Foliar Spray Formulation
- A Process for preparation of formulation for the management of borers (Healer & Sealer)
- Bio-pesticide based on *Bacillus Thuringiensis* Biolarvicide
- Manufacture of Potassium Humate from Lignite
- Bio-fertilizer-cum-Biofungicide/ Biobactericide Composition B5
- Azotobacter Biofertiliser for Mulberry
- Subsoiler cum Differential Rate Fertilizer Applicator
- Neem based pesticide formulation
- Glycol Based Anti-Freeze Coolant
- Goat Pox Vaccine Technology
- Ayush-64
- Test Kit for Micro Biological Quality of Drinking Water
- Soleckshaw

2.3 Prize Award For Meritorious Inventions

The Corporation has been encouraging innovators/inventors to develop innovative

technologies and emphasizing the need to enhance productivity through innovations by giving Prize Awards.

NRDC Meritorious Invention Awards (2010) for a total of ₹ 22 lakhs were given to twenty-eight inventors for eight inventions out of a total number of 143 applications received by the Corporation for the year 2010. WIPO Gold Medal was also given on behalf of World Intellectual Property Organization (WIPO) for the invention of Mobile Fibre Extraction Machine.

Innovate India

Since 2007, the Corporation has teamed up to create a unique annual event “Innovate India”. This event is organised for the distribution of NRDC Prize Awards for Meritorious Inventions followed by a conference with relevant themes decided upon time to time. The Corporation organized this year event “Innovate India 2012” at Mumbai in association with Engineering Export Promotion Council of India (EEPC) on 23rd & 24th March, 2012.

The Award Ceremony was followed by a one and half day Conference on “Leveraging Inventions and Innovations for Enhancing Productivity” at Convention and Exhibition Centre, Goregaon East, Mumbai. It was inaugurated by His excellency Keuneth Viagem Marizane, Dy. Minister of Industry & Trade, Ministry of Industry, Republic of Mozambique and attended by a large number of young innovators, scientists, students, researchers, industrial personnel and entrepreneurs.

2.4 Intellectual Property Consultancy and Management

The Corporation has been providing financial, technical and legal assistance for patenting through its National and Foreign Patent Protection Schemes which are augmented by patent search facility.

During 2011-12, the Corporation has provided financial assistance to 67 applicants for filing patents in India.



The Corporation has organized 10 Seminars/ Workshops in the title theme on “Intellectual Property and Innovation Management in Knowledge Era”. NRDC officials have given more than 50 lectures on different issues of IPR and technological innovation in various seminars/ workshops and conferences. Corporation has also given the financial support to organize Conference on “Impact of Intellectual Property Regime in Pharmaceutical Sector in India Post-2005” on 11th October 2011 to the Associated Chambers of Commerce and Industry (ASSOCHAM), New Delhi.

The Corporation has been providing service in patent information and its novelty assessment through patent search and for the current financial year till date, Corporation has conducted 47 patent searches for the novelty assessment of any invention.

Intellectual Property Facilitation Centre (IPFC)

NRDC & MoMSME Jointly sponsored Intellectual Property Facilitation Centre (IPFC) at NRDC Regional Office, Bengaluru was approved in December 2010 with a total budget of ‘100.00 lakhs (MSME:NRDC 65:35).

A Steering Committee for IPFC Project was formed which met on February 03, 2012 at NRDC Regional Office, Bengaluru and discussed the future course of action to be taken in the NRDC-MoMSME IPFC project. The centre has started functioning and formal inauguration is being planned.

2.5 Publications

NRDC continued to publish its Hindi monthly science magazine “Awishkar”. The publication is aimed at fostering the spirit of inventiveness, innovativeness and entrepreneurship amongst the students, scientists, budding entrepreneurs etc. and creating scientific awareness in the masses by disseminating information on S&T topics. Some

of the important topics covered are Nuclear reactor and radiation, Aakash – Tablet computer, Green Chemistry, Pigeon Genome – discovered by Indian Scientists.

2.6 Promotion of Rural and Household Technology (PRHT)

The Corporation is networking with developmental agencies viz; NGOs, Academia etc. and supporting their endeavor in taking up technology based projects in rural and backward areas, so that, local manpower and resources can be optimally utilized and employment generating activities may get a boost.

The Corporation during 2011-12 provided support to the capacity building activities of

- i) Rural Development Organization (RDO), Tirupathi in promoting Azolla Pinnata Feedstock for Efficient and cost effective Bio-gas Production in Tirupathi area
- ii) Adhar, Kanpur for upgrading the skills of women SHGs for fabrication of water remediation kit for removal of Chrome vi from drinking water’ and enhancing their income in Kanpur
- iii) Women Education Development Social Service Trust (WEDSS), Tanjavur (Tamilnadu) and Mathi Foundation, Dindigul (Tamil Nadu) for women skill upgradation programme on design and assembly of Inverter”
- iv) Technology informatics Design Endeavour (TIDE), Bangaluru) for upgrading the skill of Women SHGs for value addition in brick making by way of construction and use of innovative low cost brick kiln (LCBK)
- v) People’s Institute for Development and Training(PIDIT), New Delhi for conducting workshop cum Training Programme on Traditional Terracotta in Deogarh, Jharkhand for local artisans.

2.7. Rural Cluster

The Corporation continued its efforts in the Cluster Development Programmes in diverse sectors, viz., Sericulture and Coir.

a) Sericulture Cluster Development Program

Keeping in view of the past successes in bringing overall development of the Sericulture farmers through Cluster approach, this year NRDC has funded two proposals from the organizations under the Central Silk Board for carrying out development programs on cluster approach.

b) Coir Cluster Development

The Corporation had given financial assistance of Rs. 15 lakhs in 2009-10 to CCRI for fabrication of Anupam Looms and distributing to the Cooperatives. CCRI has fabricated three looms and one has been demonstrated to M/s. Chirayindkeezh – Anjengo Coir Mats & Matting Cooperative Society, Muttappalam, Trivandrum. Other two looms are ready for demonstration and planning for distribution to Cooperatives. One more loom is being planned to distribute to Coir Cooperative.

The demonstration and training of the looms shall propagate usefulness of the new looms and ultimately result in more use of the looms and enhance the productivity and quality of the products.

2.8 Exhibitions and Publicity

Participation in exhibitions, seminars, workshops and entrepreneurship development programs are of vital importance for the creation of awareness about the role of the Corporation in technology transfer and technologies available with the Corporation for transfer. With this objective in view, the Corporation participated in 28 exhibitions, seminars and get-togethers in India and abroad organised by various agencies as given below:

- Bangalore India Bio, Bangalore-04-06 May, 2011
- 99 th Indian Science Congress, Bhubneshwar-03-07 Jan, 2012
- FAJR Regional Exhibition on Innovation & Inventions, Tehran-04-07 Feb, 2012
- Bio Asia-2012, Hyderabad-09-11 Feb, 2012
- FICCI MSME Summit-2012, New Delhi-23 Feb, 2012
- The India Engineering Sourcing Show 2012, Mumbai-22-24 March, 2012

2.9 Technology and Project Export

The Corporation had been putting up efforts and endeavouring to export technologies and services, plant and equipment and undertake turnkey projects. The Corporation has signed MoUs with two export oriented companies viz. M/s. Seftech India Pvt. Ltd., New Delhi and M/s. Pamski Overseas Trade Ltd., New Delhi, for providing technologies and services. These two companies are working aggressively for undertaking projects in African countries like, Senegal, Ghana, Cameroon, Mozambique etc.

The Corporation had earlier submitted proposal to Ministry of External Affairs for 'Pilot Research Project for production of Tomato in Ghana' for financial assistance. The Corporation has recently clarified the queries raised by MEA and submitted bid to MEA for setting up of a Technology Incubation Centre at Malawi. Earlier, the Corporation had submitted its expression of interest for the same.

It is expected that the Corporation may receive some projects in the export front.

2.10 Knowledge Management System (KMS) for Technology Promotion

The Corporation had introduced the Knowledge Management System for technology evaluation/promotion with a view to develop a self propelled mechanism for systematic evaluation of the technologies, provide value addition to the



technologies assigned to the Corporation after proper evaluation, monitor the value addition and licensing of the technologies and provide the entrepreneurs complete technology package, so that the large number of technologies which the Corporation license to various entrepreneurs could become success and do not undergo technological or financial problems as was the case earlier.

During 2011-12, 18 technologies related to Biotechnology, Agriculture, Ayurveda & Herbal were discussed in KMS meetings of expert panel and panel suggested the measures which have been followed to make the technology marketable.

2.11 Basic Engineering Design Package

The Corporation continued to prepare BEDP through outside consultants and during 2011-12 10 technologies were identified and work orders placed for the preparation of BEDP. These are:

1. Sugarcane Juice Powder
2. Virgin Coconut Oil
3. Poly Hydroxy Butyrate (PHB) Production by Eco-Friendly Rhizobia from Agri-Byproducts Towards Cost Effective Biodegradable Plastics
4. Production of Liquid Biofertilizer
5. An Improved Process for the Preparation of Aloin from Aloe vera
6. Mosquito Larvicidal Formulation Based on Bacillus Thuringiensis Var Israelensis
7. A process for the production of Bitter Gourd Hypoglycemic Drink for the control of diabetes mellitus (Type-2)
8. Anti Dandruff formulation based on Silver nano Particle
9. Biofertilizer-cum-Biofungicide/ Biobactericide composition B5
10. Herbal Ghee

2.12 Market Survey

The Corporation carries out market surveys on commercially important technologies through

professional market survey agencies in order to be able to make the technology to be licensed more complete and credible, but also help in assessing the realistic price at which the technology can be licensed. During 2011-12, market survey reports on the following items were prepared:

1. Low cost tissue culture medium
2. Poly Hydroxy Butyrate (PHB) Production by Eco-Friendly Rhizobia from Agri-Byproducts Towards Cost Effective Biodegradable Plastics
3. Sea weed extract fertilizer
4. Ayush QOL-2A Capsule – a supportive therapy for the improvement of quality of life in HIV/ AIDS patients
5. Ayush QOL-2C Capsule - for improvement of quality of life in cancer patients receiving Chemo/Radio therapy
6. System for Providing restorative/relaxation bathing
7. Novel Formulation/Composition of Safranal
8. Recombinant IgM ELISA for the Diagnosis of Leptospirosis
9. Real time PCR for Dengue
10. Processes for preparation of products for antenatal and post natal care-Ayush AG, PG Tablet Ayush PK Avaleha and Ayush SS Granules
11. Resazurin Reduction Test (RRT) for the assessment of semen quality in men
12. Low Calory Flavoured Milk
13. Cold Water Miscible Starch
14. Cassava Extruded Products

2.13 Programme for North-Eastern States

The following programmes were carried out in the North East states to improve productivity, employment, livelihood especially that of women, unemployed youths and facilitate new avenues of employment generation and income generating activities. During FY 2011-12 the following programmes were undertaken successfully in different sectors.

1. Skill development training programme on handloom weaving for unemployed youth of NER at Kumarghat in Tripura.
2. Development of High Land water harvesting for drinking and pisciculture-cum-irrigation reservoir using plasticulture technology in Dimapur, Nagaland
3. Skilled Development Programme on Computer Training at Diyun in Changlang District, Arunachal Pradesh
4. Food/Fruit Processing for Unemployed youths of NER at Karimganj, Assam
5. Women's Empowerment Programme on Kauna Cerafts at Thoubal district, Manipur

2.14 Women Entrepreneurship Development Programme (WEDP)

The WEDP program is aimed at promoting, inspiring and encouraging women students at different levels from various universities/ colleges to take up entrepreneurship to empower themselves. The program covered various topics on entrepreneurship development, How to write project report, Role of DIC, MSME, Success stories by women entrepreneurs, Schemes available with financial Institutions/banks, technologies appropriate for entrepreneurship, etc.

Identified women of all sectors including economically backward class women were given skill training on need based technologies to improve their standard of living by increasing their earnings.

For the financial Year 2011-12, the Corporation, successfully conducted WED Programmes at eleven different Universities/colleges. These are: Maharshi Dayanand University, Ajmer, Assam University, Silchar, Assam, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot Satna, MP, Bengal Engineering & Science University, Shibpur, Howrah, Netaji Subhash Chandra Bose, Govt. Girls College, Lucknow, Sikkim Manipal Institute of Technology,

Rangpo Sikkim, University of Agricultural Science, Bangalore, Acharya Nagarjuna University, Guntur, AP, Gurukul Kangri University, Dehradun, Juhri Devi Girls Post Graduate College, Kanpur. and about 1200 women benefited

The Corporation has also conducted skill development programs for women. The various programs carried out in the field are Skill development program in Bakery production; fruits and vegetable processing and preservation; Jute products; Fabric work at Lucknow and Muzaffaranagar, U.P., wherein about 80 number of women attended. Corporation also conducted work shop on Low cost Sanitary Napkins at Lady Irwin College, DU, Delhi. Training was given in 5 Batches of 12 women each, wherein about 60 women were trained. The training was given to women students/Groups/ NGOs.

The above programs were covered in 26 news papers including leading and local news papers. The program also helped to identify new technologies developed by various universities/ colleges for commercialisation through NRDC.

2.15 Human Resource

The total manpower of the Corporation as on 31st March 2012 is 91, viz., (Group A-28, Group B-29, Group C-22, Group D-10, and Group D (contractual)-2. The employee-management relationship was cordial throughout the year.

During the year under review, there were no employees who received remuneration in excess of ₹ 24 lakhs per annum or ₹ 2,00,000 per month, requiring disclosure as per the Provisions of Section 217(2A) read with the Companies (Particulars of Employees) Rules 1975.

2.16 Implementation Of Official Language

The Corporation continued to make efforts to fulfill the targets prescribed by the Government



of India under the Official Language Act and the Rules framed therein with regard to increasing the use of Hindi Rajbhasha in the office during the year 2011-12. Employees were motivated to use their working knowledge of Hindi in day to day official work. All the Standard Forms, Files, etc., are bilingual. Significant progress has been made in the field of correspondence, noting and drafting in Hindi. All Hindi letters are being replied in Hindi only. The Annual Report of the Corporation is being published in diglot form since 1986-87. The Corporation also publishes a popular Science and Technology monthly magazine in Hindi,

entitled 'Awishkar'. To popularise the use of Hindi, the Corporation organized a "Rajbhasha Pakhwara" (14-30 September, 2011). During the programme different types of competitions like Hindi essay writing, Hindi drafting and noting, were organized. Certificate and cash awards were given to the winners. Cash Awards were also given to employees under "Rajbhasha Incentive Scheme". To enrich the Hindi vocabulary of the employees of the Corporation as well as the visitors, an English word with its Hindi meaning is written daily on a writing board as 'Today's word' at the reception of the Corporation.



VII-B. CENTRAL ELECTRONICS LIMITED

1. INTRODUCTION

Central Electronics Limited is the other Public Sector Undertaking of DSIR engaged in the field of Solar Photovoltaic cells (SPV). The mandate of CEL includes development and harnessing technology for Solar Energy Systems and Solutions; Strategic Electronic Components and systems required for Defense, Space, Atomic Energy and other Science & Technology Mission; Signaling and Safety in Public Transport Systems; Infrastructure, Eco-systems management and energy conservation and Security and surveillance in strategic establishments. CEL's objectives are as follows:

Solar Photovoltaics: To be a major global and domestic player in the area of Solar Photovoltaic cells and Modules by capacity enhancement and by manufacturing higher wattage modules with special emphasis on use of thinner wafers to become price competitive in the domestic and international markets.

Railway Signalling and Safety Equipment: To maintain leadership in the development, manufacturing, supply and commissioning of signaling and safety equipment for the Indian Railways to meet their existing and emerging

modernization needs in line with their future strategies.

Defence: To expand the product portfolio using state-of-the-art technology for supply of strategic components such as PCM to be used by DRDO laboratories; PZT and di-electric material for use by BEL, NPOL and BARC; and heat fuse to be used by ordinance factories.

Safety and Security: To diversify into security systems and equipment used to counter terrorist threats in India by commercializing the latest state of-the-art technology from abroad.

CEL has been the pioneer in the country in the different areas of manufacturing & proprietary manufacturer of the many strategic electronic components for use by defense organizations in the country.

2. OPERATING RESULTS (2011-12)

During the year the Company recorded production of Rs.151.49 Crores and sales of Rs. 160.02 Crores against the previous year's production of Rs.156.80 Crores and sales of Rs. 152.99 Crores. During the year under review company incurred a net loss of ₹ 15.91 Crores as against the net loss of ₹ 17.25 Crores in the previous year.



₹ in Crore

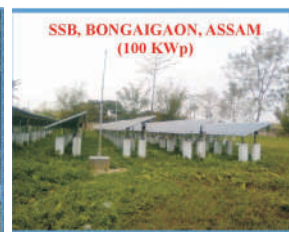
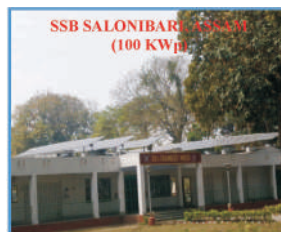
	2011-12	2010-11
Production	151.49	156.80
Sales	160.02	152.99
Gross Margin	(-)8.55	6.09
Gross Profit	(-)11.05	3.68
Net Profit before tax and extra ordinary items	(-)15.65	0.11
(+) Net Profit/(-) Net Loss after tax and extra ordinary items	(-)15.91	(-) 17.25

2.1 Exports

During the year 2011-12, exports have been ₹ 7.0 Crores, as against ₹ 9.96 Crores in 2010-11.

2.2 Major Achievements of the CEL during 2011 -12

- Company has successfully installed a 100 KWp PV power plant on the roof of the MED building of the company through DSIR support.
- Under roof top scheme of MNRE, company has installed many solar power plants of various capacities at various location of Sashastra Seema Bal (SSB) and Central Industrial Security Force (CISF) at Ghaziabad, NISA etc.
- Company has successfully installed different power plants at various locations in the country like Rajayoga Ed Mount Abu, Tripura Industrial Development Corporation, Agartala etc.
- Company has successfully installed different power plants at various academic institutions such as Guahati University, Assam Engineering College, Krishna Kanta Handique State Open University and Tripura University etc.
- Company has executed large number of projects of Solar Photovoltaic systems for
- During the year, the Company has exported SPV products to Nepal, Sudan, Namibia, Afghanistan, Mali etc.
- In-house production of the phosphorous diffusion paste for the cost reduction of input material. The manufacturing license has been taken from Inter-University Micro Electronic Centre (IMEC), Belgium.
- Company has received a prestigious order of technology transfer of module manufacturing to Mozambique.
- Company has successfully started M. Tech programme in two streams namely Solar Photovoltaic & Renewable Energy and Operational Management & Lean ERP in collaboration with SRM University, Chennai.
- Company has successfully optimized the different process stages and implemented these steps for the commercial manufacturing of silicon solar cells. Due to that, company has

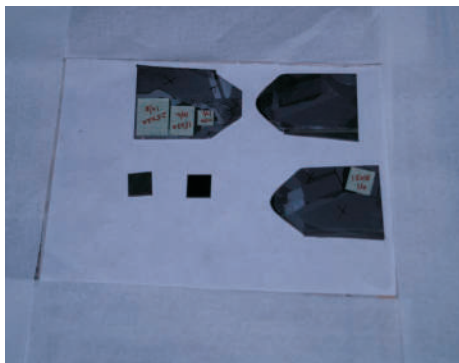


Few off-grids Power Plant installed at different location of SSB

Indian Railways for their integrated power supply systems.

now capable to manufacture more than 175 Watt modules.

- Company has received purchase order for supply of 900 nos. 20 x 20 mm CZT crystals worth ₹ 14.50 Crores from Solid State Physics Laboratory (SSPL) Delhi during the next three years. During 2011-12, a total of 300 substrates were supplied to SSPL.



CZT Substrate of different size developed by CEL

- Company has developed Point Zone Digital Axle Counter (PZDAC). The complete system is ready for field trials at the railways site for RDSO approval. With the development of this product, CEL has included one more system in their portfolio that will be helpful for the more safety of the railways/passenger.
- Company has developed Universal Fail Safe Block Interface (UFSBI) Equipment system capable to work on both copper and optic fiber cable. RDSO approval of block signaling system using UFSBI has also been obtained. With the approval of above system, CEL will have complete range of Axle Counters based signaling systems.
- During the year, company has sold 537 Nos. of Axle Counters (444 Nos. Digital and 93 Nos. of Universal Axle Counter) to Indian Railway despite tough competition from private firm.
- Company has executed a number of Railway Signaling projects of Block proving by Axle Counter. The company also commissioned 10 panel interlocking stations of Northern Railway.

- Company has completed project of providing 330 KM long Cathodic Protection Systems to Paradeep, Haldia Pipeline of Indian Oil Corporation Ltd.
- Company has enhanced the capacity to manufacture Phase Control modules for Akash Missiles and weapon locating Radar to 40,000 PCMs per year. The company has executed an order to supply of 64,800 PCM from BEL, Ghaziabad. During the financial year 2012-13 further order for supply of 1,50,000 Nos. PCM is to be expected from BEL, Ghaziabad.
- Company has successfully up-graded the production and testing facility from existing 10,000 to 2,50,000 Piezo generators per year and 1,00,000 pcs to 10,00,000 pcs Piezo elements per year. CEL is the only source for manufacturing Piezo generators in India. CEL has been identified as the only PSU agency for bulk production of Piezo Generators used in Karl Gustaf Gun by Ordnance Factory, Khamaria. During the year, company has supplied 32,000 No. of Piezo Generator to Ordnance Factory Khamaria (OFK).

3. FUTURE STRATEGY

As a Public Sector Undertaking (PSU) of the Government, CEL's programmes and business plan projection, business operations for production, distribution and marketing as also advocacy and sales support services are always aligned with the programmes being implemented by the Federal and State Governments in India.

Under the XII five year (2012-17) plan, CEL has proposed ambitious objective of diversification of products and new ventures. The different future objectives and strategies are:

- (i) The Government of India has recently launched an ambitious Jawaharlal Nehru National Solar Mission (JNNSM) with targeting the 20 GW of solar power by the year 2020. Leveraging on its technology prowess, CEL plans to develop



capabilities for the manufacture of Dye Sensitized Solar Cells (DSSCs), emerging as one of the highly creditable alternatives to silicon/thin film technologies. DSSCs are becoming more popular, due to their high conversion efficiency (~ 11%), non-toxic nature and abundantly available material, potential low initial capital investment, and much less sophisticated equipment for production activities. The development and commercialization of this technology will be helpful to reduce the cost of the solar PV in the country. Presently, CEL is also participating in indo-European joint project for the development of this type of solar cell. The finding of the Indo-European project will also be helpful to create the proposed fabrication and testing facility for the DSSCs. The project provides new insight to the Indian Scenario, particularly in the field of solar energy and help to solve ongoing energy crises of the country. It will help to provide the energy to consumer away from the grid supply, who is still waiting for cheap solar energy and also help the recent government commitment to PV expansion under National Solar Mission.

(ii) For development of reliable and cost effective technologies, versatile and innovative electronic products, there is an emergent need for indigenous world class Research and Development (R&D) center, in house Testing and Quality Assurance facilities to cater the need for designing and developing new products, improved designs and value additions to existing range of products, moving into components and subassemblies manufacturing. CEL has proposed to establish an R & D centre to cater to the needs for design, development, testing and validation of a all product portfolio. The proposed R & D centre will work in collaboration with the different institutions/ universities and research labs working for the development of new material/product /system and helpful for trained work force development in the country.

(iii) CEL has already designed and developed safety and signaling equipment for Indian Railways transport system as per European standard and is

pioneer in this field in the country. To maintain leadership in this field, it is proposed to develop a new technology of data logging for various railways signaling installation in the future.

(iv) The National/International market is changing very rapidly and new product and process are emerging day by day. It is important to keep the watch on the market and adopt the change of the market by maintenance of product portfolio with technological edge and process technology according to the International scenario. In this view, CEL has proposed an open outlay project entitled “Development of New Product, Process & Technology”. The project will be helpful for the company to adopt any change in the product/ process during the future.

(v) Government of India (CSIR/DSIR) and CEL proposed to take the steps toward establishment of world-class state-of-the-art national mono/multi crystalline silicon ingot growth and slicing facilities for producing silicon wafers of 1000 MW/year capacity in different phases that will help to make the availability and cost-competitive the silicon wafers in the country. The other PSUs (BHEL and BEL) & recently MIDHANI also have shown their interest with CEL for the establishment of the national facility. In this view company has started a step towards establishment of national facility for silicon wafer production facility in the country by making the prefeasibility report comparing different technology by a consultant of international repute. The findings of the present project will provide a roadmap for establishment of national facility for silicon production in the country proposed under the fmeqa science project in the future.

(vi) Government of India proposed a massive expansion of solar capacity and aims to reduce the price of electricity generated from solar energy, to match from fossil fuels in order to make it the leading primary energy source. Hence, in the present scenario, the cost reduction is on the top priority issue to make the solar energy useful for the mankind. Company believes that primary cost

reduction will be attributed both by scaling up of the upstream manufacturing facilities as well as increasing the prevailing efficiency through R & D using advanced technology concepts. It is, therefore, planned for development & up-gradation of PV Module Manufacturing Facility during the next coming years.

(vii) Microwave Electronics Division (MED) of CEL has been into the prototype production of C-and X-Band Phase Control Modules (PCMs) to LRDE, Bangalore for use in FLR and WLR (Flight/Weapon Level Radar).

CEL has supplied more than 30,000 PCMs to LRDE over a period of 15 years to meet the prototype phased array requirement. Subsequently, after successful completion of field trials conducted by LRDE at various locations of India, bulk order for 20,000 C-Band and 4,000 X-Band from BEL, Ghaziabad was executed over a period of last two years. BEL already confirmed that there is requirement of an average of 60,000 PCMs annually for another five years.

To meet this huge requirement, CEL needs to upgrade the production facility for an additional 20,000 PCMs, annually. The company is planning to enhancement/up-gradation of production facilities for PCMs.

(viii) CEL is running its business activities in six buildings (Administration, SPV Process & Marketing, MED, SPD, ECD) constructed way back in year 1978. All these buildings have got damaged badly over a period of thirty years. The company is planning to maintain & Up-gradation of infrastructure to provide the new look & basic facilities for the manpower.

A huge requirement of security, surveillance and scanning systems in the country as the sensitive places are always on the targets for terrorism and other form of crime. In view of our initial market study, presently a demand of 10,000-14,000 per year systems in the country, this will grow in future.

In this view, CEL is planning to augment the infrastructure and manufacturing of security, surveillance and scanning equipment in association with proven technology provider. Technology provider (who is already in such type of business) will assist in establishing production line, software maintenance, service & support & customer training activities. Manufacturing facilities will be created in CEL with consulting directions by technology provider.

(ix) Sensing and monitoring is playing an increasingly important role in the power (cleantech) industry and for all consumers. Sensors are a key component in smart electricity grids and smart home technologies that permit electricity producers and consumers to efficiently manage power resources through information gained from production, distribution and use of power. While sensing and monitoring is already widely used in the power industry, it is relatively new for consumers to have smart appliances and smart meters. In the near future, company is planning to enter in the Emerging Business in the Area of Power Electronics (Cleantech) and Sensor technology.

4. RESEARCH AND DEVELOPMENT

1. Central Electronics Limited at present is pursuing R&D activities within its various internal divisions. These efforts are focused on (i) product improvements, (ii) design changes to enhance product performance characteristics and (iii) for augmenting fault tolerance during deployments and operations in field conditions. Detailed plans have already been made for the setting up of an R&D division with the support of CSIR for which approvals and commitment of fund allocations have been obtained.

2. The R&D division would take up activities relating to design of new products and systems in the areas of signaling and safety for railways and mass rapid transportation systems, surveillance/gadgets, robotic components and assemblies, green technology solutions, embedded systems, sensors,



actuators and TR modules for strategic applications besides product improvements for existing line of products. The new R&D and training complex architecture uses passive design building elements for energy saving and green technology solutions.

3. CEL is also undertaking the design and development of Mobile Platform Solution for business operations in MSME units. The solution being designed leverages mature service oriented architecture with embedded capabilities interfacing intelligent cognitive features for profile based adaptation and customization of decision support functions and interfaces for automated operations. It integrates form based transactions for process automation, facilitates activity logging and interactive invocation of decision support, analytics and drilled down visualization of transactions facilitated by engaging role centric user interface. This research initiative is likely to be funded under the NIMITLI project of CSIR.

5. FOREIGN EXCHANGE RECIEPTS AND OUTGO

During the year under review, company has spent ₹ 29.28 Crores in foreign exchange as against ₹ 27.47 Crores in the previous year towards purchase of raw material, components and spares, capital goods, travel etc. Company earned foreign exchange of ₹ 6.73 Crores as against ₹ 6.24 Crores in the previous year from export of its products.

6. ENERGY CONSERVATION

The company being an electronic industry, its operations are not energy intensive. However, the company frequently evaluates its processes and plant and machinery to economize on its energy consumption. To reduce power consumption, conventional tube lights and bulbs have been replaced with CFLs. It has done redistribution of the leads in the solar photovoltaic plant so as to make optimum use of its captive DG sets. The company has recently installed a 100 KWp PV power plant & same under consideration to reduce

over reliance on the conventional grid parity. More than 1,000 poplar plants have been planted. A nursery of poplar plants has been set up to provide saplings for further plantation next year. Thus, the company is putting in efforts towards improvement of the environment.

7. PARTICULARS OF EMPLOYEES

In accordance with the Companies (particulars of employees) Rules 1975 read with Sub-section 2-A of Section 217 of Companies Act 1956 as amended in 1988, none of the employees of the Company either employed throughout the year or for a part of the year under report, was in receipt of remuneration more than the maximum prescribed in the Rules.

8. IMPLEMENTATION OF HINDI, INDUSTRIAL RELATIONS AND HUMAN RELATIONS

The company had very cordial industrial relations during the year. The management also initiated programmes for upgrading the skills of the employees. In order to ensure the use of Hindi, the employees continued to be trained in Prabodh, Praveen, Pragya Hindi Courses, Hindi typewriting and use of Hindi Computers. Hindi week was organized from 14th to 21st September, 2012. Various short-time training programmes and workshops were conducted for workers and officers during the year. Special workshops and various competitions in Hindi were organized and awards distributed to the winners. Half-yearly Hindi Newsletter 'HAMARA CEL' was also published.

9. WELFARE OF RESERVED CATEGORIES

All Government Directives relating to the reserved categories such as SC, ST, Physically Handicapped, and Ex-servicemen etc. continue to be implemented during the year. Total number of employees in these categories was 177 which represent about 29.75% of the total strength of the Company as on 31.3.2012.



VIII. ADMINISTRATION AND FINANCE

1. ADMINISTRATION

The Department of Scientific & Industrial Research (DSIR) was created in January 1985. The Administrative Division of the Department, comprising Establishment Section, General Section, Budget & Account Section and Vigilance Unit, looks after activities related to personnel, implementation of the Flexible Complementary Scheme (FCS)-a fast track promotion mechanism meant for the Scientists (Group'A'), foreign deputations of officers, vigilance matters, administrative reforms mechanism, budget, release of budgetary support for the Department proper and the Autonomous Organisations/Public Sector Undertakings under its administrative control. The work related to Housekeeping, Cash, Drawing

and Disbursement is being looked after by the sister Department-Department of Science and Technology who own the Technology Bhawan estate for administrative convenience.

Since both DST & DSIR are situated in same premises, all the celebrations such as S&T Foundation Day, Technology Day, Retirement Meetings, Sadbhavna Divas, Sports, Staff Welfare get-togethers, Hindi Pakhwada, Vigilance Week, etc. are celebrated as a common event with active cooperation of both the Departments.

The Administration Division also looks after work related to CGHS facilities, staff welfare, coordination etc.

1.1 Staff Strength

The staff in position in different groups in the Department (other than CSIR/CDC and PSUs) as on 1st December, 2012 is given below:

	No. of Employees				
	Gen	SC	ST	OBC	Total
Group'A'(Gazetted)	30	5	2	-	37
Group'B'(Gazetted)	6	2	-	2	10
Group'B'(Non-Gazetted)	15	5	-	2	22
Group'C'(Non-Gazetted)	9	2	1	2	14
Group'D'(Non-Gazetted)	2	6	-	-	08
Total	62	20	3	6	91



1.2 Promotion of Hindi

The Official Language Division of the Department, manned by an officer of the level of Deputy Director (OL), has made relentless efforts towards implementation of the instructions issued by the Department of Official Language for implementation of the official language policy in the Department and the Autonomous Bodies and Public Sector Undertakings under its administrative purview. Hindi Section of the Department carries out translation work under Section 3(3) of Official Language Act. DSIR has made the following efforts for progressive use of Rajbhasha in the official work, as also implementation of official language policy of the Government.

- Quarterly meetings of Official Language Implementation Committee are held regularly under the chairmanship of the Joint Secretary of the Department, who is the nodal officer for implementation of the official language policy in the Department. During the year, three meetings were organized and important decision were taken Follow up action has been taken in compliance with the decisions taken in these meeting.
- The progress reports regarding use of Rajbhasha in the Department are sent to the Department of Official Language (Headquarter) with the approval of joint secretary every quarter.
- During the year, Rajbhasha inspections have been done in the two offices of the department i.e. NRDC & CDC and suggestions were given to solve the practical problems being faced by the employees of their offices while working in Hindi.
- Parliamentary Committee on official language conducted inspection of implementation of official language in one of the DSIR office i.e NRDC (public sector enterprise) on 06 June, 2012. Hindi section of deptt. Co-ordinated with NRDC in the inspection.
- Officers have been issued instructions to make use of the services of stenographers, Personal Assistant (PAs), Private Secretary (PSs) trained in Hindi stenography for doing the work in Hindi. The stenographers not knowing Hindi Stenography are being nominated for such training. as per training program prescribed by the Department of official language from time to time.
- A booklet containing a set of technical terms in Hindi useful to the Department and a set of standard drafts, dictionaries, scientific glossary and reference literature useful for official purposes, have been distributed to officers/ staff members in the Department.
- During the year, General Administration has been specified to do their work in Hindi as per rule 8 (4) of official language.
- For compliance of the implementation of the Official Language Policy effective Check Points have been preposed.
- Hindi Pakhwara was observed from 14th-28th September, 2012 in the Department in collaboration with the Department of Science and Technology. On the occasion, the message of Secretary, DSIR regarding progressive use of Hindi was circulated. Various competitions with active participation of officers and employees such as Hindi Poetry, Essay writing, Hindi typing and shorthand, noting and drafting competition, Translation competition, Quiz and Hindi dictation (for class IV employees) were organised. Cash prizes of ₹ 2000/- , ₹ 1500/- and ₹ 1000/- for first, second and third winners respectively were given away with certificates. Consolation prizes of ₹ 500/- were also given away.
- 26th meeting of Joint Hindi Advisory Committee of Ministry of Science & Technology and Earth Science was organised on 16th November 2012 at CSIR, Science Centre, New Delhi, which was chaired by

honourable minister of Science & Technology and Earth Science Shri Jaipal Reddy and was attended by Secretary, DSIR. Hindi Section of department co-ordinated with DST in organising the meeting.

- Hindi Division of this Department is having a small Library containing Hindi Books, novels, newspapers, magazines for use by the officers/staff as a promotional activity.
- In an effort to fulfill the provisions of the official Language Policy in the electronic mode, the Department has hosted its official website in English and Hindi. Unicode has been installed in all computers to enable officers/staff to correspond to use of Rajbhasha in the electronic mode of e-mail. Employees are being imparted Hindi/computer training.
- During the year two workshops were organised to create conducive environment for

promotion of Hindi in official work with special emphasis on section 3(3) of official language act. Officers and staff discussed their difficulties, hardships and the misgivings about the use of Rajbhasha Hindi, which were addressed and attended to immediately. All the officers and staff were of the view that these types of workshops are very useful and should be organised regularly after brief intervals.

2. FINANCE

The financial summary giving the AE 2011-12, BE 2012-13, RE-2012-13 and BE 2013-14 of various Plan and Non-Plan schemes of DSIR is given in Table 1.

3. EXTRACTS FROM CAG'S REPORT

The extracts from CAG's report are given at Annexure 12.





Table 1 : FINANCIAL SUMMARY

(₹ in crores)

**AE 2011-12, BE 2012-13, RE 2012-13 & BE 2013-14 of various Plan and Non-Plan Schemes
(Headwise/broad category-wise)**

	Actual Expenditure 2011-12			Budget Estimates 2012-13			Revised Estimates 2012-13			Budget Estimates 2013-14		
	Plan	NP	Total	Plan	NP	Total	Plan	NP	Total	Plan	NP	Total
Secretariat Economic Services - DSIR	0.00	7.11	7.11	0.00	9.00	9.00	0.00	7.80	7.80	0.00	10.50	10.50
Assistance to CSIR												
Administration	30.00	490.50	520.50	37.00	520.00	557.00	25.00	500.00	525.00	45.00	560.00	605.00
National Laboratories	1438.91	787.00	2225.91	1316.00	830.00	2146.00	1211.73	790.20	2001.93	1372.00	875.00	2247.00
Scientists Pool	0.00	6.50	6.50	0.00	7.00	7.00	0.00	7.00	7.00	0.00	7.50	7.50
Research Schemes, Scholarship & Fellowship	190.00	95.00	285.00	200.00	105.00	305.00	180.00	96.00	276.00	180.00	105.00	285.00
Intellectual Property and Tech. Management	38.00	0.00	38.00	43.00	0.00	43.00	40.00	0.00	40.00	40.00	0.00	40.00
New Millennium Indian Technology Leadership Initiative	50.00	0.00	50.00	60.00	0.00	60.00	40.00	0.00	40.00	45.00	0.00	45.00
Setting up Institute of Translational Research	10.00	0.00	10.00	95.00	0.00	95.00	20.00	0.00	20.00	76.00	0.00	76.00
CSIR 800 Schemes	0.00	0.00	0.00	50.00	0.00	50.00	0.00	0.00	0.00	50.00	0	50.00
CSIR Schemes for Open Innovation	0.00	0.00	0.00	77.00	0.00	77.00	0.00	0.00	0.00	70.00	0	70.00
CSIR Initiative for inclusive participative & collaborative research & development	0.00	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	10.00	0	10.00
National Civil Aircraft Development	0.00	0.00	0.00	10.00	0.00	10.00	0.00	0.00	0.00	10.00	0	10.00
Total Assistance to CSIR	1756.91	1379.00	3135.91	1898.00	1462.00	3360.00	1516.73	1393.20	2909.93	1898.00	1558.00	3456.00
Assistance to CDC	4.00	0.00	4.00	5.00	0.00	5.00	3.16	0.00	3.16	4.00	0	4.00
Assistance to other scientific bodies												
Technology Promotion Development & Utilization Programmes	49.42	0.00	49.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0

Contd...

	Actual Expenditure 2011-12			Budget Estimates 2012-13			Revised Estimates 2012-13			Budget Estimates 2013-14		
	Plan	NP	Total	Plan	NP	Total	Plan	NP	Total	Plan	NP	Total
Information Technology	0.19	0.00	0.19	3.50	0.00	3.50	2.16	0.00	2.16	3.00	0	3.00
APCTT	2.07	0.00	2.07	3.00	0.00	3.00	1.20	0.00	1.20	2.40	0	2.40
DSIR building & infrastructure	0.00	0.00	0.00	0.50	0.00	0.50	0.00	0.00	0.00	1.00	0	1.00
Support to R&D schemes to CEL	4.00	0.00	4.00	10.00	0.00	10.00	2.75	0.00	2.75	10.00	0	10.00
Investments in Public Enterprises - CEL	2.50	0.00	2.50	3.50	0.00	3.50	0.00	0.00	0.00	4.00	0	4.00
Loans & Advances – CEL	2.50	0.00	2.50	3.50	0.00	3.50	0.00	0.00	0.00	4.00	0	4.00
Total CEL	9.00	0.00	9.00	17.00	0.00	17.00	2.75	0.00	2.75	18.00	0	18.00
Development and Promotion of Rural Technology, Export of Technology Informatics for Tech. Transfer etc. NRDC	3.50	0.00	3.50	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Invention Promotion Programme	3.50	0.00	3.50	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
Programme for Inspiring Investors and Innovators	0.00	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	4.50	0	4.50
Programme for Development of Technologies for Commercial Plan	0.00	0.00	0.00	3.00	0.00	3.00	0.00	0.00	0.00	3.50	0	3.50
Total NRDC	7.00	0.00	7.00	8.00	0.00	8.00	0.00	0.00	0.00	8.00	0	8.00
Promoting Innovations in individuals, Start-ups and MSMEs”(PRISM)	0.00	0.00	0.00	25.00	0.00	25.00	4.80	0.00	4.80	18.00	0	18.00
Patent Acquisition and Collaborative Research and Technology Development(PACE)	0.00	0.00	0.00	10.00	0.00	10.00	0.20	0.00	0.20	17.50	0	17.50
Building Industrial R&D and Common Research Facilities (BIRD)	0.00	0.00	0.00	18.50	0.00	18.50	0.00	0.00	0.00	9.10	0	9.10
Access to Knowledge for Technology Development and Dissemination (A2K+)	0.00	0.00	0.00	24.50	0.00	24.50	24.00	0.00	24.00	34.00	0	34.00
G. Total	1828.59	1386.11	3214.70	2013.00	1471.00	3484.00	1555.00	1401.00	2956.00	2013.00	1558.00	3571.00



ANNEXURE - 1

STATEMENT ON RECOGNITION OF IN-HOUSE R&D UNITS

Month	Year	Receipts	Cumulative Receipts	Disposal	Cumulative Disposal
January	2012	34	59	8	8
February	2012	48	107	22	30
March	2012	48	155	26	56
April	2012	22	177	19	75
May	2012	24	201	34	109
June	2012	16	217	34	143
July	2012	22	239	40	183
August	2012	39	278	22	205
September	2012	35	313	26	231
October	2012	30	343	—	231
November	2012	33	376	48	279
December	2012	30	406	32	311

* A pendency of 25 applications was carried forward from year 2011

ANNEXURE - 2

**STATEMENT ON RENEWAL OF RECOGNITION OF IN-HOUSE R&D UNITS WHOSE
RECOGNITION WAS VALID UPTO 31.03.2012**

Month	Year	Receipts	Cumulative Receipts	Disposal	Cumulative Disposal
February	2012	180	180	0	0
March	2012	120	300	58	58
April	2012	40	340	152	210
May	2012	50	390	123	333
June	2012	24	414	76	409
July	2012	33	447	31	440
August	2012	9	456	7	447
September	2012	18	474	18	465
October	2012	8	482	17	482
November	2012	5	487	5	487
December	2012	3	490	3	490



ANNEXURE - 3

LIST OF IN-HOUSE R&D UNITS IN INDUSTRY REPORTING ANNUAL EXPENDITURE MORE THAN ₹ 500 LAKHS

Sl. No.	Name of the firm	R&D Expenditure Reported (₹ in lakhs) *
1.	Ajanta Pharma Ltd.	2196
2.	Alembic Ltd.	4898
3.	Alkali Metals Ltd.	542
4.	Apollo Tyres Ltd.	32058
5.	Ashok Leyland Ltd.	27232
6.	Asian Paints (India) Ltd.	3590
7.	Associated Cement Companies Ltd.	682
8.	Astra Microwave Products Ltd.	571
9.	Atul Ltd.	882
10.	Amara Raja Batteries Ltd.	2301
11.	Audco India Ltd.,	538
12.	Aurobindo Pharma Ltd.	1732
13.	Arch Pharma Labs Ltd.	2576
14.	Automotive Infotronics. Pvt. Ltd.	1309
15.	Avesthagen Ltd.	2485
16.	Bajaj Auto Ltd.	12460
17.	Bajaj Tempo Ltd.	1974
18.	BASF India Ltd.	945
19.	Battelle Science & Technology India Pvt. Ltd.	633
20.	Bharat Biotech International Ltd.	448
21.	Bharat Dynamics Ltd.	807

Sl. No.	Name of the firm	R&D Expenditure Reported (₹ in lakhs) *
22.	Bharat Earth Movers Ltd.	1793
23.	Bharat Electronics Ltd.	2092
24.	Bharat Forge Ltd.,	752
25.	Bharat Heavy Electricals Ltd.	98186
26.	Bharat Petroleum Corporation Ltd.	2564
27.	Bharat Serums & Vaccines Ltd.	2838
28.	Bilcare Ltd.	2628
29.	Biocon India Ltd.	12450
30.	Biological E. Ltd.	6853
31.	BPL Ltd.	2643
32.	Brakes India Ltd.	1530
33.	Britannia Industries Ltd.	928
34.	BST Ltd.	928
35.	Cadila Healthcare Ltd.	30170
36.	Cadila Pharmaceutical Ltd.	2600
37.	Central Electronics Ltd.	3363
38.	CavinKare Pvt. Ltd.	850
39.	Central Mine Planning & Design Inst. Ltd.	2579
40.	Cipla Ltd.	2324
41.	Clariant Chemical (India) Ltd.	1500
42.	Claris Life Sciences Ltd.	2077
43.	CMC Ltd.	891
44.	Cipla Ltd.	28485
45.	Crompton Greaves Ltd.	9772
46.	Cummins India Ltd.	6200
47.	Deepak Nitrite Ltd.	646
48.	Delphi – TVS Diesel Sysems Ltd.	1790
49.	Dishman Pharmaceutical & Chemical Ltd.	863
50.	Divi's Laboratory	2166
51.	Dr. Reddy's Laboratories Ltd.	59180
52.	Eicher Motors Ltd.	1526

*Annexure-3 Contd.*

Sl.	Name of the firm	R&D Expenditure Reported (₹ in lakhs) *
53.	E-I DuPont India Pvt. Ltd.	3660
54.	EID Parry (India) Ltd.	792
55.	Electronics Corporation of India Ltd.	4328
56.	Emcure Pharmaceuticals Ltd.	3969
57.	Emerson Network Power (India) Pvt. Ltd.	565
58.	Enem Nostrum Remedies Pvt. Ltd.	600
59.	Engineers India Ltd.	8542
60.	Escorts Ltd.(Tractor Division)	1734
61.	Exide Industries Ltd.	938
62.	Excel Crop care	967
63.	FDC Ltd.	2080
64.	Fenner (India) Ltd.	886
65.	Gharda Chemicals Ltd.	802
66.	Glaxo Smithkline Pharmaceutical Ltd.	581
67.	Glenmark Pharmaceutical Ltd.	5051
68.	Gennova Biopharmaceuticals Ltd.	772
69.	GMM Pfaudler Ltd.	2085
70.	Godfrey Philips (India) Ltd.	1005
71.	Grauer & Weil (India) Ltd.	878
72.	Greeves Cotton Ltd.	1079
73.	Grasim Industries Ltd.	886
74.	G7 Synergon Pvt. Ltd.	3300
75.	Gujarat Alkalies & Chemicals Ltd.	530
76.	Gujarat State Fertilizers & Chemicals Ltd.	1231
77.	Gujarat Olio Chem Ltd.	571
78.	HBL Nife Power System Ltd	600
79.	Himachal Futuristics Communication Ltd.	4283
80.	Himalaya Drug Company	804
81.	Hindustan Aeronautics Ltd.	12063
82.	Hindustan Lever Ltd.	9936
83.	Hindustan Polymides & Fibres Ltd.	2523

Sl. No.	Name of the firm	R&D Expenditure Reported (₹ in lakhs) *
84.	Hindustan Petroleum Corporation Ltd.	561
85.	Hindustan Zinc Ltd.	1491
86.	ILS Bioscience Pvt. Ltd.	550
87.	Indian Aluminium Company Ltd.	628
88.	Indian Oil Crop. Ltd	20773
89.	Indian Petrochemicals Corporation Ltd.	7127
90.	Indian Telephone Industries Ltd.	7154
91.	Indoco Remides Ltd.	1014
92.	Indus Biotech Ltd.	1432
93.	Intas Pharmaceuticals Ltd.	10593
94.	International Tractors Ltd.	2019
95.	IPCA Lab. Ltd.	1409
96.	ITC Ltd.	824
97.	J.B. Chemicals & Pharmaceuticals Ltd.	1136
98.	Johnson & Johnson Ltd.	6071
99.	Jyoti Ltd.	622
100.	Jubilant Organosys Ltd.	6091
101.	Kansai Nerolac Paints Limited	1291
102.	Kirloskar Oil Engine Ltd.	894
103.	Lakshmi Machine Works Ltd.	1184
104.	Larsen & Toubro Ltd.	1600
105.	LG Electronics India Pvt. Ltd.	5182
106.	Link well Tele System (P) Ltd.	537
107.	Lucas-TVS Ltd.	2324
108.	LML Ltd.	925
109.	Lupin Ltd.	26690
110.	Malladi Drug and Pharmaceuticals Ltd.	660
111.	Maharashtra Hybrid Seeds Company Ltd.	1452
112.	Mahindra & Mahindra Ltd.	12074
113.	Matrix Laboratories Ltd.	29369
114.	Micro Labs Ltd.	710

*Annexure-3 Contd.*

Sl. No.	Name of the firm	R&D Expenditure Reported (₹ in lakhs) *
115.	Minda Industries Ltd.	1495
116.	MindariKa Pvt. Ltd.	1144
117.	Mirc Electronics Ltd.	895
118.	Monsanto Holding Pvt. Ltd.	3100
119.	Moser Baer India Ltd.	1077
120.	Motor Industries Co. Ltd.	2973
121.	MRF Ltd.	1215
122.	Natco Fine Pharmaceuticals Pvt. Ltd.	506
123.	Natural Remedies Pvt. Ltd.,	539.74
124.	National Mineral Development Corporation Ltd.	695
125.	National Thermal Power Corporation Ltd.	561
126.	Nector Lifesciences Ltd.	1388.24
127.	Neyveli Lignite Corporation Ltd.	1055
128.	Nicholas Piramal Pvt. India Ltd.	9115
129.	Novartis Healthcare Pvt. Ltd.	1113.38
130.	Nuziveedu Seeds Ltd.	1395
131.	Oil & Natural Gas Corp. Ltd.	18460
132.	Oil India Ltd.	1400
133.	Orchid Chemicals & Pharmaceuticals Ltd.	7090
134.	Organica Aromatics Ltd.	4819
135.	Panacea Biotech Ltd.	2263
136.	Pest Control (I) Ltd.	764
137.	Pfizer Ltd.	2429
138.	P. I. Industries Ltd.	516
139.	Pricol Ltd.	1234
140.	Proagro Seed Company Ltd.	724
141.	Proalgen Biotech Ltd.	1852
142.	Projects & Development India Ltd., The	675
143.	Promed Exports Ltd	1659
144.	Punjab Tractors Ltd.	1276
145.	Radient Cables Pvt. Ltd.	801

Sl. No.	Name of the firm	R&D Expenditure Reported (₹ in lakhs) *
146.	Rallis India Ltd.	1000
147.	Ramco Systems Ltd.	3284
148.	Ranbaxy Laboratories Ltd.	49015
149.	Regent Drug Ltd	2067
150.	Reliance Industries Ltd.	4106
151.	Reliance Life Sciences	2652
152.	Sahajananad Medical Technologies Pvt. Ltd.	689.22
153.	Sami Lab Ltd.	572
154.	Sanmar Speciality Chemicals Ltd.	1086
155.	Saurav Chemicals Ltd.	1410
156.	Secure Meters Ltd.	4191
157.	Semi Conductor Complex Ltd.	502
158.	Serum Institute of India. Ltd.	6530
159.	Shantha Biotechnics Pvt. Ltd.	2630
160.	Shasun Chemical and Drugs Ltd.	2850
161.	Shasun Pharmaceuticals Ltd.	1426
162.	Shriram Piston & Rings Ltd.	583
163.	SRF Ltd.	3238
164.	Steel Authority of India Ltd.	1040
165.	Strides Arcolab Ltd.	3050
166.	Sun Pharmaceuticals Industries Ltd.	38387
167.	Sundaram Clayton Ltd.	526
168.	Sudarshan Chemical Industries Ltd.	1155
169.	Surya Pharmaceutical Ltd.	2490
170.	Suven Life Sciences Ltd.	1446
171.	Syngenta India Ltd.	905
172.	Syngne International Ltd.	5751
173.	Tata Consultancy Services (TCS) Ltd.	1694
174.	TATA Chemicals Ltd.	43810
175.	Tata Motors Ltd.	76871
176.	Tata Power Co. Ltd.	814

*Annexure-3 Contd.*

Sl. No.	Name of the firm	R&D Expenditure Reported (₹ in lakhs) *
177.	Tata Steel Ltd.,	8057
178.	Tata Tea Ltd.	508
179.	The United Phosphorous Ltd.	650
180.	Themis Laboratories Pvt. Ltd.	554
181.	Torrent Pharmaceuticals Ltd.	3191
182.	Tractors & Farm Equipment Ltd.	2587
183.	Tube Products of India (Unit of Tube Investment of India Ltd.)	650
184.	TVS Motor Co. Ltd.	9804
185.	UCAL Fuel Systems Ltd.	1100
186.	Unichem Laboratories Ltd.	2445
187.	Unimark Laboratories Ltd.	2328
188.	USV Ltd.	5168
189.	Venco Research & Breeding Farm Ltd.	2203
190.	Venkateshwara Research & Breeding Farm (P) Ltd.	1045
191.	Videocon International Ltd.	2341
192.	Wanbury Ltd.,	2497
193.	Wheels India Ltd.	759
194.	Wipro Ltd.	2436
195.	Wockhardt Ltd.	2359
196.	Zen Technologies Ltd.	779

* R&D Expenditures Reported are as claimed by the firms in their available Annual reports in DSIR/renewal applications.

ANNEXURE - 4

**LIST OF IN-HOUSE R&D UNITS IN INDUSTRY REPORTING
ANNUAL EXPENDITURE IN THE RANGE OF
₹ 100 LAKHS TO ₹ 500 LAKHS**

Sl. No.	Name of the firm	R&D Expenditure Reported (₹ In lakhs) *
1.	Advanced Enzymes	475
2.	Aarti Industries Ltd.	464
3.	Aarti Drugs Ltd.	374
4.	Accurate Gauging & Instruments Pvt. Ltd.	140
5.	Ador Welding Ltd.	240
6.	Advanced Neuro-Science Allies Pvt. Ltd.	404
7.	Advanta India Ltd.	142
8.	Aerospace System Pvt. Ltd.	65
9.	Ajit Seeds Ltd.	346
10.	Alkyl Amines Chemicals Ltd.	256
11.	Alkam Laboratories Ltd.	364
12.	Amalgam Leather Pvt. Ltd.	283
13.	Amara Raja Batteries Ltd.	136
14.	Amar Biotech Ltd.	115
15.	Amoli Organics Pvt. Ltd.	140
16.	Amphenol Interconnect India Pvt. Ltd.	162
17.	Amrutanjan Ltd.	373
18.	Amtrex Hitachi Appliances Ltd.	120
19.	Ankur Seeds Pvt. Ltd.	313
20.	Anabond Ltd.	322
21.	Apar Industries Ltd.	160

*Annexure-4 Contd.*

Sl. No.	Name of the firm	R&D Expenditure Reported (₹ in lakhs) *
22.	Aptech Ltd.	179
23.	Apollo Tyres Ltd.	413
24.	Applied Electro-Magnetics Pvt. Ltd.	240
25.	Arch Pharma Labs Ltd.	100
26.	Ardee Business Services Pvt. Ltd.	114
27.	Arjuna Natural Extracts Ltd	183
28.	A S L Advanced System Ltd.	375
29.	Autometer Alliance Ltd.	176
30.	Avera Laboratories Ltd.	121
31.	Avsarala Tungsten Ltd.	183
32.	Avestha Genuine Technologies Pvt. Ltd.	495
33.	BPL Engineering Ltd.	125
34.	BPL Telecom Ltd.	110
35.	BalaJi Amines Ltd.	372
36.	Bajaj Electricals Ltd.	167
37.	Ballarpur Industries Ltd.	104
38.	Balmer Lawrie & Company Ltd.	253
39.	Balsara Hygiene Products Ltd.	124
40.	Bangalore Integrated System Solution Pvt. Ltd.	215
41.	Banyan Network Pvt. Ltd.	138
42.	Bata India Ltd.	392
43.	Bayer Crop Sciences Ltd.	190
44.	Biological E. Ltd.	292
45.	Biostadt MH Seeds Ltd.	264
46.	Bejo Sheetal Seeds Pvt. Ltd	390
47.	Berger Paints India Ltd.	279
48.	Bharat Seats Ltd.	132
49.	Bharat Heavy Plate & Vessels Ltd.	338
50.	Bhartia Industries Ltd.	129
51.	Bilag Industries Pvt. Ltd.	315
52.	Biological E. Ltd.	114

Sl. No.	Name of the firm	R&D Expenditure Reported (₹ in lakhs) *
53.	Bombay Burmah Trading Corporation Ltd.	132
54.	Botil Oil Tools India Pvt. Ltd.	493
55.	Buhler (India) Pvt. Ltd.	476
56.	CMC Computers Ltd.	134
57.	Calyx Chemical & Pharmaceuticals Pvt. Ltd.	244
58.	Camlin Ltd.	194
59.	Carborundum Universal Ltd.	185
60.	Castrol India Ltd.	487
61.	Catterpillar India Ltd.	232
62.	Celestial Labs Ltd.	165
63.	Cantaur Chemical Ltd.	373
64.	Cantaur Pharmaceuticals Ltd.	350
65.	Century Textiles & Industries Ltd.	56
66.	Ceat Ltd. (Tyre Division)	118
67.	Chembond Chemicals Ltd.	104
68.	Chennai Petroleum Corporation Ltd.	334
69.	Colour-Chem Ltd.	482
70.	Comed Chemicals Ltd.	166
71.	Concept Pharmaceuticals Ltd.	250
72.	Coral Telecom Ltd.	101
73.	Cosmo Films India Ltd.	290
74.	CTM India Ltd.	206
75.	DE-NOCIL Crop Protection Ltd.	216
76.	DGP Hinoday Industries Ltd.	190
77.	DGP Windsor India Ltd.	152
78.	Dai-ichi Karkaria Ltd.	355
79.	Dhampur Sugar Mills Ltd.	300
80.	Dr. Vithalrao Vikha Patil Sahakari Sakhar Karkhana Ltd.	384
81.	Duke Arnic Electronics Ltd.	108
82.	Dynamatic Technologies Ltd.	232
83.	East India Pharmaceutical Works Ltd.	105

*Annexure-4 Contd.*

Sl. No.	Name of the firm	R&D Expenditure Reported (₹ in lakhs) *
84.	Efftronics System Pvt. Ltd.	212
85.	Emcure Biotech Ltd.	450
86.	Elder Pharmaceutical Ltd.	400
87.	Electronic Research Ltd.	131
88.	Elgi Tread (India) Ltd.	208
89.	Elin Electronics Ltd.	332
90.	Emergent Genetics India Pvt. Ltd.	323
91.	Emmellen Biotech Pharmaceuticals Ltd.	193
92.	Encore Software Ltd.	428
93.	Enercon Systems Pvt. Ltd.	100
94.	Enem Nostrum Remedies Pvt. Ltd.	500
95.	Eureka Forbes Ltd.	424
96.	Evonik Energy Services (India) Pvt. Ltd.	275
97.	Excel Crop Care Ltd.	252
98.	Excel Industries Ltd.	142
99.	Eveready Industries India Ltd.	110
100.	Excel Industries Ltd.	208
101.	Fermenta Biotech Ltd.	240
102.	Fibcom India Ltd.	273
103.	Filtra Catalysts & Chemicals Ltd.	129
104.	Flamingo Pharmaceuticals Ltd.	113
105.	Forbes Marshall Pvt. Ltd.	304
106.	Fortune Biotech Ltd.	204
107.	Foseco India Ltd.	242
108.	Gajra Gears Pvt. Ltd.	90
109.	Gammon India Ltd.	128
110.	Ganga Kaveri Seeds Pvt. Ltd.	381
111.	Garware Polyester Ltd.	261
112.	Gensynth Fine Chemicals Pvt. Ltd.	110
113.	Gland Pharma Ltd.	450
114.	Granules India Ltd.	278

Sl. No.	Name of the firm	R&D Expenditure Reported (₹ in lakhs) *
115.	Gujarat State Fertilizers & Chemicals Ltd.	378
116.	Gilbrandson Chemicals Ltd.	168
117.	Garware Wall Ropes Ltd.	180
118.	Genus Overseas Eletronics Ltd.	302
119.	Gland Pharma Ltd.	261
120.	Godavari Sugar Mills Ltd.	100
121.	Godrej Agrovvet Ltd.	135
122.	Goodlass Nerolac Paints Ltd.	412
123.	Gupta H.C. Oversease (I) Pvt. Ltd.	300
124.	Gujarat Narmada Valley Fertilisers Co. Ltd.	167
125.	HMT Ltd. (Tractor Division)	140
126.	HMT Machine Tools Ltd.	281
127.	Hargovind Bajaj Research & Development Centre	258
128.	Harita Seating Systems Ltd.	168
129.	Hindustan Motors Ltd. (Auto Division)	478
130.	Haryana State Electronics Development Corpn. Ltd.	170
131.	Hawkins Cookers Ltd.	110
132.	Heinz India Pvt. Ltd.	408
133.	Hetero Drugs Ltd.	406
134.	Hema Engineering Industries Ltd.	102
135.	Hikal Ltd.	351
136.	High Polymer Lab.	116
137.	Hindalco Industries Ltd.	191
138.	Hindustan Antibiotics Ltd.	126
139.	Hindustan Cables Ltd.	207
140.	Hindustan Construction Company Ltd.	362
141.	Hindustan Copper Ltd.	119
142.	Hindustan Insecticides Ltd.	105
143.	Hindustan Photo Films Manufacturing Co. Ltd.	83
144.	Hindustan Polyamides & Fibres Ltd.	251
145.	Hindustan Zinc Ltd.	362

*Annexure-4 Contd.*

Sl. No.	Name of the firm	R&D Expenditure Reported (₹ in lakhs) *
146.	Hitachi Home & Life Solutions India Ltd.	158
147.	Hyderabad Industries Ltd.	164
148.	Hytech Seed India Pvt. Ltd.	155
149.	IBP Company Ltd.	229
150.	Indian Acrylics Ltd.	295
151.	India Glycols Ltd.	121
152.	India Nippon Electricals Ltd.	130
153.	Indian Hume Pipe Ltd.	106
154.	Indian Rare Earth Ltd.	236
155.	India Pistons Ltd.	233
156.	Ind Swift Laboratories Ltd.	458
157.	Ind Swift Ltd.	133
158.	Indo American Hybrid Seeds (India) Ltd.	169
159.	Indoco Remedies Ltd.	401
160.	Indofill Chemicals Ltd. (Division of Modipon Ltd.)	220
161.	Indo-National Ltd.	147
162.	Infotech Enterprises Ltd.	114
163.	Innova Children's Heart Hospital	461
164.	Innovassynth Technologies (I) Ltd.	154
165.	Intervet India Pvt. Ltd.	368
166.	Ion Exchange (India) Ltd.	122
167.	Jay Hind Industries Ltd.	105
168.	J. Mitra & Co. Ltd.	109
169.	J.B. Chemicals & Pharmaceuticals Ltd.	438
170.	JCBL Ltd.	193
171.	J.K. Agri-Genetics Ltd.	493
172.	Jain Irrigation Systems Ltd.	149
173.	Jindal Steel Power Ltd.	188
174.	Jindal Vijaynagar Steel Ltd.	240
175.	Jyoti Ceramic Industries Pvt. Ltd.	169
176.	KCP Sugar Industries Corporation Ltd.	421

Sl. No.	Name of the firm	R&D Expenditure Reported (₹ in lakhs) *
177.	Kancor Ingredients Ltd.	165
178.	Kannametal Widia India Ltd.	295
179.	Kasila Farms Ltd.	110
180.	KEC International Ltd.	159
181.	Kerala Minerals & Metals Ltd.	110
182.	Kerala State Electricity Board	142
183.	KG Design Service Pvt. Ltd.	130
184.	Kirloskar Brothers Ltd.	171
185.	Kirloskar Copeland Ltd.	262
186.	Kirloskar Electric Co. Ltd.	125
187.	Kinetic Engineering Ltd.	251
188.	Kochi Refineries Ltd.	191
189.	Kopran Research Laboratories Ltd.	307
190.	Krishidan Seeds Ltd.	415
191.	Kumar Organic Products Ltd.	188
192.	L&T Komatsu Ltd.	138
193.	Lab India Instruments Pvt. Ltd.	161
194.	Lamco Industries Pvt. Ltd.	306
195.	Lifecare Innovations (Pvt.) Ltd.	109
196.	Luminous Power Technologies (P). Ltd.	432
197.	Lupin Ltd.	225
198.	Lyka Labs Ltd.	123
199.	MIC Electronics Ltd.	237
200.	MRO-Tek Ltd.	282
201.	Midas Communication Technologies Pvt. Ltd.	427
202.	MTAR Technologies Pvt. Ltd.	165
203.	Maruti Udyog Ltd.	275
204.	Macleods Pharmaceuticals Ltd.	292
205.	Madhu Silica Pvt. Ltd.	177
206.	Madras Engineering Industries Pvt. Ltd.	134
207.	Mafatlal Industries Ltd.	268

*Annexure-4 Contd.*

Sl. No.	Name of the firm	R&D Expenditure Reported (₹ in lakhs) *
208.	Malladi Drug and Pharmaceuticals Ltd.	274
209.	Manali Petrochemical Ltd.	80
210.	Manugraph India Ltd.	104
211.	Marico Industries Ltd.	240
212.	Metal Power Company Ltd.	134
213.	Matrix Telecom Pvt. Ltd.	337
214.	Mc-Dowell & Co. Ltd.	355
215.	Megafine Pharma (P) Ltd.	329
216.	Midas Communication Technology Pvt. Ltd.	159
217.	Minda Huf Ltd.	227
218.	Mishra Dhatu Nigam Ltd.	277
219.	Modipon Ltd.	221
220.	Multi Arc India Ltd.	239
221.	NRC Ltd.	155
222.	Nagarjuna Fertilisers & Chemicals Ltd.	176
223.	Nagarjuna Agrichem Ltd.	161
224.	National Aluminium Company Ltd.	435
225.	Namdhari Seeds Ltd.	201
226.	National Organic Chemical Industries Ltd.	206
227.	Natural Remedies Pvt. Ltd.	351
228.	Navya Biologicals Pvt. Ltd.	210
229.	Newland Laboratories Ltd.	439
230.	Nicco Corpn. Ltd. (Cable Divn.), Calcutta	121
231.	Nirmal Seeds pvt. Ltd.	114
232.	Novodigm Ltd.	187
233.	Nunhum Seeds Ltd.	147
234.	Ocimum Bio Solution (India) Pvt. Ltd.	141
235.	OmniActive Health Technologies Ltd.	507
236.	Oriental Engineering Works Pvt. Ltd.	106
237.	Otis Elevator Co. (India) Ltd.	123
238.	P I Industries Ltd.	250

Sl. No.	Name of the firm	R&D Expenditure Reported (₹ in lakhs) *
239.	Panasonic Batteries India Co. Ltd.	195
240.	Parry Agro Industries Ltd.	140
241.	Philips Carbon Black Ltd.	129
242.	Piaggio Vehicle. Pvt. Ltd.	383
243.	Pidilite Industries Ltd.	396
244.	Premas Biotech Pvt.Ltd.	462
245.	Premier Polytronics Pvt. Ltd.	101
246.	Pratista Industries Ltd.	379
247.	RPG Life Sciences Ltd.	406
248.	Radiant Corporation Pvt. Ltd.	329
249.	Rane Brake Linings Ltd.	333
250.	Rane TRW Steering Systems Ltd.,	140
251.	Rasi Seeds Ltd.	125
252.	Rajapalayam Mills Ltd.	187
253.	Rajasthan Antibiotics Ltd.	217
254.	Raptakos Brett Co. Ltd.	239
255.	Rolta India Ltd.	270
256.	Rashtriya Chemicals & Fertilizers Ltd.	456
257.	Reliance Cellulose Products Ltd.	146
258.	Reva Electric Car Co. Pvt. Ltd.	355
259.	Rubamin Pharmaceuticals Ltd.	125
260.	SRF Ltd.	290
261.	Sai Life Sciences Ltd.,	176
262.	Sakthi Sugar Ltd.	364
263.	Sakata Ink (I) Ltd.	122
264.	Samcor Glass Ltd.	244
265.	Samtel Colours Ltd.	245
266.	Samtel Color Ltd.	115
267.	Sandvik Asia Ltd.	186
268.	Schenectady-Beck India Ltd.	101
269.	Scooters India Ltd.	112

*Annexure-4 Contd.*

Sl. No.	Name of the firm	R&D Expenditure Reported (₹ in lakhs) *
270.	Seed works International	336
271.	Sekhsaria Chemicals Ltd.	347
272.	Seminis Vegetables Seeds India Ltd.	294
273.	Semco Electric Pvt. Ltd.	114
274.	Shalimar Paints Ltd.	315
275.	Shree Cement Ltd.	193
276.	Shreeji Laser Technology Pvt. Ltd.	127
277.	Shriram Pistons & Rings Ltd.	338
278.	Siechem Technologies Pvt. Ltd.	237
279.	Siegwerk India Pvt. Ltd.	390
280.	Simpson & Co. Ltd.	355
281.	SLN Technologies Pvt. Ltd.	125
282.	SMR Automotive System India Ltd.	178
283.	SOF Blue Pvt. Ltd.	333
284.	Sona Koyo Steering Systems Ltd.	262
285.	Sonodyne International Pvt. Ltd.	157
286.	Southern Petrochemical Industries Corpn. Ltd.	332
287.	Spaco Carburettors (India) Ltd.	132
288.	Speck Systems Ltd.	180
289.	Sparsh Pharma International Pvt. Ltd.	100
290.	Steel Strips Ltd.	201
291.	Sterlite Industries (India) Ltd.	228
292.	Structwell Designers & Consultants Pvt. Ltd.	113
293.	Stumpp, Schedle and Somappa Spring Pvt. Ltd.	247
294.	Sudarshan Biotech Ltd.	160
295.	Sudarshan Chemicals Industries Ltd.	404
296.	Sundaram Brake Lining Ltd.	301
297.	Sundaram Fastner Ltd.	356
298.	Sujeeva Greentec Pvt. Ltd.	100
299.	Swaraj Mazda Ltd.	173
300.	TIL Ltd.	114

Sl. No.	Name of the firm	R&D Expenditure Reported (₹ in lakhs) *
301.	TVS Electronics Ltd.	442
302.	TVS Srichakra Ltd.	142
303.	Thirumalai Chemicals Ltd.	348
304.	Tablets India Ltd.	164
305.	Tamilnadu Petroproducts Ltd.	280
306.	TATA Chemicals Ltd.	101
307.	Tata International Ltd.	102
308.	Tata Refractories Ltd.	206
309.	Tata Tea Ltd.	419
310.	Tally Solutions Pvt. Ltd.	262
311.	Tecumesh Products India Ltd.	184
312.	Telco Construction Equipment Company Ltd.	343
313.	Tetra Pak India Pvt. Ltd.	158
314.	Tejas Networks Ltd.	320
315.	Thermax Ltd.	337
316.	Tonira Pharma Ltd.	234
317.	Themis Laboratory Limited	475
318.	The Apex Electricals Ltd.	152
319.	The Dharamsi Morarji Chemical Co. Ltd.	138
320.	The India Cement Ltd.	128
321.	Thermax Ltd.	338
322.	Tide Water Oil Co. (India) Ltd.	130
323.	Titanium Tantalum Products. Ltd.	250
324.	Transasia Biomedicals Ltd.	426
325.	Travancore Titanium Products Ltd.	125
326.	Triveni Engineering & Industries Ltd.	169
327.	Turbo Engineering Ltd.	228
328.	Tulip Lab Pvt. Ltd.	125
329.	Tulsi Seeds Pvt. Ltd.	120
330.	Unitech Machines Ltd.	326
331.	United Telecoms Ltd.	311

*Annexure-4 Contd.*

Sl. No.	Name of the firm	R&D Expenditure Reported (₹ in lakhs) *
332.	VIP Industries Ltd.	425
333.	Vaishnavi Biotech Ltd.	341
334.	Venkateshwara Hatcheries Ltd.	460
335.	Vishnu Chemicals Ltd.	269
336.	Voltas Ltd.	132
337.	Walchandnagar Industries Ltd.	103
338.	Whirlpool of India Ltd.	120
339.	Yuken India Ltd.	178
340.	Zandu Pharmaceuticals Works Ltd.	139
341.	Zenotech Laboratories Ltd.	193

* R&D expenditures reported are as claimed by the firms in their available Annual reports in DSIR/renewal applications.

ANNEXURE - 5

**LIST OF SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS (SIROS) RECOGNIZED BY
DSIR DURING THE PERIOD JANUARY 2012 TO NOVEMBER 2012.**

S.No.	Name of Organisation	DSIR Validity
1	Academy of Life Sciences of the Society of Plant Reproductive Biologists, Agra	31-03-2014
2	Academy of Scientific and Innovative Research (AcSIR), New Delhi	31-03-2015
3	Ankush Shikshan Sanstha, Nagpur	31-03-2015
4	Asian Institute of Public Health, Bhubaneswar	31-03-2015
5	Assam Down Town University of Down town Charity Trust, Dispur, Guwahati	31-03-2015
6	AVT Institute for Advanced Research of 'The Ayurvedic Trust', Coimbatore.	31-03-2014
7	Bangalore Medical Services Trust, Bangalore	31-03-2015
8	Bangaore Baptist Hospital, Bangalore	31-03-2015
9	Bioclues Voluntary Organization, Secunderabad	31-03-2014
10	Dayanand Medical College & Hospital Managing Society, Ludhiana	31-03-2014
11	Dayanand Sagar Institutions of Mahatma Gandhi Vidya Peeth Trust, Bangalore	31-03-2015
12	Deep Ganga Foundation, Delhi	31-03-2015
13	Durbar Mahila Samanwaya Committee, Kolkata	31-03-2015
14	Eternal University of the Kalgidhar Trust, Sirmore, H.P.	31-03-2015
15	G.H. Raisonni Educational & Medical Foundation, Nagpur	31-03-2015
16	Helplife, Pune	31-03-2014
17	Institute of Liver & Biliary Sciences (ILBS), New Delhi	31-03-2014
18	International Union for Health Promotion and Education Punjab Chapter, Ludhiana, Punjab	31-03-2015
19	Jawaharlal Nehru Technological University Anantapur, Anantapur	31-03-2015
20	Maharishi Markandeshwar University Trust, Mullana, Ambala	31-03-2014

*Annexure-5 Contd.*

S.No.	Name of Organisation	DSIR Validity
21	Mahatma Gandhi Mission's Medical College, Navi Mumbai	31-03-2015
22	Molecular Diagnostics, Counseling, Care & Research Centre, Coimbatore	31-03-2015
23	Nansen Environmental Research Centre, Kochi	31-03-2015
24	Narayana Medical College & Hospital of Narayana Educational Society : Nellore, Nellore	31-03-2015
25	National Institute of Applied Human Research and Development (NIAHRD), Cuttak, Odisha	31-03-2014
26	National Institute of Food Technology Entrepreneurship and Management (NIFTEM), New Delhi	31-03-2015
27	National Institute of Mental Health & Neurosciences, Bangalore	31-03-2014
28	Natya Shod Sansthan, Kolkata	31-03-2014
29	Nitte University, Mangalore, Karnataka	31-03-2014
30	Parimal Banerji International Research Foundation, Kolkata	31-03-2015
31	Peermade Development Society, Peermade, Kerala	31-03-2015
32	Pondicherry Institute of Medical Sciences (A unit of Madras Medical Mission), Pondicherry	31-03-2014
33	PRAYAS (Initiative in Health, Energy Learning and Parenthood), Pune	31-03-2015
34	Prayas, New Delhi	31-03-2015
35	Pushpagiri Medical Society, Tiruvalla, Kerala	31-03-2014
36	Sairam Advanced Centre for Research of Sapthagiri education Trust, Chennai	31-03-2015
37	Sat Kaival College of Pharmacy (SKCOP), Sarsa, Anand, Gujarat	31-03-2014
38	SETH Research Foundation, New Delhi	31-03-2014
39	Shivani Educational and Charitable Trust, Banamaliprasad, Dhenkanal, Orissa	31-03-2015
40	Shivrath Centre of Excellence in Clinical Research [a joint Venture with Gujarat State Bio-technology mission (GSBTM), D/Science & Technology, Govt. of Gujarat], Thaltej, Ahmedabad	31-03-2014
41	Society for Energy, Environment & Development, Hyderabad	31-03-2015
42	Society for Institute of Development Management, Bhopal	31-03-2015
43	Sri Balaji Educational 31-03-2014& Charitable Trust, Puducherry	31-03-2015
44	Sri Venkateshwara Education Society, Bangalore	31-03-2015
45	SRM University (SRM Institute of Science and Technology), Chennai	31-03-2015

S.No.	Name of Organisation	DSIR Validity
46	St. Stephen's Hospital of St. Stephen's Hospital Society, Delhi	31-03-2014
47	Tata Institute of Social Sciences, Mumbai	31-03-2015
48	The Deccan Sugar Technologists' Association (India), Pune	31-03-2014
49	Toc H Institute of Science & Technology, Ernakulam	31-03-2015
50	Vivekanand Medical Foundation & Research Centre (Research Division), Latur	31-03-2014
51	World Healthal Trust, New Delhi	31-03-2014

**ANNEXURE -6**

**CERTIFICATES FOR CLAIMING ACCELERATED DEPRECIATION ALLOWANCE
ISSUED BY DSIR UNDER RULE 5(2) OF THE
I.T. RULES VIDE NOTIFICATION NO. 133/342/86-TPL DATED 01-04-1987**

Sl.No.	Name of the Company	Source of Know-how/ Technology	Item of Manufacture	Investments Certified (₹ in lakhs)
1.	Bharat Electronics Ltd., Bangalore	Defence Research & Development Laboratories and In-house.	Electronic equipment and components	2824.98
2.	Bharat Electronics Ltd., Bangalore	Defence Research & and Development Laboratories In-house.	Electronic equipment and components	3191.36
3.	Bharat Electronics Ltd., Bangalore	Defence Research & Development Laboratories and In-house.	Electronic equipment and components	883.35
Total				6899.69

ANNEXURE -7

LIST OF COMMERCIAL R&D COMPANIES APPROVED BY DSIR U/S 80IB(8A) OF IT ACT 1961

1. M/s Icube Nanotec Indian Pvt. Ltd., Delhi
2. M/s TCG Lifesciences Limited, Kolkata
3. M/s Jubilant Chemsys Ltd., Noida
4. M/s Lotus Labs Pvt. Ltd., Bangalore
5. M/s Shipra Labs Ltd., Hyderabad
6. M/s GVK Bioscience Pvt. Ltd., Hyderabad
7. M/s Synchron Research Services Pvt. Ltd., Ahmedabad
8. M/s Evotec (India) Pvt. Ltd., Thane (W)
9. M/s Clintha Research Limited (Formerly M/s BA Research India Ltd., Ahmedabad)
10. M/s Advinus Therapeutics Pvt. Ltd., Bangalore
11. M/s Fine Research & Development Centre Pvt. Ltd., Mumbai
12. M/s Actavis Pharma Development Centre, Bangalore
13. M/s Clinsys India Ltd., Nodia
14. M/s Orchid Research Laboratories Ltd., Chennai
15. M/s P I Life Science Research Ltd., Udaipur
16. M/s Aditya Birla Science & Technology Company Ltd., Navi Mumbai
17. M/s Sun Pharma Advance Research Company Ltd., Baroda
18. M/s Computational Research Laboratories Pvt. Ltd., Pune
19. M/s Global Transgenes Limited, Aurangabad
20. M/s Fortis Clinical Research Ltd., Faridabad



ANNEXURE - 8

LIST OF COMPANIES APPROVED U/S 35(2AB) OF INCOME TAX ACT, 1961

Sl. No.	Firm	Sl. No.	Firm
1.	Zeus Numerix Pvt. Ltd.	24.	Unique Biotech Limited
2.	Panama Petrochem Ltd.	25.	Motherson Sumi Systems Limited
3.	East West Seeds India Pvt. Ltd.	26.	Mangalam Cement Ltd.
4.	PCP Chemicals Pvt. Ltd.	27.	Polyplex Corporation Limited
5.	GSP Crop Science Private Limited	28.	Agro Tech Foods Limited
6.	AVT Natural Products Limited	29.	Geo Biotechnologies India Pvt. Ltd
7.	Shakti Agrotech Pvt. Ltd.z	30.	Minex Metallurgical Co.Ltd.
8.	Tergene Biotech Private Limited	31.	FIBCOM India Limited
9.	PRS Permacel Private Limited	32.	Stedman Pharmaceuticals Pvt. Ltd.
10.	Mybox Technologies Pvt. Ltd.	33.	Indian Herbs Research & Supply Co. Ltd.
11.	Lakshmi Precision Screws Ltd.	34.	Jayashree Electrodevices Pvt. Ltd.
12.	Sparsha Pharma	35.	Kusum Healthcare Pvt. Ltd.
13.	Kamani Oil Indusutries Pvt. Ltd.	36.	Mangalam Drugs and Organics Ltd.
14.	Godrej Industries Limited	37.	Neo Seeds India Limited
15.	Renu Electronics Private Limited	38.	SLN Technologies Pvt. Ltd.
16.	Tata Johnson Controls Automotive Ltd.	39.	Crest Composites and Plastics Pvt. Ltd.
17.	AVI-OIL India Private Limited	40.	Bharat Nursery Pvt. Ltd.
18.	Everest Industries Limited	41.	ATS Elgi Limited
19.	Pan Seeds Private Limited	42.	Whirlpool of India Limited
20.	Tasty Bite Eatables Limited	43.	Virchow Biotech Private Limited
21.	Voltas Ltd.	44.	Span Diagnostics Ltd.
22.	Ayurved Ltd.	45.	Marsons Limited
23.	Universal Construction Machinery and Equipment Ltd.	46.	Marshall Breeders Pvt. Ltd.

Sl. No.	Firm	Sl. No.	Firm
47.	Mobme Wireless Solutions Pvt. Ltd.	78.	Poly Medicure Limited
48.	C.R.I. Rumps Pvt. Ltd.	79.	Omkar Speciality Chemicals Ltd.
49.	Amoli Organics Pvt. Ltd.	80.	KPIT Cummins Infosystems Ltd.
50.	ReGen Powertech Pvt. Ltd.	81.	Mitra Industries Pvt Ltd.
51.	Provimi Animal Nutrition India Pvt. Ltd.	82.	Chemical Resources
52.	Powai Labs Technology Pvt. Ltd.	83.	Minda Valeo Secutity System Pvt. Ltd.
53.	Fermenta Biotech Limited	84.	Hikal Limited
54.	Mahindra Sona Ltd.	85.	Colourtex Industries Ltd.
55.	AGIO Pharmaceuticals Ltd.	86.	United Biotech (P) Ltd.
56.	Kajaria Ceramics Ltd.	87.	Rasayani Biologics Pvt Ltd,
57.	20 Microns Nano Minerals Ltd.	88.	Fiem Industries Limited
58.	Gumpro Drilling Fluids Pvt. Ltd.	89.	Vivimed Labs Ltd.
59.	Snam Alloys Pvt. Ltd.	90.	Agriland Biotech Limited, Baroda
60.	NTL Electronis India Ltd.	91.	Janatics India Pvt Ltd., Coimbatore
61.	Cell Works Research India Pvt. Ltd.	92.	Amalgamated Plantations Pvt Ltd.
62.	Garware Elastomerics Limited	93.	Behr India Limited
63.	Rubicon Research Pvt. Ltd.	94.	Eimco Elecon (india) Ltd
64.	Cosme Pharma Laboratorics Ltd.	95.	The Kerala Minerals and Metals Ltd.
65.	SM Herbals Pvt. Ltd.	96.	HCL Infosystems Ltd.
66.	Kancor Ingredients Limited	97.	Reliance Industries Ltd.
67.	STP Limited	98.	Uniphos Envirotroic Pvt Ltd.
68.	Automed Systems Pvt. Ltd.	99.	JSL Lifestyle Limited
69.	Windlas Biotech Ltd.	100.	Persistent Systems Ltd.
70.	Global Calcium Pvt. Ltd.	101.	Acpl Exports pvt. Ltd, New Delhi
71.	Radhe Renewable Energy Development Pvt. Ltd.	102.	Bio Genex Life Sciences Pvt. Ltd
72.	Ace Designers Ltd.	103.	Sakata Seed India Pvt Ltd.
73.	Metahelix Life Sciences Limited	104.	Eveready Industries India Ltd.,
74.	Pharmanza Herbal Pvt. Ltd.	105.	Victor Gaskets India limited
75.	Deccan Enterprises Pvt. Ltd.	106.	Hindustan Motors Limited
76.	Grand Polycoats Co. Pvt. Ltd.	107.	Pinnacle Industries Ltd.
77.	Hitech Plast Ltd.	108.	Infosys Limited
		109.	INDO-US Biotech Pvt Ltd.

*Annexure-8 Contd.*

Sl. No.	Firm	Sl. No.	Firm
110.	Lakshmi Machine Works Ltd.	142.	Super Agri Seeds Pvt Ltd.
111.	Amol pharmaceuticals pvt Ltd.	143.	Ahlcon Parenterals (India) Ltd
112.	Optra Systems Pvt. Ltd.	144.	Rudraksha Allied Chemical Private Limited
113.	Star Engineers (I) Pvt. Ltd	145.	Takata India Pvt Ltd.
114.	Envision Scientific Pvt. Ltd	146.	McNally Bharat Engineering Co. Ltd.
115.	NeoCorp International Limited	147.	Instapower Ltd.
116.	LCS controls private limited	148.	Tally Solutions Pvt Ltd.
117.	Globion India private limited	149.	Gabriel India Limited
118.	Resonance Laboratories Pvt Ltd.	150.	Hykon Power Electronics (P) Ltd.
119.	Senthil Seeds Pvt Ltd.	151.	Symmetrix Biotech Pvt Ltd.
120.	Shreem Elecric Ltd.	152.	Rotofit Engineers Limited
121.	DTL Ancillaries Ltd.	153.	Escorts Construction Equipments Ltd.
122.	ZIM Laboratories Ltd.	154.	Avasarala Technologies Ltd.
123.	MEC Shot Blasting Equipments Pvt Ltd.	155.	Cheminova India Limited
124.	Encube Ethicals Pvt Ltd.	156.	Hetero Labs Limited
125.	Unijules Life Sciences Ltd.	157.	Sasken Communications Technologies Ltd.
126.	Centum Electronics Limited	158.	Geltec Pvt. Ltd
127.	Spicer India Limited	159.	Electropneumatics & Hydraulics (India) Pvt Ltd.
128.	IDMC Limited	160.	Suguna Poultry Farm Limited
129.	Garware Polyester Ltd.	161.	Mankind Pharma Limited
130.	Precimeasure Controls Pvt Ltd.	162.	Mehta API Pvt Ltd.
131.	Raptim Research Ltd.	163.	Strassenburg Pharmaceuticals Ltd.
132.	Mosil Lubricants Pvt Ltd.	164.	Centum Rakon India Pvt Ltd.
133.	Orient Paper Mills	165.	Associated Soapstone Distributing Company Pvt Ltd.
134.	Ciron Drugs & Pharmaceuticals Pvt Ltd.	166.	O/E/N India Limited
135.	HLL Lifecare Limited	167.	Hoganas India Pvt Ltd.
136.	McNally Sayaji Engineering Ltd	168.	Akums Drugs & Pharmaceuticals Ltd.
137.	Oil India Ltd	169.	Oswal Industries Ltd.
138.	Agappe Diagnostics Ltd.	170.	Usha International Ltd.
139.	GMM Pfadler Limited	171.	Fluidtherm Technology (P) Ltd.
140.	Formulated Polymers Limited		
141.	Symphony Limited		

Sl. No.	Firm	Sl. No.	Firm
172.	International Panaacea Limited	202.	Parry Agro Industries Ltd.
173.	Aquatech Systems (Asia) Pvt Ltd.	203.	3M India Ltd.
174.	Eco Recycling Ltd.	204.	Setco Automotive Ltd.
175.	Rolta India Ltd.	205.	Tata Power Company Ltd.
176.	Indo Shell Cast Pvt Limited	206.	Siechem Technologies Pvt Ltd.
177.	Camlin Fine Sciences Ltd.	207.	Sri Research For Tissue Engineering Pvt. Ltd.
178.	MAG Solvics Pvt Ltd.	208.	Sri Bitech Laboratories India Ltd.
179.	Polaris Financial Technology Ltd.	209.	Richcore Lifesciences Pvt Ltd.
180.	Tridiagonal Solutions Pvt Ltd.	210.	Jindal Crop sciences Pvt Ltd.
181.	Enaltec Labs Pvt Ltd.	211.	VST Tillers tractors Ltd.
182.	Span Biotronics Pvt Ltd.	212.	Orbicular Pharmaceuticals Technologies Pvt Ltd.
183.	Daimler Commercial Vehicles Pvt. Ltd.	213.	Bharat Dynamics Ltd.
184.	Patel Brass Works Pvt Ltd.	214.	D.K. Pharmachem Pvt Ltd.
185.	Poddar Pigments Ltd.	215.	GEO Biotechnologies India Pvt Ltd.
186.	Tata Yazaki Autocomp Ltd.	216.	Hawkins Cookers Ltd.
187.	Lark Laboratories (India) Ltd.	217.	Pranav Vikas (India) Ltd.
188.	Stovec Industries Ltd.	218.	Ador Welding Ltd.
189.	Mahle Filter Systems (India) Ltd.	219.	Khosla Machines Pvt Ltd.
190.	Privi Organics Limited	220.	Ramtech Software Solutions Pvt Ltd.
191.	Bloom Energy India Pvt Ltd.	221.	Sandeep Axles Pvt Ltd.
192.	Kaypeeyes Biotech Pvt Ltd.	222.	Deepak Novochem Technologies Ltd. Pune
193.	Rex-Tone Industries Ltd.	223.	R.J. Biotech Limited
194.	Optimal Power Synergy India Pvt Ltd.	224.	Surya Roshni Ltd.
195.	Continental Carbon India Ltd.	225.	Deki Electronics Ltd.
196.	Shri Navkar Metals Ltd.	226.	Varuna Biocell Pvt Ltd.
197.	Abbott India Ltd.	227.	Logic Plus Plus India Pvt Ltd.
198.	Zensar Technologies Ltd.	228.	Rhydburg Pharmaceuticals Ltd.
199.	Nu Genes Pvt Ltd.	229.	Ittiam Systems Pvt Ltd.
200.	D-Espat Pvt Ltd.	230.	Techno Auto Components (I) Pvt Ltd.
201.	Orkash Services Pvt Ltd.		



ANNEXURE - 9

LIST OF TDDP/PATSER PROJECTS COMMERCIALIZED

S. No.	Agency	Title
1.	Ace Designers Pvt. Ltd., Bengaluru	Development of P C based C N C Machining System
2.	Aesthetic Technologies Pvt. Ltd., Kolkata and NRDC, New Delhi	Interactive Multimedia for I P R Training
3.	Aishwaraya Telecom Pvt. Ltd. Hyderabad	Optical Test Equipments
4.	Andrew Yule & Co. Ltd., Kolkata	Rough Top Rubber Conveyer Belting
5.	Arch Pharmalabs Ltd., Mumbai,	Development of Polymorphic Form1 Clopidogrel Bisulphate
6.	Atcom Technologies, Mumbai	Technology Development of Microbalance of 1.0 MG Accuracy and High Dynamic Range
7.	Bharat Earth Movers Ltd., Bengaluru	Upgradation of 50 T Dumper & 200 HP Front end loader
8.	Solaris Chemtech Ltd. (Formerly BILT Chemicals Ltd.) Mumbai	Development of Technology for Tetra Bromo Bisphenol-A (TBBA) on a Pilot Plant level
9.	Delta Agro Chemicals Ltd. Krishna, and Indian Institute Of Chemical Technology, Hyderabad	Development of Process for Furfuryl Alcohol by Hydrogenation of Furfuryl
10.	Dolphin Industrial Cooperative Society, Vizianagarm	Development of Glazing on Terracotta Clay Products
11.	Encon Thermal Engineers (P) Ltd. Faridabad and I I P, Dehradun	Development of Industrial Gas Burner
12.	Enercon Systems Pvt. Ltd., Bengaluru, and ER&DC Thiruvananthapuram ,	Development of a Centralised Electrical Management System & Conservation of Electrical Energy in Industries
13.	Elkay Chemicals Pvt. Ltd, Pune	Development of next Generation Amino Silicon based on Hydrosilation process
14.	Gujarat Narmada Fertilizer Co. Ltd. Bharuch and Engineers India Limited, New Delhi	Development of Liquid Phase oxidation process for Hydrogen Sulphide and Recovery of Sulphur from sour gases

S. No.	Agency	Title
15.	Hero Cycles Ltd., Ludhiana	Development of 6-HI Cold Rolling Mill
16.	Hindustan Zinc Ltd., Udaipur	Simultaneous Recovery of Copper Sulphate and Cobalt from Zinc Plant Wastes
17.	I.B.P Co. Ltd. Gurgaon	Development of Detonating Cord
18.	Indian Institute of Packaging (IIP), Mumbai (Select Packaging Machines Ltd.) Thane and Samarpan Fabricators, Mumbai	Development of Blister Packaging Machines and Packaging Machines for Odd Shaped Articles
19.	Innovation Communication Systems Ltd. Hyderabad	Development of Interactive Voice Response Systems
20.	J S L Industries Ltd., Anand and ERDA, Vadodara	Upgradation of Air Circuits Breaker Type A-7
21.	Lifecare Innovations Pvt. Ltd New Delhi	Scale Up Process Development for Production of Liposomal Amphotericin B- Awareness Programme and Clinical Performance: Trials
22.	Litex Electricals (P) Ltd., Pune and Centre for Advanced Technology, Mumbai	Development of Xenon/Krypton Filled Lamps for Laser Pumping
22.	Litex Electricals (P) Ltd., Pune and Centre for Advanced Technology, Mumbai	Development of Xenon/Krypton Filled Lamps for Laser Pumping
23.	Maini Materials Movements (P) Ltd., Bengaluru	Research Development, Design and Engineering of World Class In-Plant Material Handling Equipment for Global Market
24.	Mecpro Heavy Engg. Ltd., New Delhi	Demonstration of on Efficient Solvent Extraction Plant & Technology with the Vent Air Cracking System
25.	Mecpro Heavy Engg. Ltd. New Delhi	Development and Demonstration of Eco-Friendly and Efficient Edible Oil Refining Technology of Twin Bleaching System and De-acidification cum Deodorization System
26.	Minda Industries Ltd. Delhi	Development of Auto Elect Switches
27.	Mishra Dhatu Nigam Ltd. Hyderabad	Welding Molydenum Wires to make 20 KG Coils
28.	Mishra Dhatu Nigam Ltd. Hyderabad	Development of Wires With High Surface Finish
29.	NALCO Bhuvneshwar	Pilot Scale Development of Special Alumina and Hydrates
30.	Organic Coating Ltd. Mumbai	Manufacturing of Water Based Flexo and U V Radiation Curing Inks
31.	PAN India Electromech. Pvt. Ltd	Development and Demonstration of Complete Automated Solution For Hydrography
32.	Priya Bricks (P) Ltd., New Delhi	Development of Stiff Extrusion Bricks
33.	Radiant Corporation Pvt. Ltd., Hyderabad	Development of special version Low Loss RF Cables & others Specialty Cables

*Annexure-9-Contd.*

S. No.	Agency	Title
34.	Rishang Keshing Foundation For Management of Tribal Areas, New Delhi	Integration Pilot Demonstration Plant for Spice Processing
35.	S M Telesys Ltd. Noida	Development of Multilingual Pagets
36.	Steel Strips Wheels Ltd., Chandigarh	Technology Development and Demonstration of Automotive Wheel Rims through Modified Manufacturing Process
37.	T. Stanes Pvt. Ltd. , Coimbatore	Development of Digested Organic Supplement (DORS)
38.	Zen Technologies Ltd., Secunderabad	Interactive Small Arms Training Software - Intensive Computer based Training Aid Meant to Help Trainees Perfect Advanced Marksmanship Skills Including Skills based
39.	Ardee Business Services Pvt. Ltd., Vishakhapatnam	Development of Four Channel RAMDRAS Coal Dry Beneficial System
40.	Maharashtra State Seeds Corporation Ltd., Mumbai	Development and Testing of Mini Dry HCl Gas Cotton Delinting Plant
41.	United Telecoms Group Bengaluru	Design & Development of ADSL (Asymmetric Digital Subscriber Line) System
42.	United Telecoms Group Bengaluru	Dev. of ATM Access Multiplexor
43.	Anu Labs, Hyderabad	Development of Process For Manufacturing of 1 Bromo 3-Chloro Propane (B.C.P) & 1,3 DiBromo Propane (BBP) in Pilot Plant
44.	Ned Energy Ltd., Bengaluru	Development and Demonstration of High Energy Density Valve Regulated Lead Acid Batteries For Electric Vehicles
45.	MIC Electronic Ltd., Hyderabad	Development of Fraud Management and Control Centre (FMCC)
46.	Aishwaraya Telecom Pvt. Ltd., Hyderabad	Design & Development of Optical Power Meter (Typa A & B) and Optical Talk set
47.	Central Electronics Ltd.	Digital Axle Counter System
48.	T. Stanes and Company Ltd., Coimbatore	Establishing Bio Control Agency Production Unit.
49.	M/s. Poona Health Services Pvt. Ltd., Poona	Development of Implants for knee joints
50.	Development of Digested Organic Supplement (DORS)	T. Stanes Pvt. Ltd., Coimbatore
51.	Development of Technology for Cross-linked Polyurethane Dispersions	Haryana Chemicals Limited, Haryana
52.	Celestial Labs.	Development of toxicity prediction module
53.	Engineers India Ltd (EIL)	H2S Removal

**DETAILS OF PROJECTS SUPPORTED UNDER TECHNOPRENEUR PROMOTION
PROGRAMME DURING THE YEAR**

Project Proposals recommended for approval during the Year 2011-2012

Sl. No.	Name of the project
TePP Phase I	
1	Development of low cost diagnostic tool to identify cardiac patients at risk of restenosis
2	Rapid detection and differentiation of torch infections by one-step PCR assay
3	Development of portable, non-invasive Oral Cancer Detection System
4	An innovative technology for Recharging Alluvial Aquifers
5	Vishwakarma Diesel Engine – High Machine and Eco-friendly Diesel Engine
6	Belt system for Body Support
7	Evaluation of laccase production under solid state and submerged fermentation
8	Automated garment dyeing, chemical washing end effluent treatment wet processing machine for cotton textiles and cotton garments
9	Traffic jam detection & control using PLC&SCADA
10	Design and fabrication of Automated Hank Reeling machine
11	Design and development of Yarn Break Informator
12	Root crops washer(specially designed for Carrots and Reddish)
13	Multiple zone well completion technology for enhanced oil recovery
14	Formulation and development of nutraceutical formulation with anti-cancer activity
15	Finger gesture based automated wheel chair
16	Low cost hand controlled drive vehicle for handicaps
17	Automatic fodder feeding system for cattle
18	Modular & reversible 2-in-1 school shoes
19	Prototype development of Rahman's Yender
20	Sports car with hybrid engine



Sl. No.	Name of the project
21.	Design and development of a Micro Light Propeller Hydro Turbine
22.	Computer interfaced Hi-fidelity Affordable Mannequin for Effective CPR(Cardiopulmonary Resuscitation) training
23.	Single spring mounted suspension type extendable with cultivator (STF)/13.03.2012
Micro-Technopreneurship	
24.	Anti theft emergency device(ATED)
25.	Motion control of wheel chair by head rotation using MEMS accelerometer sensor
26.	Mobile based belonging locator
27.	Visbreaker for crude petroleum oil
28.	A device to control fine dust in rice mills
29.	Double tank flush cistern
30.	3 rd Invincible EYE-A home automation system using voice and face recognition
31.	Handheld terminal for Indian Logistic System
32.	Emission controlling bio-absorbents for automobiles
COMPLETED PROJECTS	
1.	Innovation on Normal Scaife i.e. GEM-polishing wheel for gem polishing application
2.	Automated scan lock
3.	Buttonhole machine
4.	Growth stimulator for plants
5.	Development of a wireless sensor network & communication protocol in underground mine environment
6.	Design and development of low cost u-controller based Digital CO ₂ analyser for beverage industry
7.	Cost effective cell phone controlled AC and Car lock system(TS)
8.	Alkali lignin products & cooler pads from dry pine needles (Ph-II)
9.	Tea & tea based herbal health drinks (Ph-II)
10.	Design and development of 3GPP LTE (Long term evolution) cellular products for base station, CPE (Customer Premise Equipments) and WiL TE (Wi Fi+LTE) based femtocells (Ph-II)
11.	Development of process technology for production of photographic films(Ph-II)
12.	LPG fuelled iron box
13.	Digital controlled precise dispensing valve for liquids under gravity flow
14.	Crankshaft metrology system
15.	Portable front-loaded washing machine without concrete structure



Sl. No.	Name of the project
16.	Sensors for fluoride and E coli in fluids
17.	Bulk synthesis of carbon nano tubes
18.	Ultrathin(microporous) metal film sealed chargeable battery
19.	Intelligent pump calibrator
20.	Shoe brush with wax polish
21.	Merlyn D3 low cost modular bomb disposal robot with flexible chassis system
22.	Rat Vanisher(Rat Repellent)
23.	Slow release multi micro-nutrient Boron based fertilizer
24.	Development of device for testing minimal anti-biotic concentration for Bio-film eradication
25.	Stem cell marker protein CD44 in cancer diagnosis: Development of an Immunodiagnostic Kit
26.	Multi-Radio Data Communication system for wireless active RFID/Sensor Network
27.	Fabrication of low-cost lab scale electro-spinning machine
28.	Developing novel photo catalysts for photo degradation on various dyes without pre-treatment
29.	Bio-conversion of feather – a poultry waste to high nutritive value feed using keratinase
30.	Vision system for automatic inspection of rectangular sensor devices
31.	Nutraceutical composition containing egg yolk derived anti-diarrhoeal agent
32.	Smart toilet
33.	Design and development of water disinfectant process controller
34.	Development of non-evasive EIT based sensor to monitor vital foetal & material parameters for mass health care purpose
35.	Development of Drishti-care – a tele-diagnosis platform for retinal examination
36.	Promotion of thrombocheck test kit
37.	Guided crank PIN design IC engine
38.	Development of speech enabled chest vibrometer (TS)
39.	Development of bio-active wound dressings (TS)
40.	Focal length independent, high resolution wide frame, camera array & X-ray imager
41.	Laryngotracheal stenosis : A new indigenous stent design
42.	Electronic vibration alert indicator (TS)
43.	Multi-level automatic two-wheeler parking unit
44.	Mobile control military operation in a defence vehicle as a lab model (TS)
45.	Development of ELISA kits for Thyroid Stimulating Hormone (TSH), Thyroxine(T4) and 3,5,3-Tridothyroxine (T3)



Sl. No.	Name of the project
46.	Pickling acid recovery using diffusion analysis
47.	Guided crank PIN design IC engine
48.	Light duty variable displacement compressor
49.	Manual Compressor (TS)
TePP ON-GOING PROJECTS [as on 05.12.2012]	
TePP Phase I	
1	Areca nut peeling machine
2	Stored Heat Cooker
3	Direct Current Transformer
4	Elliptical Machining Bed (EMB)
5	Design improvement of Mangal Turbine
6	Tamper proof electronic lock
8	Manually operated water pump
9	Seamless Weaving Machine
10	Visual events recognition on a chip
11	Soap less washing machine
12	Vessel cleaning machine
13	Development and commercialization of electric fences
14	Automatic vending machine
16	Technology up-gradation of Ayurvedic Bullet Proof Jacket
17	Modified wood stove
18	NUALGI for growth of Diatom algae
19	High speed wireless sensor data acquisition system
20	Auto compression sprayer
21	Intelligent LP Gas Detector (IGD)
22	Salt harvesting equipment
23	Inhaler for insulin administration
24	Product Hairminator for validation of Hypothesis – Cytotoxic Lectin Inhibit growth of Hair follicle
25	Technology upgradation of Telescopic Bronchoscope
26	Development of groundnut separator machine
27	Development of different variants for mobile operated switch
28	Design and development of temperature indicating chalks (??)



Sl. No.	Name of the project
29	Development of Arrowroot grinding machine
30	Development of advanced model of pomegranate deseeding machine and procuring certifications to meet the requirement of the export market
31	Development of Walnut cracker machine
32	SN Door Wind Mill
33	Development of low cost, high performance LED based home illumination system for rural and tribal areas
34	Prepaid cash card for ATM system for electric bill
35	Prototyping Chandrapabha water gun (Rain Gun) and trial runs for testing the durability, acceptability, replicability etc.
36	Pooga sizing machine
37	Mrityunjay – An Advanced Electronic Distant Patient Monitoring System
38	Low cost multi-media projector
39	Micro controller based custom designed overload relay
40	Scale-up and standardization of an economical commercially viable laboratory process to isolate γ -Oryzanols from the waste products arising out of rice bran oil refineries
41	Device and process to capture losses due to weather event in any specific geographical coordinate
42	Ball press washer for cleaning and crushing biological raw materials
43	Lengthwise Zig-zag cutting of steel coils
44	Synthesis of nanocrystalline HAP and sintered compacts of the same
45	Bath Brush
46	Development of aqueous metal oxide based super capacitors
47	Heart throb-portable generic multi factor medical measurement unit
48	Variable length pedal-crank assembly with doubling of torque
49	Steerable Headlights
50	Shoulder harness helmet
51	Development of friction stir welding process
52	Innovation of Ultraclean electro stag refined technology/cost effective substitute for clinical applications
53	Development of a wireless sensor network & communication protocol in underground mine environment
54	Microprocessor based lubrication flow and inductive sensing and controlling device
55	2-D Nano-Positioner
56	Development of a commercial Rheometer for High Performance Concrete
57	Smart solar irrigation unit
58	Design & development of dynamic stretch comfort measurement device for sport and healthcare application



Sl. No.	Name of the project
59	Low temperature heat engine
60	Design & development of domestic monoblock pump without shaft
61	Fermenter – microprocessor based controller with GSM mobile technology
62	Design & development of a prototype of a digital textile printing machine
63	Pilot plant desalination of sea water
64	Integrated security management
65	RSW Chiller
66	Simultaneous production of multiple digestive enzymes from microbial sources
67	Planar inverted F-antenna for mobile communication (PIFA)
68	Development of Customized Audiometer
69	Development of Bhavana's Procto Tub
70	Banana cotton separator
71	Manually operated wheat reaper
72	Development of improved seed drill
73	Instant sewage treatment plant (e-STP)
74	Product development of sugarcane bud chipper
75	Development of Star Node Circuit Breaker (SNCB) for newly invented midget transformers as well as for some presently available conventional transformers
76	Multimodal interaction systems for urban children for playing computer games
77	Bathrooms for the safety of elderly
78	Design of novel plant bioreactor
79	Fabrication of high energy planetary mill and low temperature synthesis of tungsten-carbide & cobalt composite powder at nano scale using the same
80	Portable microchip slide projector (teaching aid)
81	Development of sensor-based systems for estimation of Fluoride and E. Coli in drinking water
82	Development of filler grade PTFE powder and recycling PTFE scrap material
83	Products designed to maintain temperature without the need of continuous power
84	High energy density capacitor development
85	Retractable auto disposable syringes
86	Synthesis of carbon nanotubes loaded with metal nanoparticles for application as electrodes in fuel cells
87	Natural potassium extract from agricultural organic source
88	Prickly pear (OPUNTIA) Products – The New Emerging Nutraceuticals
89	Municipal solid waste Window Turner



Sl. No.	Name of the project
90	Solar powered DC/BLDC motor operated kerosene dispensing unit with biometric/bar code access control for PDS
91	Development of cost effective new generation electronic energy meter for domestic use
92	Non-electric water level indicator
93	Handwriting improvement slate
94	Digitally controlled three dimensional billboard
95	Peptone biotech
96	Application turned lacquering process on solid bamboo species to make non-toxic, eco-friendly toys and accessories for children
97	Indian sink utensils washer
98	Electrical transmission tower damaged protection monitor
99	Vaneer laminated lumber
100	Embedded hardware based security solutions
101	Automated multilevel modular system for parking vehicles
102	Recycling of Tungsted Carbide Scrap Material by a cost effective process
103	Evolutionary glass slumping technology within the realms of art, architecture and sciences
104	ACCEPTOR
105	Community lighting from the use of hand pump
106	Project Y-Cook – Convenient to eat, multi dish just eat food in thermoformed interlock-able multilayer rigid containers
107	Development of a commercial product – Digital Protractor
108	Continuous ethanol fermentation from Mahua flower by using packed bed bioreactor with immobilized yeast for production of industrial grade ethanol
109	Instant non-invasive hemoglobin and blood sugar analyzer
110	A damper controlled above knee prosthesis
111	Scale independent pilot model design of bio-gas purification from agro industrial waste
112	Design and development of Fresnel moulds, lenses and goods
113	Fitment removal cum lifting/lowering arrangement for draft fear of wagons of Railways
114	Open ocean farming structures for the cultivation of commercially important Indian Seaweeds
115	Multi line refreshable Braille display
116	Scientific development and validation of a herbal drug for Diabetic –Neuropathy
117	Innovation of high performance cricket leg gear
118	Development of device for testing minimal antibiotic concentration for biofilm eradication



Sl. No.	Name of the project
119	CNG Magnetorherological finishing machine
120	Development of bio-medical engineering application toolkit and development of Steth ECG Stress ECG,, Smart Bed among others using the modules of BEAT
121	Tarang Pariwartak – generating electricity from Ocean waves
122	Bullock drawn improved multi crop seed cum fertilizer drill
123	Novel and affordable emergency modification system for school children
124	Content sharing on TV
125	An improved oropharyngeal airway
126	2 in 1, Self Secured Orthodontic spring separator for predictable separation of teeth in orthodontic patients
127	Development of prototype of flat bed 3-axis PC controlled vertical NC milling machine for sculptured surface machining for ornamental wood carving
128	Interactive Surfaces – Multi-touch walls and tables
129	A machine for interpretation and diagnosis of heart conditions based on ECG using expert system
130	Low cost device for notifying the presence of water borne diseases (pathogen) in community drinking water
131	Production and testing of selected Probiotic products as poultry feeds
Micro-Technopreneurship	
132	Energy efficient electromagnetic motor
133	New ocean wave energy harvesting system
134	Design and development of switched reluctance (SR) submersible motor
135	Vision system for automatic inspection of rectangular sensor devices
136	Evolution of some Ayurvedic formulation for their potentiality in the cure and management of diseases like cancer, diabetes
137	Digital valve controller P/N:DVC 02
138	Indirect type solar drier for processing food products
139	Development of filtered air supplying device for helmets
140	Vehicle driver monitoring system
141	Insype
142	Wireless transmission of power
143	Mobile presence authentication system
144	Development of multi-layer scan able voice output communication aid and special access switches
145	Development of a novel method for biometric recognition
146	Portable refrigerator



Sl. No.	Name of the project
147	Micro-mouse
148	Controlled motion in ironing through automation
149	Alternative growth medium for rice straw mushroom for increasing production per unit space
150	Development of a preservative and carrier by spores of entomopathogenic fungi with biological control applications
151	Continuously controlled electronic servo mains voltage stabilizer
152	Fuel theft alert system
153	Mechanical Porter
154	Multi angle power weeder
155	Electric assisted hydraulic rickshaw
156	Coconut fibre as suture material
157	Prototype development of low cost non-invasive glucometer
158	HEPCO beverage—a herbal and fruit beverage with medicinal & nutritional properties)
159	Health insoles/footwear
160	Data accumulation of a player in live sports
161	Wireless voice assistant for the dumb
162	Character recognizer for physically impaired using MEMS based wireless system
163	Audio sensing assistance for deaf people
164	Mobile phone detector in aircraft
165	Surveillance snake robot
167	Intuitive tele-controlled machine arm

TePP Phase-II

168	Design and development of Mechatronic Flyer Frame for Cotton Spinning
169	A rotary apparatus adopted to perform as a variable compression ratio IC engine
170	Heating/cooling apparel and accessories
171	Testing, trials & validation of prefabrication technology(PFT) developed products
172	Banana fibre separator machine
173	Tractor mounted pulveriser

**ANNEXURE -11****DEPARTMENT OF SCIENTIFIC & INDUSTRIAL RESEARCH (DSIR)
STAFF STRENGTH AS ON 1st DECEMBER 2012**

	No. of Employees				
	Gen	SC	ST	OBC	Total
Group'A' (Gazetted)	30	5	2	-	37
Group'B' (Gazetted)	6	2	-	2	10
Group'B' (Non-Gazetted)	15	5	-	2	22
Group'C' (Non-Gazetted)	9	2	1	2	14
Group'D' (Non-Gazetted)	2	6	-	-	08
Total	62	20	3	6	91

**REPRESENTATION OF SCs, STs AND OBCs**

Groups	Number of Employees				Number of appointments made during the previous Calendar year									
	(As on 15.12.2010)				By Direct Recruitment				By Promotion			By other Methods		
	Total	SCs	STs	OBCs	Total	SCs	STs	OBCs	Total	SCs	STs	Total	SCs	STs
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Group A	37	5	2	-	7	1	-	-	1*	-	-	-	-	-
Group B	32	7	-	4	-	-	-	-	-	-	-	-	-	-
Group C	14	2	1	2	-	-	-	-	-	-	-	-	-	-
Group D (Excluding sweeper)	08	6	-	-	-	-	-	-	-	-	-	-	-	-
Group D (Sweeper)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	91	20	3	6	7	1			1	-	-	-	-	-

Note: DSIR recruits only Scientific and Technical posts.

* Under FCS

**REPRESENTATION OF THE PERSONS WITH DISABILITIES
AS ON 1st DECEMBER 2012**

Group	Number of Employees				Direct Recruitment								Promotion							
					No. of vacancies reserved				No of Appointments Made				No. of vacancies reserved				No of Appointments Made			
	Total	VH	HH	OH	VH	HH	OH	Total	VH	HH	OH	VH	HH	OH	Total	VH	HH	OH		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19		
Group A	37	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-		
Group B	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Group C	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Group D	08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Total	91	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-		



ANNEXURE -12

EXTRACTS OF AUDIT OBSERVATIONS BY CAG

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

Unrealistic budgetary assumptions *

7.16 The budget circulars issued by the Ministry of Finance every year stipulate that due note, while framing the estimates, be taken of the past performance, the stages of formulation/implementation of the various schemes, the institutional capacity of the implementing agencies to implement the scheme, the constraints on spending by the spending agencies etc.,. The objective is to minimise the scope for avoidable surrenders at a later stage. Further, no provision should normally be made in the budget without completion of pre-budget scrutiny of the projects/schemes. Where, however, provision has been made without necessary scrutiny, such scrutiny should be completed and appropriate approvals obtained therefor before the commencement of the financial year at the latest by the time budget is passed by the Parliament. Scrutiny of the head-wise Appropriation accounts revealed that the Ministries/ departments made excessive provisions under various minor /sub-heads, which ultimately resulted in large savings and surrenders at the end of the year. **Appendix VII-J** gives the details of 140 such cases with savings of ₹ 10 crore and above, constituting more than 40 per cent of the budgeted provision.

(₹ in crore)					
Sl. No.	Minor/Sub-Head	Budget provisions	Actual Disbursement	Saving	Percentage of saving to budget provision
Grant No. 84 – Department of Scientific and Industrial Research					
105	3425.60.200.03 – Grants-in-aid for Technology Promotion Development & Utilization Programme	40.50	14.67	25.83	64

1.3 Utilisation Certificates

As per Financial Rules, certificates of utilization of grants in respect of grants released to statutory bodies/organizations are required to be furnished within 12 months from the closure of the financial year by the bodies/organizations concerned. Ministry/Department-wise details indicating the position of the total number of 31243 outstanding utilization certificates involving an amount of ₹ 25272.94 crore in respect of grants released up to March 2009 due by March 2010 (after 12 months of the financial year in which the grants were released) are given in **Appendix – VII**, as shown below:

(₹ in Lakhs)

Ministry/Department	Period to which grants relate (upto March 2009)	Utilization Certificates outstanding in respect of grants released upto March 2009 which were due by 31 st March, 2010	
Department of Scientific & Industrial Research	2005-06	1	13.64
	2006-07	3	55.00
	2007-08	4	71.40
	2008-09	73	450.45

*** Union Audit Report No. - 1 of 2010-11 for period ended March 2010 - Union Government (Civil) - Accounts of the Union Governments**

Report No. -38 of 2010-11 for period ended March 2010 - Autonomous Bodies



ANNEXURE -13



सत्यमेव जयते

R F D

(Results-Framework Document)

for

Department of Scientific and Industrial
Research
(2011-2012)



Section 1: Vision, Mission, Objectives and Functions

Vision

Enabling India to emerge as global industrial research and innovation hub

Mission

- Attracting industrial research in the country through industry and institution centric motivational measures and incentives;
- Creating an enabling environment for development and utilization of new innovations.
- Enhance innovations through its resources and channelize benefits thereof to the people.

Objective

- 1 To promote and nurture research and development in industry with a view to enhance industry's share in national R&D; expenditure;
- 2 To promote innovations through its resources and channelize benefits for public good.
- 3 To assess R&D; and Innovation Output of the industry;
- 4 Promotion and support for development of new and innovative products, processes and technologies and for improving industrial competitiveness;
- 5 To setup a Sectoral Innovation Council;
- 6 To empower women with technological support;
- 7 Capacity building of Asia Pacific region through Asian & Pacific Centre for Transfer of Technology (UN ESCAP-APCTT);
- 8 To implement e-Governance initiatives.

Functions

- 1 Recognition of In-house R&D; units of industry and Scientific and Industrial Research Organizations (SIROs);
- 2 Implementation of fiscal incentives to industry;
- 3 To launch studies and surveys that will help the department in promoting innovations and channelizing benefits thereof to the people;
- 4 To pursue industry for taking up socially relevant projects;
- 5 To pursue industry in taking up sponsored projects in public funded institutions for public good;
- 6 To hold periodic meetings with industries to review their R&D; and innovation work and analyze the data obtained;



Section 1: Vision, Mission, Objectives and Functions

- 7 To promote and support industry for development of new products, processes and technologies;
- 8 To encourage the spirit of creativity and innovativeness in individuals and scientist entrepreneurs;
- 9 To prepare a white paper, outlining the roadmap for Sectoral Innovation Council;
- 10 To provide technology based support to programmes aimed at benefiting women;
- 11 To provide infrastructural and programme support to UN-APCTT (Asian Pacific Centre for Transfer of Technology);
- 12 Implementation of Enterprise Resource Planning (ERP) solution;
- 13 Monitoring of Sevottam Complaint Citizen Charter and Grievance Redress Mechanism.

Section 2: Inter se Priorities among Key Objectives, Success indicators and Targets

Objective	Weight	Action	Success Indicator	Unit	Weight	Target / Criteria Value				
						Excellent 100%	Very Good 90%	Good 80%	Fair 70%	Poor 60%
[1] To promote and nurture research and development in industry with a view to enhance industry's share in national R&D expenditure;	20.00	[1.1] Recognition and renewal of R&D Centres	[1.1.1] Recognition & registration to new in-house R&D units; Scientific & Industrial Research Organisations (SIRO); Public Funded Research Institutions (PFRI)	Nos.	8.00	230	225	210	200	190
			[1.1.2] Renewal of recognition & registration to in-house R&D units; SIROs; PFRIIs	Nos.	5.00	715	700	650	620	580
		[1.2] Fiscal incentives for Scientific Research	[1.2.1] Approving new companies for availing fiscal benefits	Nos.	7.00	68	65	60	57	54
		[2.1] Study on identification and commercialization of socially relevant innovative technologies, available nationally as well as internationally	[2.1.1] Satisfactory completion of study	Date	4.00	15/01/2012	31/01/2012	15/02/2012	29/02/2012	15/03/2012
[2] To promote innovations through its resources and channelize benefits for public good.	20.00	[2.2] Study on promotion of knowledge based enterprises in the country, based on people's innovations	[2.2.1] Satisfactory completion of study	Date	3.00	15/01/2012	31/01/2012	15/02/2012	29/02/2012	15/03/2012
		[2.3] Study on nurturing the innovative potential of technical institutions in the country	[2.3.1] Satisfactory completion of study	Date	3.00	15/02/2012	29/02/2012	15/03/2012	22/03/2012	31/03/2012
		[2.4] Study on creating an enabling environment for promoting innovation based start-ups	[2.4.1] Satisfactory completion of study	Date	3.00	15/02/2012	29/02/2012	15/03/2012	22/03/2012	31/03/2012

Section 2: Inter se Priorities among Key Objectives, Success indicators and Targets

Objective	Weight	Action	Success Indicator	Unit	Weight	Target / Criteria Value				
						Excellent 100%	Very Good 90%	Good 80%	Fair 70%	Poor 60%
						15/03/2012	22/03/2012	27/03/2012	31/03/2012	--
[3] To assess R&D and Innovation Output of the industry.		[2.5] Study on promotion of innovations in export oriented SMEs for enhancing their exports	[2.5.1] Satisfactory completion of study	Date	3.00	15/03/2012	22/03/2012	27/03/2012	31/03/2012	--
		[2.6] Study on promotion of innovations in select manufacturing industry sectors for global competitiveness	[2.6.1] Satisfactory completion of study	Date	4.00	15/03/2012	22/03/2012	27/03/2012	31/03/2012	--
[4] Promotion and support for development of new and innovative products, processes and technologies and for improving industrial competitiveness;	5.00	[3.1] Periodic meetings with industries to review their R&D and Innovation work and analysis of data	[3.1.1] Assessment of new Patents filed	Date	2.00	31/12/2011	15/01/2012	31/01/2012	15/02/2012	29/02/2012
		[4.1] Technical and partial financial support to industrial R&D and technology development & demonstration projects through Technology Development and Demonstration Programme (TDDP)	[3.1.2] Assessment of new products commercialized [4.1.1] Approval of fresh projects	Date	3.00	31/12/2011	15/01/2012	31/01/2012	15/02/2012	29/02/2012
	26.00	[4.2] Support to individuals for conversion of science based innovative ideas into workable prototypes/processes through Technopreneur Promotion Programme (TePP)	[4.1.2] Product prototype or process developed & demonstrated	Nos.	7.00	37	35	30	25	20
			[4.2.1] Approval of fresh projects	Nos.	7.00	4	3	2	1	0
				Nos.	6.00	95	90	80	70	60

Section 2:
Inter se Priorities among Key Objectives, Success indicators and Targets

Objective	Weight	Action	Success Indicator	Unit	Weight	Target / Criteria Value				
						Excellent 100%	Very Good 90%	Good 80%	Fair 70%	Poor 60%
[5] To setup a Sectoral Innovation Council;	6.00	[5.1] To develop a white paper outlining the roadmap for creation of sectoral innovation council	[4.2.2] Product prototype or process demonstrated	Nos.	6.00	40	37	34	30	27
			[5.1.1] Stakeholder discussions	Date	3.00	30/06/2011	07/07/2011	14/07/2011	21/07/2011	28/07/2011
			[5.1.2] Drafting of the white paper	Date	3.00	31/08/2011	07/09/2011	14/09/2011	21/09/2011	28/09/2011
[6] To empower women with technological support;	3.00	[6.1] To provide technology based support to programmes aimed at benefiting women	[6.1.1] Number of organizations supported	Nos.	3.00	9	8	6	4	3
[7] Capacity building of Asia Pacific region through Asian & Pacific Centre for Transfer of Technology (UN ESCAP-APCTT);	3.00	[7.1] To provide infrastructural and programme support	[7.1.1] Number of activities/projects supported	Nos.	3.00	3	2	1	--	--
[8] To implement e-Governance initiatives.	2.00	[8.1] Design, Development, Validation and Certification of Enterprise Resource Planning (ERP) solution	[8.1.1] Finalization of system study, specifications, information architecture, Graphical User Interface (GUI) validation and User Acceptance Test (UAT) Certification	Date	2.00	10/12/2011	15/12/2011	20/12/2011	24/12/2011	31/12/2011
* Efficient Functioning of the RFD System	3.00	Timely submission of Draft for Approval	On-time submission	Date	2.0	07/03/2011	08/03/2011	09/03/2011	10/03/2011	11/03/2011
		Timely submission of Results	On-time submission	Date	1.0	01/05/2012	03/05/2012	04/05/2012	05/05/2012	06/05/2012
* Improving Internal Efficiency / Responsiveness / Service delivery of Ministry / Department	10.00	Implementation of Sevotam	Resubmission of revised draft of Citizens' / Clients' Charter	Date	2.0	15/12/2011	20/12/2011	25/12/2011	28/12/2011	31/12/2011

* Mandatory Objective(s)



Section 2: Inter se Priorities among Key Objectives, Success indicators and Targets

Objective	Weight	Action	Success Indicator	Unit	Weight	Target / Criteria Value				
						Excellent	Very Good	Good	Fair	Poor
						100%	90%	80%	70%	60%
* Ensuring compliance to the Financial Accountability Framework	2.00		Independent Audit of Implementation of Grievance Redress Mechanism	%	2.0	100	95	90	85	80
		Ensure compliance with Section 4(1) (b) of the RTI Act, 2005	No. of items on which information is uploaded by February 10, 2012	No	2.0	15	15	14	13	12
		Identify potential areas of corruption related to departmental activities and develop an action plan to mitigate them	Finalize an action plan to mitigate potential areas of corruption.	Date	2.0	10/02/2012	15/02/2012	20/02/2012	24/02/2012	29/02/2012
		Develop an action plan to implement ISO 9001 certification	Finalize an action plan to implement ISO 9001 certification	Date	2.0	10/02/2012	15/02/2012	20/02/2012	24/02/2012	29/02/2012
		Timely submission of ATNS on Audit Paras of C&AG	Percentage of ATNS submitted within due date (4 months) from date of presentation of Report to Parliament by CAG during the year.	%	0.5	100	90	80	70	60
* Mandatory Objective(s)		Timely submission of ATRs to the PAC Sectt. on PAC Reports.	Percentage of ATRs submitted within due date (6 months) from date of presentation of Report to Parliament by PAC during the year.	%	0.5	100	90	80	70	60
		Early disposal of pending ATNs on Audit Paras of C&AG Reports presented to Parliament before 31.3.2011.	Percentage of outstanding ATNs disposed off during the year.	%	0.5	100	90	80	70	60
		Early disposal of pending ATRs on PAC Reports presented to Parliament before 31.3.2011	Percentage of outstanding ATRs disposed off during the year.	%	0.5	100	90	80	70	60

Section 3: Trend Values of the Success Indicators

Objective	Action	Success Indicator	Unit	Actual Value FY 09/10	Actual Value FY 10/11	Target Value FY 11/12	Projected Value for FY 12/13	Projected Value for FY 13/14
[1] To promote and nurture research and development in industry with a view to enhance industry's share in national R&D expenditure;	[1.1] Recognition and renewal of R&D Centres	[1.1.1] Recognition & registration to new in-house R&D units; Scientific & Industrial Research Organisations (SIRO); Public Funded Research Institutions (PFRI)	Nos.	--	--	225	--	--
		[1.1.2] Renewal of recognition & registration to in-house R&D units; SIROs; PFRI	Nos.	600	625	700	775	785
	[1.2] Fiscal incentives for Scientific Research	[1.2.1] Approving new companies for availing fiscal benefits	Nos.	30	63	65	67	70
[2] To promote innovations through its resources and channelize benefits for public good.	[2.1] Study on identification and commercialization of socially relevant innovative technologies, available nationally as well as internationally	[2.1.1] Satisfactory completion of study	Date	--	--	31/01/2012	--	--
	[2.2] Study on promotion of knowledge based enterprises in the country, based on people's innovations	[2.2.1] Satisfactory completion of study	Date	--	--	31/01/2012	--	--
	[2.3] Study on nurturing the innovative potential of technical institutions in the country	[2.3.1] Satisfactory completion of study	Date	--	--	29/02/2012	--	--
	[2.4] Study on creating an enabling environment for	[2.4.1] Satisfactory completion of study	Date	--	--	29/02/2012	--	--

Section 3: Trend Values of the Success Indicators

Objective	Action	Success Indicator	Unit	Actual Value FY 09/10	Actual Value FY 10/11	Target Value FY 11/12	Projected Value for FY 12/13	Projected Value for FY 13/14
[3] To assess R&D and Innovation Output of the industry;	promoting innovation based start-ups							
	[2.5] Study on promotion of innovations in export oriented SMEs for enhancing their exports	[2.5.1] Satisfactory completion of study	Date	--	--	22/03/2012	--	--
	[2.6] Study on promotion of innovations in select manufacturing industry sectors for global competitiveness	[2.6.1] Satisfactory completion of study	Date	--	--	22/03/2012	--	--
[4] Promotion and support for development of new and innovative products, processes and technologies and for improving industrial competitiveness;	[3.1] Periodic meetings with industries to review their R&D and Innovation work and analysis of data	[3.1.1] Assessment of new Patents filed	Date	--	--	15/01/2012	--	--
		[3.1.2] Assessment of new products commercialized	Date	--	--	15/01/2012	--	--
	[4.1] Technical and partial financial support to industrial R&D and technology development & demonstration projects through Technology Development and Demonstration Programme (TDDP)	[4.1.1] Approval of fresh projects	Nos.	--	--	35	--	--
		[4.1.2] Product prototype or process developed & demonstrated	Nos.	--	--	3	--	--
	[4.2] Support to individuals for conversion of science based innovative	[4.2.1] Approval of fresh projects	Nos.	--	--	90	--	--

Section 3:
Trend Values of the Success Indicators

Objective	Action	Success Indicator	Unit	Actual Value FY 09/10	Actual Value FY 10/11	Target Value FY 11/12	Projected Value for FY 12/13	Projected Value for FY 13/14
[5] To setup a Sectoral Innovation Council;	ideas into workable prototypes/processes through Technopreneur Promotion Programme (TePP)							
		[4.2.2] Product prototype or process demonstrated	Nos.	--	--	37	--	--
		[5.1.1] Stakeholder discussions	Date	--	--	07/07/2011	--	--
		[5.1.2] Drafting of the white paper	Date	--	--	07/09/2011	--	--
[6] To empower women with technological support;	[6.1] To provide technology based support to programmes aimed at benefiting women	[6.1.1] Number of organizations supported	Nos.	--	--	8	--	--
[7] Capacity building of Asia Pacific region through Asian & Pacific Centre for Transfer of Technology (UN ESCAP-APCTT);	[7.1] To provide infrastructural and programme support	[7.1.1] Number of activities/projects supported	Nos.	--	--	2	--	--
[8] To implement e-Governance initiatives.	[8.1] Design, Development, Validation and Certification of Enterprise Resource Planning (ERP) solution	[8.1.1] Finalization of system study, specifications, information architecture, Graphical User Interface (GUI) validation and User Acceptance Test (UAT) Certification	Date	--	--	15/12/2011	--	--
* Efficient Functioning of the RFD System	Timely submission of Draft for Approval	On-time submission	Date	0.00	05/03/2010	07/03/2011	--	--

* Mandatory Objective(s)

Section 3: Trend Values of the Success Indicators

Objective	Action	Success Indicator	Unit	Actual Value FY 09/10	Actual Value FY 10/11	Target Value FY 11/12	Projected Value for FY 12/13	Projected Value for FY 13/14
* Improving Internal Efficiency / Responsiveness / Service delivery of Ministry / Department	Timely submission of Results	On- time submission	Date	0.00	29/04/2011	03/05/2012	--	--
	Implementation of Sevottam	Resubmission of revised draft of Citizens' / Clients' Charter	Date	--	--	20/12/2011	--	--
		Independent Audit of Implementation of Grievance Redress Mechanism	%	--	--	95	--	--
	Ensure compliance with Section 4(1) (b) of the RTI Act, 2005	No. of items on which information is uploaded by February 10, 2012	No	--	--	15	--	--
	Identify potential areas of corruption related to departmental activities and develop an action plan to mitigate them	Finalize an action plan to mitigate potential areas of corruption.	Date	--	--	15/02/2012	--	--
* Ensuring compliance to the Financial Accountability Framework	Develop an action plan to implement ISO 9001 certification	Finalize an action plan to implement ISO 9001 certification	Date	--	--	15/02/2012	--	--
	Timely submission of ATNS on Audit Paras of C&AG	Percentage of ATNS submitted within due date (4 months) from date of presentation of Report to Parliament by CAG during the year.	%	--	100	90	--	--
	Timely submission of ATRs to the PAC Sectt. on PAC Reports.	Percentage of ATRs submitted within due date (6 months) from date of presentation of Report to Parliament by PAC during the year.	%	--	100	90	--	--

* Mandatory Objective(s)

Section 3: Trend Values of the Success Indicators

Objective	Action	Success Indicator	Unit	Actual Value FY 09/10	Actual Value FY 10/11	Target Value FY 11/12	Projected Value for FY 12/13	Projected Value for FY 13/14
	Early disposal of pending ATNs on Audit Paras of C&AG Reports presented to Parliament before 31.3.2011.	Percentage of outstanding ATNs disposed off during the year.	%	--	100	90	--	--
	Early disposal of pending ATRs on PAC Reports presented to Parliament before 31.3.2011	Percentage of outstanding ATRs disposed off during the year.	%	--	100	90	--	--

* Mandatory Objective(s)



Section 4:
Description and Definition of Success Indicators
and Proposed Measurement Methodology

Success Indicators	Actions	Description and Definition	Measurement Methodology
Objective 1			
To promote & nurture research & development in Industry with a view to enhance industry's share in national R&D expenditure	Recognition and renewal of R&D Centres	Applications for In-house R&D are scrutinized in the department and those recommended by the Screening Committee are approved by the Competent authority for recognition / registration. Similarly applications for renewal of recognition are scrutinized in the department and approved by the competent authority.	The number of new in-house R&D centres, SIROs and PFRIs recognized / registered or the recognition renewed
	Fiscal incentives for Scientific Research	As per Income Tax Act, Secretary, DSIR is the prescribed authority for approval of companies for claiming weighted deduction on R&D expenditure. The department certifies the expenditure eligible for weighted tax deduction to DGIT (E).	The number of companies eligible for weighted tax deduction notified to DGIT (E).



Objective 2			
To promote innovations through its resources and channelize benefits for public good	Study on identification and commercialization of socially relevant innovative technologies, available nationally as well as internationally	- The study will identify the institutions, industries and other agencies, nationally as well as internationally that have developed socially relevant and sustainable technologies, recognized at some forum. - Study will include case studies on successful socially relevant technologies. - Identification of commercialization potential of the identified technologies through industries and other agencies.	Monitoring of study for completion by the targeted date.
	Study on promotion of knowledge based enterprises in the country, based on people's innovations	- The study will carry out a SWOT analysis of around 500 projects of individual innovators supported through the TePP programme of the Department. - It would also identify the potential entrepreneurs, who are interested in scaling up select innovations and setting up knowledge based enterprises. - It would also suggest mechanisms for setting up knowledge based enterprises.	Monitoring of study for completion by the targeted date.



Annexure-13-Contd.

	Study on nurturing the innovative potential of technical institutions in the country	· The study will select technical institutions in the country that are doing innovative research and development. · It would suggest mechanisms for protection and commercialization of select technologies developed in these institutions.	Monitoring of study for completion by the targeted date.
	Study on creating an enabling environment for promoting innovation based start-ups	· The study will identify the needs of entrepreneurs incubating in various incubators and venture centres. · It would suggest, creation of an enabling environment that would help the innovators in launching their startup companies.	Monitoring of study for completion by the targeted date.
	Study on promotion of innovations in export oriented SMEs for enhancing their exports	· The study would identify the specific areas where innovations are required in export oriented SMEs. · It would give an indication of the SME sectors, the scale and size of SMEs, the target markets, etc. where innovations could contribute in making a quantum jump in the export of SMEs.	Monitoring of study for completion by the targeted date.

	Study on promotion of innovations in select manufacturing industry sectors for global competitiveness	- The study would identify key manufacturing sectors in consultation with NMCC and benchmark their performance with international standards. - It would suggest ways and means for promoting their competitiveness.	Monitoring of study for completion by the targeted date.
Objective 3			
To assess R&D and Innovation Output of the industry	Periodic meetings with industries to review their R&D and Innovation work and analysis of data	Evaluation and assessment of R&D being carried out in industrial units.	Number of new patents filed and value of new products commercialized by industrial units during the year.
Objective 4			
Promotion and support for development of new & innovative products, processes and technologies and for improving industrial competitiveness	Technical and partial financial support to industrial R&D and technology development & demonstration projects through Technology Development and Demonstration Programme (TDDP)	Projects only with innovative technological content are supported from the proof of concept / laboratory stage upto the pilot plant stage, demonstrating the commercialization potential of the product / process developed.	The numbers of projects approved are the ones recommended by Technical Advisory Committee (TAC) and concurred by IFD. Out of the total number of projects supported, projects that result into commercialization are measured which indicates the outcome.



Annexure-13-Contd.

	Support to individuals for conversion of science based innovative ideas into workable prototypes/processes through Technopreneur Promotion Programme (TePP)	Creative individuals are supported to convert their innovative ideas into prototypes / models.	The numbers of projects approved are the ones recommended by TePP Screening Committee (TSC) and concurred by IFD.
Objective 5			
To setup a Sectoral Innovation Council	To develop a white paper outlining the roadmap for creation of sectoral innovation council	Adviser to PM on Public Information Infrastructure and Innovations has proposed Sectoral Innovation Councils, aligned with ministries / departments under the National Innovation Council. DSIR shall be responsible for setting up one such Sectoral Innovation Council.	Defining the mandate and terms of reference of council, holding stakeholders discussions, preparation of background paper for detailed inputs and finally preparation of whitepaper outlining the roadmap for Sectoral Innovation Council.
Objective 6			
To empower women with technological support	To provide technology based support to programmes aimed at benefiting women	Inviting projects from NGOs and other organizations aimed at evolving technological solutions for the benefit of women.	The numbers of projects approved are the ones recommended by Technical Advisory Committee (TAC) and concurred by IFD.
Objective 7			

Capacity building of UN ESCAP-APCTT	To provide infrastructural and programme support	DSIR is the country's focal point for United Nations Economic and Social Commission for Asia and the Pacific (UN ESCAP)-APCTT. The department provides institutional grant and programme support. UN ESCAP decides the programmes to be carried out by APCTT.	Number of programmes / activities supported in a year are measured.
Objective 8			
To implement e-Governance initiatives.	Design, Development, Validation and Certification of Enterprise Resource Planning (ERP) solution	System Study, Requirement specification, Process, Information Architectures, and Development of ERP, Graphical User Interface (GUI) Validation, User Acceptance Test (UAT) and Certification	Validation, Successful User Acceptance Test (UAT), Functional Testing, Alpha Testing and certification.



Section 5:
Specific Performance Requirements from other Departments

Department	Relevant Success Indicator	What do you need?	Why do you need?	How much you need?	What happens if you do not get it?
Relevant scientific departments e.g. DST, DBT, Ministry of Environment and Forests, Ministry of New and Renewable Energy, Department of Information Technology, etc.	Approval of fresh projects for development and demonstration of new technologies	Peer review of fresh proposals	To assist the Technical Advisory Committee (TAC) of the Department in recommendation of the projects	This is an essential requirement for recommendation of proposals by TAC	Approval of fresh projects will be affected and programme objectives would be hampered



Annexure-13-Contd.

Relevant scientific departments e.g. DBT, Department of Information Technology, Department of Pharmaceuticals, Department of Chemicals & Petrochemicals, Department of Agriculture, ICMR, ICAR, etc.	Recognition of new In-house R&D units, SIROs and PFRIs	Comments and views on the applications received for recognition	The views of Administrative Ministry are taken into consideration before recognition	-	The number of recognitions could be lower
Department of Revenue, Ministry of Finance	Approval of new cases for Income tax deduction/benefits	Long term policy on fiscal incentives for scientific research required	For efficient implementation of fiscal incentives by DSIR	Sufficiently long term policy of 10-15 years duration required	If the incentives are announced or withdrawn frequently, DSIR will not be able to implement effectively as the response time from industry has to be considered.

Section 6: Outcome/Impact of Department/Ministry

Outcome/Impact of Department/Ministry	Jointly responsible for influencing this outcome / impact with the following department (s) / ministry(ies)	Success Indicator	Unit	FY 09/10	FY 10/11	FY 11/12	FY 12/13	FY 13/14
1 Increased R&D spend by industry	Director General of Income Tax (E)	R&D expenditure certified u/s, 35(2AB) of Income Tax (Rs. in Crores)		3000	3200	3500	3800	4000
2 Enhanced innovative output of industry	Industry	No. of Innovative products / processes successfully demonstrated		7	6	3	8	10
3 Nurturing innovative potential of individuals	TePP Outreach Centres	No. of Innovations demonstrated by individuals		10	32	37	40	42

Annexure-13-Contd.

Performance Evaluation Report

Objective	Weight	Action	Success Indicator	Unit	Weight	Target / Criteria Value						Performance	
						Excellent 100%	Very Good 90%	Good 80%	Fair 70%	Poor 60%	Achiev- ement	Raw Score	Weighted Raw Score
1 To promote and nurture research and development in industry with a view to enhance industry's share in national R&D expenditure;	20.00	Recognition and renewal of R&D Centres	Recognition & registration to new in-house R&D units; Scientific & Industrial Research Organisations (SIRO); Public Funded Research Institutions (PFRI)	Nos.	8.00	230	225	210	200	190	235	100.0	8.0
			Renewal of recognition & registration to in-house R&D units; SIROs; PFRIIs	Nos.	5.00	715	700	650	620	580	720	100.0	5.0
			Approving new companies for availing fiscal benefits	Nos.	7.00	68	65	60	57	54	72	100.0	7.0
			Satisfactory completion of study	Date	4.00	15/01/2012	31/01/2012	15/02/2012	29/02/2012	15/03/2012	15/01/2012	100.0	4.0
2 To promote innovations through its resources and channelize benefits for public good.	20.00	Study on identification and commercialization of socially relevant innovative technologies, available nationally as well as internationally	Fiscal incentives for Scientific Research										
			Study on promotion of knowledge based enterprises in the country, based on people's innovations	Date	3.00	15/01/2012	31/01/2012	15/02/2012	29/02/2012	15/03/2012	15/01/2012	100.0	3.0
			Study on nurturing the innovative potential of technical institutions in the country	Date	3.00	15/02/2012	29/02/2012	15/03/2012	22/03/2012	31/03/2012	15/02/2012	100.0	3.0
			Study on creating an enabling environment for promoting innovation based start-ups	Date	3.00	15/02/2012	29/02/2012	15/03/2012	22/03/2012	31/03/2012	15/02/2012	100.0	3.0

Performance Evaluation Report

Annexure-13-Contd.

Objective	Weight	Action	Success Indicator	Unit	Weight	Target / Criteria Value							Performance	
						Excellent	Very Good	Good	Fair	Poor	Achievement	Raw Score	Weighted Raw Score	
						100%	90%	80%	70%	60%				
		Study on promotion of innovations in export oriented SMEs for enhancing their exports	Satisfactory completion of study	Date	3.00	15/03/2012	22/03/2012	27/03/2012	31/03/2012		15/03/2012	100.0	3.0	
		Study on promotion of innovations in select manufacturing industry sectors for global competitiveness	Satisfactory completion of study	Date	4.00	15/03/2012	22/03/2012	27/03/2012	31/03/2012		15/03/2012	100.0	4.0	
3 To assess R&D and Innovation Output of the industry;	5.00	Periodic meetings with industries to review their R&D and Innovation work and analysis of data	Assessment of new Patents filed	Date	2.00	31/12/2011	15/01/2012	31/01/2012	15/02/2012	29/02/2012	31/12/2011	100.0	2.0	
			Assessment of new products commercialized	Date	3.00	31/12/2011	15/01/2012	31/01/2012	15/02/2012	29/02/2012	31/12/2011	100.0	3.0	
4 Promotion and support for development of new and innovative products, processes and technologies and for improving industrial competitiveness;	26.00	Technical and partial financial support to industrial R&D and technology development & demonstration projects through Technology Development and Demonstration Programme (TDDP)	Approval of fresh projects	Nos.	7.00	37	35	30	25	20	30	80.0	5.6	
			Product prototype or process developed & demonstrated	Nos.	7.00	4	3	2	1	0	2	80.0	5.6	
			Support to individuals for conversion of science based innovative ideas into workable prototypes/processes through Technopreneur Promotion Programme (TePP)	Approval of fresh projects	Nos.	6.00	95	90	80	70	60	95	100.0	6.0

Performance Evaluation Report

Objective	Weight	Action	Success Indicator	Unit	Weight	Target / Criteria Value					Achievement	Performance	
						Excellent	Very Good	Good	Fair	Poor		Raw Score	Weighted Raw Score
						100%	90%	80%	70%	60%		Score	Score
			Product prototype or process demonstrated	Nos.	6.00	40	37	34	30	27	40	100.0	6.0
5 To setup a Sectoral Innovation Council;	6.00	To develop a white paper outlining the roadmap for creation of sectoral innovation council	Stakeholder discussions	Date	3.00	30/06/2011	07/07/2011	14/07/2011	21/07/2011	28/07/2011	30/06/2011	100.0	3.0
6 To empower women with technological support;	3.00	To provide technology based support to programmes carried at benefiting women	Drafting of the white paper	Date	3.00	31/08/2011	07/09/2011	14/09/2011	21/09/2011	28/09/2011	31/08/2011	100.0	3.0
7 Capacity building of Asia Pacific region through Asian & Pacific Centre for Transfer of Technology (UN ESCAP, APCTT);	3.00	To provide infrastructural and programme support	Number of organizations supported	Nos.	3.00	9	8	6	4	3	9	100.0	3.0
8 To implement e-Governance initiatives.	2.00	Design, Development, Validation and Certification of Enterprise Resource Planning (ERP) solution	Number of activities/projects supported	Nos.	3.00	3	2	1			3	100.0	3.0
			Finalization of system study, specifications, Information architecture, Graphical User Interface (GUI) validation and User Acceptance Test (UAT) Certification	Date	2.00	10/12/2011	15/12/2011	20/12/2011	24/12/2011	31/12/2011	31/12/2011	60.0	1.2
* Efficient Functioning of the RFD System	3.00	Timely submission of Draft for Approval	On-time submission	Date	2.0	07/03/2011	08/03/2011	09/03/2011	10/03/2011	11/03/2011	07/03/2011	100.0	2.0
		Timely submission of Results	On-time submission	Date	1.0	01/05/2012	03/05/2012	04/05/2012	05/05/2012	06/05/2012	30/04/2012	100.0	1.0
* Improving Internal Efficiency / Responsiveness / Service delivery of Ministry /	10.00	Implementation of Sevctam	Resubmission of revised draft of Citizens' Charter	Date	2.0	16/01/2012	18/01/2012	20/01/2012	23/01/2012	25/01/2012	16/01/2012	100.0	2.0
* Mandatory Objective(s)													



Performance Evaluation Report

Objective	Weight	Action	Success Indicator	Unit	Weight	Target / Criteria Value						Achievement	Performance	
						Excellent	Very Good	Good	Fair	Poor			Raw Score	Weighted Score
						100%	90%	80%	70%	60%				
Department			Independent Audit of Implementation of Grievance Redress Mechanism											
			No. of items on which information is uploaded by February 10, 2012	%	2.0	100	90	80	70	60		37.2	0.0	0.0
		Ensure compliance with Section 4(1) (b) of the RTI Act, 2005		No	2.0	16	15	14	13	12		16	100.0	2.0
		Identify potential areas of corruption related to departmental activities and develop an action plan to mitigate them	Finalize an action plan to mitigate potential areas of corruption.	Date	2.0	26/03/2012	27/03/2012	28/03/2012	29/03/2012	30/03/2012		24/03/2012	100.0	2.0
		Develop an action plan to implement ISO 9001 certification	Finalize an action plan to implement ISO 9001 certification	Date	2.0	16/04/2012	17/04/2012	18/04/2012	19/04/2012	20/04/2012		29/03/2012	100.0	2.0
* Ensuring compliance to the Financial Accountability Framework	2.00	Timely submission of ATNS on Audit Paras of C&AG	Percentage of ATNS submitted within due date (4 months) from date of presentation of Report to Parliament by CAG during the year.	%	0.5	100	90	80	70	60		100	100.0	0.5
		Timely submission of ATRs to the PAC Sectt. on PAC Reports.	Percentage of ATRs submitted within due date (6 months) from date of presentation of Report to Parliament by PAC during the year.	%	0.5	100	90	80	70	60		100	100.0	0.5
		Early disposal of pending ATNS on Audit Paras of C&AG Reports	Percentage of outstanding ATNS disposed off during the year.	%	0.5	100	90	80	70	60		0	0.0	0.0

* Mandatory Objective(s)

Performance Evaluation Report

Objective	Weight	Action	Success Indicator	Unit	Weight	Target / Criteria Value					Performance		
						Excellent	Very Good	Good	Fair	Poor	Achiev- ement	Raw Score	Weighted Raw Score
		presented to Parliament before 31.3.2011.											
		Early disposal of pending ATRs on PAC Reports presented to Parliament before 31.3.2011	Percentage of outstanding ATRs disposed off during the year.	%	0.5	100	90	80	70	60	100	100.0	0.5
* Mandatory Objective(s)													
Total Composite											93.9		

**CSIR INSTITUTES/ LABORATORIES****LABORATORIES**

AMPRI	Advanced Materials and Processes Research Institute, Bhopal -462 026, www.ampri.res.in
CBRI	Central Building Research Institute, Roorkee -247 667, www.cbri.org.in
CCMB	Centre for Cellular and Molecular Biology, Hyderabad-500 007, www.ccmb.res.in
CDRI	Central Drug Research Institute, Lucknow -226 001, www.cdriindia.org
CECRI	Central Electrochemical Research Institute, Karaikudi -623 006, www.cecni-india.com
CEERI	Central Electronics Engineering Research Institute, Pilani -333 031, www.ceeri.res.in
CFTRI	Central Food Technological Research Institute, Mysore-570 020, www.cftri.com
CGCRI	Central Glass and Ceramic Research Institute, Kolkata -700 032, www.cgcri.res.in
CIMAP	Central Institute of Medicinal & Aromatic Plants, Lucknow -226 015, www.cimap.res.in
CIMFR	Central Institute of Mining & Fuel Research, Dhanbad -828 108, www.cmriindia.nic.in
CLRI	Central Leather Research Institute, Chennai -600 020, www.clri.org
CMERI	Central Mechanical Engineering Research Institute, Durgapur -713 209, www.cmeri.org
CRRI	Central Road Research Institute, New Delhi -110 020, www.crridom.gov.in
CSIO	Central Scientific Instruments Organisation, Chandigarh -160 030, www.csio.res.in
CSMCRI	Central Salt & Marine Chemicals Research Institute, Bhavnagar -364 002, www.csmcri.org
IGIB	Institute of Genomics & Integrative Biology, Delhi -110 007, www.igib.res.in
IHBT	Institute of Himalayan Bioresource Technology, Palampur -176 061 (HP), www.ihbt.res.in
IICB	Indian Institute of Chemical Biology, Kolkata -700 032, www.iicb.res.in
IICT	Indian Institute of Chemical Technology, Hyderabad -500 007, www.iictindia.org
IIIM	Indian Institute of Integrative Medicine, Jammu -180 001, www.riiijammu.org
IIP	Indian Institute of Petroleum, Dehradun -248 005, www.iip.res.in
IMMT	Institute of Minerals and Materials Technology, Bhubaneswar -751 013, www.immt.res.in

IMTECH	Institute of Microbial Technology, Chandigarh -160 036, www.imtech.res.in
IITR	Indian Institute of Toxicology Research, Lucknow-226 015, www.itrcindia.org
NAL	National Aerospace Laboratories, Bangaluru -560 017, www.nal.res.in
NBRI	National Botanical Research Institute, Lucknow -226 001, www.nbri-lko.org
NCL	National Chemical Laboratory, Pune -411 008, www.ncl-india.org
NEERI	National Environmental Engineering Research Institute, Nagpur -440 020, www.neeri.res.in
NEIST	North-East Institute of Science and Technology, Jorhat -785 006. www.rrljorhat.res.in
NGRI	National Geophysical Research Institute, Hyderabad -500 007, www.ngri.org.in
NIO	National Institute of Oceanography, Goa -403 004, www.nio.org
NIIST	National Institute for Interdisciplinary Science and Technology, Thiruvananthapuram -695 019, www.niist.res.in
NISCAIR	National Institute of Science Communication and Information Resources , New Delhi-110012, www.niscair.res.in
NISTADS	National Institute of Science Technology and Development Studies, New Delhi-110012 , www.nistads.res.in
NML	National Metallurgical Laboratory, Jamshedpur-831 007, www.nmlindia.org
NPL	National Physical Laboratory, New Delhi -110 012, www.nplindia.org
SERC	Structural Engineering Research Centre, Chennai -600 113, www.sercm.org

UNITS

CMMACS	Centre for Mathematical Modelling & Computer Simulation, Bengaluru
HRDC	Human Resource Development Centre, Ghaziabad
TKDL	Traditional Knowledge Digital Library, Ghaziabad
URDIP	Unit for Research and Development of Information Products, Pune



ABBREVIATIONS/ACRONYMS

AMPRI	Advanced Material and Processes Research Institute
APCTT	Asian and Pacific Centre for Transfer of Technology
CBDT	Central Board of Direct Taxes
CBRI	Central Building Research Institute
CCMB	Centre for Cellular and Molecular Biology
CDC	Consultancy Development Centre
CDRI	Central Drug Research Institute
CDS/ISIS	Computerized Data Services/Integrated Set of Information Systems
CECRI	Central Electrochemical Research Institute
CEERI	Central Electronics Engineering Research Institute
CFTRI	Central Food Technological Research Institute
CGCRI	Central Glass and Ceramic Research Institute
CII	Confederation of Indian Industry
CIMAP	Central Institute of Medicinal & Aromatic Plants
CIMFR	Central Institute of Mining and Fuel Research
CITT	Centre for International Trade in Technology
CLRI	Central Leather Research Institute
CMERI	Central Mechanical Engineering Research Institute
CRRI	Central Road Research Institute
CSIO	Central Scientific Instruments Organisation
CSIR	Council of Scientific & Industrial Research
CSMCRI	Central Salt & Marine Chemicals Research Institute
DBT	Department of Bio-Technology
DCPC	Department of Chemicals & Petrochemicals



DCSSI	Development Commissioner, Small Scale Industries
DRDO	Defence Research and Development Organization
DSIR	Department of Scientific & Industrial Research
ESCAP	Economic and Social Commission for Asia and the Pacific
EXIM	Export-Import
FC	Foreign Collaborations
FICCI	Federation of Indian Chambers of Commerce and Industry
ICAR	Indian Council of Agricultural Research
ICAS	Indian Council of Ayurveda & Siddha
ICMR	Indian Council of Medical Research
ICSSR	Indian Council of Social Sciences Research
ICSTI	International Centre for Science & Technology Information
IDAMS	Internationally Developed Data Management System
IGIB	Institute of Genomics & Integrative Biology
IGNOU	Indira Gandhi National Open University
IHBT	Institute of Himalayan Bioresource Technology
IICB	Indian Institute of Chemical Biology
IICT	Indian Institute of Chemical Technology
IIFT	Indian Institute of Foreign Trade
IIIM	Indian Institute of Integrative Medicine
IIP	Indian Institute of Petroleum
IISc	Indian Institute of Science
IIT	Indian Institute of Technology
IITR	Indian Institute of Toxicology Research
IMMT	Institute of Minerals and Materials Technology
IMT	Institute of Microbial Technology
INFLIBNET	Information Library Network
INSA	Indian National Science Academy
IPR	Intellectual Property Rights
ISRO	Indian Space Research Organization
ITPO	India Trade Promotion Organization
LAN	Local Area Network
LCA	Light Combat Aircraft



Annexure-15-Contd.

MDR	Multi Drug Resistance
MIT	Ministry of Information Technology
MoU	Memorandum of Understanding
NACIDS	National Access Centres to International Database Services
NAFEN	National Foundation of Indian Engineers
NAL	National Aerospace Laboratories
NBRI	National Botanical Research Institute
NCAER	National Council of Applied Economic Research
NCL	National Chemical Laboratory
NCSI	National Centre for Science Information
NEERI	National Environmental Engineering Research Institute
NEIST	North-East Institute of Science & Technology
NGRI	National Geophysical Research Institute
NICMAR	National Institute of Construction Management and Research
NID	National Institute of Design
NIDC	National Industrial Development Corporation
NIFT	National Institute of Fashion Technology
NIIST	National Institute for Inter-disciplinary Science and Technology
NIO	National Institute of Oceanography
NISCAIR	National Institute of Science Communication and Information Resources
NISTADS	National Institute of Science Technology and Development Studies
NMCC	National Manufacturing Competitiveness Council
NML	National Metallurgical Laboratory
NPL	National Physical Laboratory
NRDC	National Research Development Corporation
NRFC	National Register of Foreign Collaborations
NSTMIS	National Science and Technology Management Information System
PSU	Public Sector Undertaking
SERC	Structural Engineering Research Centre
SIRO	Scientific and Industrial Research Organization
SME	Small and Medium Enterprise.
TCO	Technical Consultancy Organization
TDB	Technology Development Board



TEDO	Technology Export Development Organization
TePP	Technopreneur Promotion Programme
TIFAC	Technology Information Forecasting and Assessment Council
TM	Technology Management
TQM	Total Quality Management
UGC	University Grants Commission
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
WIPO	World Intellectual Property Organization

