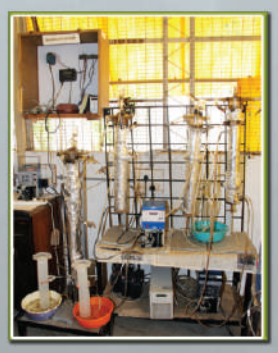
A Compendium on
CSIR - IICT Competencies and Research Facilities

www.iictindia.org





CSIR-Indian Institute of Chemical Technology

सी एस आई आर – भारतीय रासायनिक प्रौद्योगिकी संस्थान

(Council of Scientific & Industrial Research)

Ministry of Science & Technology, Govt. of India

Hyderabad - 500 007

CSIR-IICT - Research Orientation

-- Focus Areas during XII Plan

Adequate Clean Energy

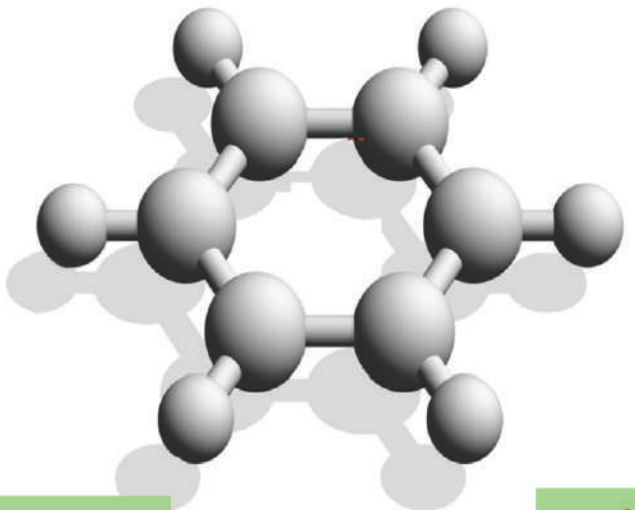
- Solar & Energy Materials
- Direct Coal Liquefaction
- Coal Gasification
- Carbon Sequestration
- Biomass to Energy
- Photobiological Processes

Affordable Health Care

- Diagnostics
- Therapeutics
- Vaccines
- Designer Molecules
- Screening
- Delivery Systems

Environment

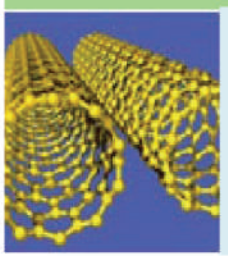
- Sustainable Technologies (Pharma, Refineries Tanneries)
- Biohydrogen
- Waste Utilization
- Biodigestors



Sustainable Chemical Industry

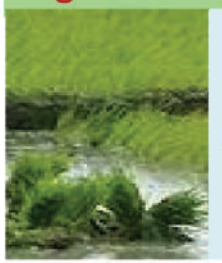
- Biocatalysts
- Fluorine Chemicals
- Process Safety
- Process Intensification
- Specialty Chemicals
- Membrane Separations

Advanced Materials



- Micro/Nano Materials for Smart and Intelligent Coatings
- Stimuli Responsive Materials
- Graphene Materials
- Photo Functional Materials

Agriculture, Food & Nutrition



- Processes for Edible Oils & Oleochemicals
- Natural & Synthetic Agrochemicals
- Plant Volatiles for Pest Control
- Pheromone Application

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2013

Foreword

Dr M. Lakshmi Kantam, FNASc
Director
CSIR-Indian Institute of Chemical Technology
Hyderabad

CSIR-IICT, an institute of global repute, is engaged in R&D activities in chemical sciences & technology and allied fields including biological sciences. The thrust areas of the Institute address the basic needs of the society viz. affordable health care, food, agrochemicals, energy, materials and environment.

The recognition as a world leader in such diverse areas of research has come through the human resources that the institute has developed over the past seven decades of its existence. The Institute is equipped with state of the art research equipment to develop innovative processes and products for the society. The National facilities of CSIR-IICT cater the needs of researchers and technologists from India and abroad.

The Compendium on **CSIR-IICT Competencies and Research Facilities** showcases the expertise of our research groups, and the research equipment & facilities available in the Institute. I am sure that this compendium will be useful to our partners in the industry and academia.

I am grateful to Sri S. Jaipal Reddy Hon'ble Cabinet Minister for Science & Technology and Earth Sciences, Government of India, and Vice President CSIR, for releasing this compendium on August 4, 2013, as we celebrate the seven decade contribution of CSIR-IICT.

M. Lakshmi Kantam

Hyderabad

(M. LAKSHMI KANTAM)

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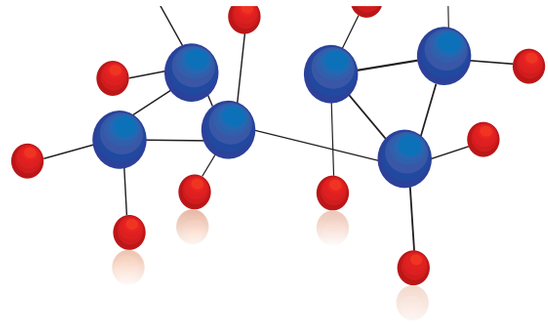


Analytical Chemistry

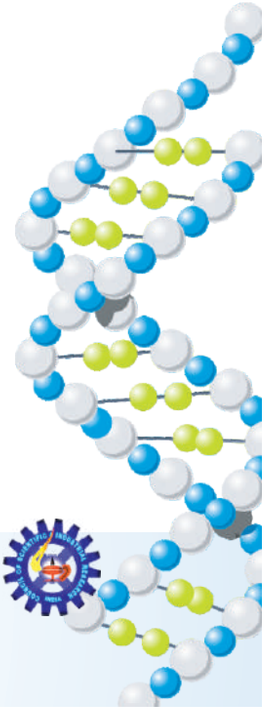
Areas of Expertise

Mass Spectrometry

- Analytical support to inhouse R&D.
- Consultancy service to pharma and agro industries.
- Human resource development.
- Differentiation of structural and chiral isomers
- Mass Spectral studies of non-natural amino acid peptides
- Non-covalent interactions involving bio molecules
- Stress stability studies and pharmaco kinetics of drugs and pharmaceuticals
- Gas phase rearrangements and isomerization
- Identification and characterization of chemical weapons convention related molecules
- Metabolite profiling of human body fluids and other biological systems
- Protein aggregation and search for new inhibitors
- Study on metal complexes and cationized organic molecules

NMR & Structural Chemistry

- Development of advanced NMR methods for Solids and Liquids
- Density functional theory (DFT) calculations and Structural chemistry: Structure based design of molecular scaffolds and ligands.
- NMR-Conformations and dynamics of soft solids, polymers and biomolecular films at interfaces and nanoscale confinements.
- Design and characterization of peptides and peptido-mimetics.
- NMR of natural products and gas-sensors.
- Analytical support to in-house R&D.
- Consultancy service to pharma and agro industries.
- Human resource development.



Analytical Chemistry

- Centralized multi faceted facility with sophisticated chromatographic (HPLC, GC, HPTLC, CE) and spectroscopic (FTIR, UV-Vis, AAS) techniques. It gives support to in-house R & D projects.
- Consultancy services to chemical and pharmaceutical industry.
- Development and validation of chromatographic and spectroscopic methods.
- Impurity profiles, USP/BP/EP/IP assays of Chiral separation, heavy metals, pesticide residue.
- Stress stability studies of drugs and pharmaceuticals
- The analytical services are rendered to Industries and Universities as per ISO - 9000-2011.
- Minerals, water, coal, paint and varnish analysis by wet analysis methods

X-ray Crystallography

- X-ray Crystallography study support to inhouse R&D.
- Consultancy service to pharmaceutical and chemical industries.
- Human resource development.
- Drug-polymorphism
- Solid state structural chemistry
- Pharmaceutical co-crystals and salts
- Structural elucidation of medicinally & biologically important molecules
- Supramolecular Chemistry & Self Assembly
- Structural studies on Nucleobase complexes
- X-ray crystallography (Powder and Single crystal) Method development and validation
- Herbal drugs characterization by X-ray Fluorescence

Facilities

Fourier Transform Infrared Spectrometer (FT-IR)

Model :
Thermo Nicolet Nexus 670

Operational aspects:
Scanning background, scanning sample, baseline corrections, recording, etc.

Accuracy:
Resolution 4cm-1 Variable up to 0.125 cm-1

Additional Features:
Library search, smoothing, peak pick plots, etc. Softwares.

Applications:
Analysis of organic and inorganic chemicals, polymers, biological samples, etc.

Department/Location:
Analytical Chemistry/Discovery Laboratory

Atomic Absorption Spectrometer (AAS)

Model:
ANALYST-300, PERKIN-ELMER, USA

Operational aspects:
Atomic Absorption Spectrophotometer Hallow cathode lamps

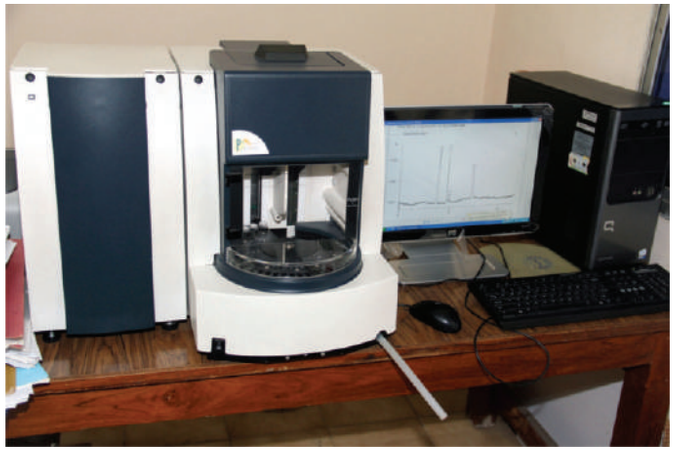
Accuracy: ±5%

Additional Features: Flame only

Applications:
Used for estimation of metals at ppm/ppb levels
Quality assurance and environmental samples
Determination of metal contents in alloys, steel, water, biological samples, etc.

Department/Location:
Analytical Chemistry/Discovery Laboratory

Capillary Electrophoresis (CE)



Model :
Prince CEC 750-The Netherlands.

Operational aspects :
Requires high voltage power supply

Accuracy : ±0.2%

Additional Features :
Built in Auto-sampler Hydrodynamic injection modes Latest software for automatic data reduction Diode Array Detector

Applications :
Quality assistance for Industrial products (Organic & Inorganic Compounds)

- Chemical impurity profiles, Industrial pollutants determination.
- Bioavailability (drugs & Pharmaceuticals)
- Reaction monitoring

Department/Location :
Analytical Chemistry/Discovery Laboratory

High Performance Thin Layer Chromatograph (HPTLC)

Model:
CAMAG 4.1.3, Switzerland

Operational aspects: The sample is analyzed at ambient temperature, as it is specifically used for the analysis of drugs and pharmaceuticals

Accuracy:10 to 100 μg

Additional Features:UV-VIS and Fluorescence Detector

Applications: Analysis of natural products, drugs, pharmaceuticals, dyes, Pesticides, etc.

- The technique provides the impurity profiles of bulk drugs in a simple one step method.
- Solvent consumption is minimum
- It covers a wide spectral range 200-800nm (absorbance/ reflectance)
- In situ UV and % composition are simultaneously obtained

Department/Location:
Analytical Chemistry/Discovery Laboratory

Elemental Analyzer (CHNS)

Model :
Vario Micro Cube Elementar, Germany

Operational aspects :
- Combustion furnace temperature 1150°C
- Reduction furnace temperature 850°C
- Gas flow (Helium) 200 ml/min

Accuracy : ±0.01% (abs)

Additional zFeatures :
Autosampler-Carbon, Nitrogen, Hydrogen and Sulfur analysis

Applications :
Elemental analysis of organic compounds, i.e. Carbon, Hydrogen, Nitrogen and Sulfur.

Department/Location:
Analytical Chemistry/Discovery Laboratory

UV-VIS Spectrophotometer

Model :
Rayleigh (RAYLEIGH) UV-2100

Operational aspects :
- Wavelength range 190 – 900 nm
- Data collection rate 20 samples per second

Accuracy : Wavelength accuracy ± 0.3 nm

Additional Features :
Deuterium, tungsten lamp Light source Photo-multiplier Detector

Applications :
Normal UV-Vis spectral analysis, quantitative analysis

Department/Location :
Analytical Chemistry/ Discovery Laboratory

High Performance Liquid Chromatograph (HPLC)

Model :
LC-20AD Shimadzu, Japan

Operational aspects :
HPLC – Pumps (flow rate 0.01-9.99 ml/min)
HPLC – preparative pump (flow rate 1-99 ml/min)
Fraction collector – (0-143)
Auto injector temperature controlled (4 to 60°C)

Accuracy : ±0.01%

Additional Features : Gel Permeation Chromatograph facility HPLC with multiple detectors, PDA (Photodiode array), RI (Refractive Index), Fluorescence, ELSD, Conductivity, Electrochemical & Chiral detectors with LC solution software.

Applications : Used for analysis of drugs, Pharmaceuticals, agrochemicals, fine chemicals, oils & fats, Polymers petrochemicals and environmental samples. To determine the molecular weight and distribution pattern of polymers, oligomers, oils and fats.

Department/Location :
Analytical Chemistry/ Discovery Laboratory

Ion Chromatograph

Model :
792 Basic IC Metrohm, Switzerland

Operational aspects :
IC dual piston pump (flow rate 0.2-2.5 ml/min) with conductivity detector

Accuracy : ±1%

Additional Features : Columns for major anions and major cations

Applications : Used for the determination of major anions and major cations in any water sample/solution.

Department/Location :
Analytical Chemistry/ Discovery Laboratory

Flame Photometer

Model :
CL-361 Elico limited, Hyderabad

Operational aspects :
Measuring range 1-100ppm for Na, K,
Li & 15-100ppm for Ca Sensitivity 0.5ppm for
Na, K, Li &15ppm for Ca Linearity better than 2%

Reproducibility 1% CV for 20 consecutive samples
Flame system LPG and oil free dry air

Accuracy : ±5%

Additional Features :
Photodiode detector

Applications :
Food& Agriculture, Pathological, Medical, Clinical, Bio-medical investigations, Mining & Metallurgy, Pharmaceuticals, R&D labs and Industries

Department/Location :
Analytical Chemistry/Discovery Laboratory

Density Meter

Model :
DMA 48, AP PAAR, Austria

Operational aspects :
Measuring range 0 to 3g/cm^3,
sample size Approx. 0.7 cm^3 and
Temperature -10 to +65^{0}C

Accuracy : ±1 x 10^{-4} g/cm^3

Additional Features :
Resolution ±1 x 10^{-5} g/cm3

Applications :
Measurement of density of liquid samples

Department/Location :
Analytical Chemistry/Discovery Laboratory

Analytical Chemistry

Mass spectrometry is a powerful and versatile analytical technique for the analysis of organic and biomolecules, mainly for determination of their molecular weight and structural characterization. Because of its high sensitivity, selectivity and speed, mass spectrometry finds application in several diverse fields, such as, chemistry, physics medicinal chemistry, biochemistry, pharmaceutical science, biological sciences, geology, cosmo chemistry, nuclear science, material science, archeology, petroleum industry, forensic science, and environmental science. Mass spectrometry has become an integral part of proteomics, metabolomics, lipidomics and the drug development process. Mass spectral analysis of products and various intermediates generated during process development helps in process control very effectively.

The Mass Spectrometry Centre at IICT has been recognized as the National Centre for Mass Spectrometry (NCMS) by the Department of Science and Technology (DST), Government of India in 1999. The center is equipped with the state-of-art mass spectrometers, which includes GC-MS, LC-MS/MS, Q-TOF, Ion Trap, GC-TOF, MALDI-TOF/TOF and Orbitrap to facilitate characterization of various types of analytes including small molecules, polymers and biomolecules. The Centre for Analysis of Chemical Toxins, a part of NCMS, is an OPCW (Organization for Prohibition of Chemical Weapons, The Netherlands) designated laboratory for off-site analysis of chemicals related to CWC. Apart from basic and applied research in mass spectrometry, NCMS has been engaged in providing knowledge based services to all IICT projects, industry, academic institutes, governmental agencies etc. In addition, the center imparts advanced training to post graduates and doctoral students. The center also provides commercial MS analytical services which have been ISO 9001 : 2008 certified.

Gas Chromatograph – Triple Sector Mass Spectrometer (GC-MS)

Model:
AUTOSPEC-M, Micromass, UK

Operational Aspects:
Electron Ionization (EI), Chemical Ionization (CI), GC-MS,High resolution

Accuracy: $\pm$ 5 PPM

Additional Features:
Linked scans (MS/MS) capabilities

Application:
Molecular weight and structure determination of small and medium organic compounds (up to 800 Da)

Department/Location:
National Centre for Mass Spectrometry /
Main building

Gas Chromatograph – Mass Selective Detector (GC-MSD)

Model:
6890N GC with 5973 inert MSD, Agilent Technologies, USA

Operational Aspects:
GC-MS under EI and CI conditions

Accuracy:
Unit resolution (±0.10 Da)

Additional Features:
Selected ion monitoring (SIM)

Application: Analysis of volatile and semi-volatile mixtures, e.g., Pesticides, insecticides, drugs & pharmaceuticals, Low molecular weight natural products, chemical warfare agents, petroleum products, environmental samples, forensic samples etc.

Department/Location:
National Centre for Mass Spectrometry / Main building

Gas Chromatograph – Mass Selective Detector (GC-MSD)

Model:
6890N GC with 5973N MSD and G 1888 Head Space sampler, Agilent Technologies, USA

Operational Aspects:
GC-MS under EI and CI conditions, NPD

Accuracy: Unit resolution (±0.10 Da)

Additional Features:
Selected ion monitoring (SIM), Headspace sampler

Application:
Analysis of volatile and semi-volatile mixtures, e.g., Pesticides, insecticides, drugs & pharmaceuticals, aroma compounds, natural products, residual solvents, petroleum products, environmental samples, forensic samples etc.

Department/Location:
National Centre for Mass Spectrometry / Main building

Liquid Chromatograph – Ion Trap Mass Spectrometer (LC-MS)

Model:
LCQ Advantage MAX, Thermo Finnigan, USA

Operational Aspects:
Electrospray ionization (ESI), Atmospheric Pressure Chemical Ionization (APCI), LC-MS

Accuracy:
Unit resolution (±0.10 Da)

Additional Features: Ultra sensitive ion trap analyzer with MS^n (n=10) capability, Surveyor LC pump with PDA detector, Automatic gain control, Mass range m/z 50-2000

Application:
Analysis of nonvolatile mixtures, structure elucidation by MS^n experiments, pharmacokinetic studies, impurity profile analysis, protein/peptide analysis

Department/Location:
National Centre for Mass Spectrometry / Main building

High Resolution Q-TOF Mass Spectrometer

Model:
QSTAR XL, Applied Biosystems, USA

Operational Aspects:
High Resolution Electrospray Ionization (ESI) and MS/MS

Accuracy: ± 5 ppm

Additional Features:
Mass resolution 10,000 (FWHM), Mass range upto 40,000 Da, accurate mass measurement, MS/MS LINAC cell, automatic scanning between MS and MS/MS

Application: High resolution ESI-MS, MS/MS analysis, determination of elemental composition of parent mass and fragment ions for structure elucidation, determination and characterization of high molecular weight biomolecules

Department/Location:
National Centre for Mass Spectrometry / Main building

Liquid Chromatograph – Triple Quadrupole Mass Spectrometer

Model:
Quattro Micro, Waters, UK

Operational Aspects: Electrospray ionization (ESI), Atmospheric Pressure Chemical Ionization (APCI), Atmospheric Pressure Photo Ionization (APPI) and MS/MS, Positive and negative ion

Accuracy:
Unit resolution (±0.10 Da)

Additional Features:
Waters Alliance HPLC with PDA detector, Product ion scan, Precursor ion scan, neutral loss scan, MRM scan, deconvolution of ESI spectra for protein analysis.

Application:
Mass range up to m/z 4000, analysis of nonvolatile mixtures, structure elucidation of nonvolatile and thermally labile compounds, pharmacokinetic studies, impurity profiling, and protein/peptide analysis

Department/Location:
National Centre for Mass Spectrometry / Main building

Matrix Assisted Laser Desorption/ionization (MALDI)-TOF/TOF

Model:
Shimadzu Biotech AXIMA Performance MALDI-TOF/TOF

Operational Aspects:
MALDI analysis with UV laser (337 nm), High energy CID (MS/MS), In-source decay (ISD), Post source decay (PSD)

Accuracy:
±50 ppm, mass resolution up to 25000 (FWHM)

Additional Features:
20 keV CID cell, Protein sequencing, metabolomics, tissue imaging and polymer analysis softwares

Application:
Analysis of proteins (upto 300 kDa), peptides, polymers, proteomics and metabolomics applications, protein identification by PMF and peptide sequencing method, imaging applications, TOF/TOF applications

Department/Location:
National Centre for Mass Spectrometry / Main building

Liquid Chromatograph-high Resolution Orbitrap Mass Spectrometer

Model:
Thermo EXACTIVE Orbitrap high resolution mass spectrometer with Accela 600 UPLC system

Operational Aspects:
High resolution (Mass resolution up to 100000) ESI, HESI, APCI and APPI ionization techniques

Accuracy: ± 5 ppm

Additional Features:
Mass range 10-4000 Da, UPLC-HRMS applications, In-source all-ion fragmentations, simultaneous UV-VIS – HRMS analysis, networks and mass spectral deconvolution analysis

Application:
Analysis of polar, semi-polar and non-polar analytes, biological samples, elemental composition, qualitative and quantitative analysis

Department/Location:
National Centre for Mass Spectrometry / Main building

Gas Chromatograph- Time Of Flight (TOF) Mass Spectrometer

Model:
AccuTOF GCv, Jeol, Japan

Operational Aspects:
High resolution GC-MS, EIMS and CIMS, positive or negative ion

Accuracy: ± 5 ppm

Additional Features:
Direct insertion probe, Agilent 7890A GC, Agilent 7693 autosampler, Mass resolution 8000 (FWHM), Mass range up to 5000 Da, PTV injector

Application:
Direct analysis of volatile and semi-volatile compounds, volatile mixtures analysis by GC, elemental composition

Department/Location:
National Centre for Mass Spectrometry / Main building

300 MHz NMR Spectrometer

Model:
AVANCE – 300 Bruker, Switzerland

Operational Aspects: Dual probe with ^{1}H and ^{13}C detection with ^{1}H Decoupling Modern multi-dimensional, multinuclear NMR Capabilities, Variable temperature systems. Air driven sample spinning, multi-user login system, User friendly menu-driven software

Special Provision: Auto sampler capable of running 60 samples automatically and stores the data floppy backup, CD backup, Ethernet compatible networking

Accuracy: ^{1}H Sensitivity (S/N) – 160.28

^{13}C Sensitivity (S/N) – 126.33

Line width on test samples – 0.3,

Line shape:hump: 2.4/7.0 Hz

Applications: More suitable for running routine samples of interest using auto sampler, Elucidating structures of small organic / bio molecules using modern 2D NMR techniques.

Department / Location:
Centre for NMR and Structural Chemistry

300 MHz NMR Spectrometer (New)

Model: AVANCE II – 300 Bruker, Switzerland

Operational Aspects: BBO probe with z-gradient ($^{1}H/X$) capable of doing ^{1}H and X detection (^{15}N- ^{31}P) with ^{1}H Decoupling Modern multidimensional, multinuclear NMR Capabilities, Variable temperature systems. Air driven sample spinning, multi-user login system, User friendly menu-driven software

Special Provision: Auto sampler capable of running 60 samples automatically and stores the data floppy backup, CD backup, Ethernet compatible networking SEI probe capable of doing inverse detection experiments like HSQC, HMQC, HMBC etc.

Accuracy: ^{1}H Sensitivity (S/N) – 175.0
^{13}C Sensitivity (S/N) – 125.0
Line width on test samples – 0.4,
Line share:hump:4/8 Hz

Applications: Suitable for running routine samples of interest using auto sampler, Elucidating structures of small organic / bio molecules as well as isolated compounds using modern 2D NMR techniques.

Department / Location:
Centre for NMR and Structural Chemistry

400 MHz NMR Spectrometer (Liquids/Solids)

Model:
UNITY INOVA – 400, Varian, USA

Operational Aspects: Dual broad band (1H-19F/X) probe and Triple resonance HXY Solid state probe (4mm) Modern 2D-NMR capabilities in liquids and solids Air driven sample spinning. Variable temperature system User-friendly menu-driven software Multi-user login system

Special Provision: High wattage amplifier to perform solid state NMR experiments. CP/MAS probe for high resolution studies of solids. Sample spinning upto 18 KHz. Broad-band 10 mm probe with 1H decoupling. SUN workstation with STARS software for line-shape analysis. Floppy backup. Ethernet compatible for networking.

Accuracy: ^{1}H Sensitivity (S/N) – 375
^{13}C Sensitivity (S/N) – 350
Line width on test samples – 0.5 Hz

Applications: Structural elucidation of bimolecular with modern 2D techniques with greater resolution. Designing and executing new pulse sequences on SUN Workstation. Structural studies of solids and catalytic systems like zeolites and other solid acids using CP/MAS solid-state probe. Monitoring solid phase synthesis on resins.

Department / Location:
Centre for NMR and Structural Chemistry

500 MHz NMR Spectrometer (Varian)

Model:
UNITY-INOVA-500 Varian, USA

Operational Aspects: 5 mm Triple resonance (1H/13C/X) PFG inverse probe. Modern multi-dimensional NMR capabilities in liquids. Improved line shapes under non-spinning, supported by cryo and room temperature shims. Variable temperature system. SUN workstation with user-friendly menu-driven software. Multi-user login system.

Special Provisions: PFG probe with enhanced sensitivity and greater shimming capabilities.
Solvent suppression and coherence transfer pathway selections through PFGs.

Apart from state-of-the-art multi-dimensional NMR pulse techniques, DOSY experimental capabilities and line shape analysis using STARS are included. Pneumatic support for magnetic alignment.
Floppy backup. Ethernet compatible networking.
Accuracy: 1H Sensitivity (S/N) – 700Line width on test samples – 0.25 Hz. Line shape 0.5/6/12Hz.
Applications: Structural analysis of natural products with greater sensitivity, Water suppression, Supports implementing home-designed pulse sequences for greater flexibility in choosing polarization transfers. Measurements in polymer solutions
Department / Location: Centre for NMR and Structural Chemistry

500 MHz NMR Spectrometer (Liquids/Solids)

Model:
AVANCE III-500 WB, Bruker, Switzerland

Operational Aspects:
5 mm Dual broad band (BBFO) probe (1H-19F/X), 3.2mm triple resonance (HXY) solid state probe. Modern multi-dimensional NMR capabilities in liquids. Improved line shapes under non-spinning, supported by cryo and room temperature shims. Variable temperature system.
Windows with user-friendly menu-driven software. Multi-user login system.

Special Provisions: Enhanced sensitivity and greater shimming capabilities.
Solvent suppression and coherence transfer pathway selections through PFGs.
High wattage amplifier to perform solid state NMR experiments. CP/MASS probe for high resolution studies of solids. Sample spinning upto 36 kHz
CD backup. Ethernet compatible networking.

Accuracy: ^{1}H Sensitivity (S/N) – 540
Line width on test samples – 0.28 Hz
Line shape 3.7/8.5Hz.
^{13}C sensitivity (S/N) - 249

Applications: For elucidating complex molecular structures and structural analysis of natural products with greater sensitivity, Water suppression, Supports implementing home-designed pulse sequences for greater flexibility in choosing polarization transfers. solid state applications

Department / Location:
Centre for NMR and Structural Chemistry

500 MHz NMR Spectrometer (Liquids)

Model:
AVANCE III HD - 500, Bruker, Switzerland.

Operational Aspects:
Dual broad band (BBFO) probe (5mm) ^{1}H/19F-X) Modern multi-dimensional NMR capabilities in liquids. Improved line shapes under non-spinning, supported by cryo and room temperature shims. Variable temperature system. Air driven sample spinning, multi-user login system, User friendly menu-driven windows software.

Special provision:
Auto sampler capable of running 60 samples and stores the data CD backup. Ethernet compatible networking.

Accuracy: ^{1}H Sensitivity (S/N) – 793
Line width on test samples – 0.62 Hz
Line shape 3.0/9.9Hz.
^{13}C sensitivity (S/N) - 250

Applications:
For elucidating complex molecular structures and structural analysis of natural products with greater sensitivity, Water suppression, Supports implementing home-designed pulse sequences for greater flexibility in choosing polarization transfers. Currently running routine samples using auto sampler.

Department / Location:
Centre for NMR and Structural Chemistry

600 MHz NMR Spectrometer

Model:
AVANCE II - 600, Bruker, Switzerland

Operational Aspects:
5mm Triple resonance ($^{13}H/^{13}C/^{15}N$) Cryoprobe (CPTCI) and Triple resonance. Modern multi-dimensional and multinuclear NMR capabilities in liquids, Gradient shimming. Enhanced sensitivity with cryoprobe Solvent suppression and coherence transfer pathway selection through pulse field gradients Improved line shapes under non-spinning, supported by cryo and room temperature shims. Variable temperature system. Air driven sample spinning, multi-user login system, User friendly menu-driven windows software. CD backup. Ethernet compatible networking.

Accuracy:
^{1}H Sensitivity (S/N) – 6000:
Line width on test samples – 0.39 Hz
Line shape 3.3/6.5Hz.
^{13}C sensitivity (S/N) - 789:1
Special provision:5mm triple resonance TBI ($^{1}H/^{13}C/X$) inverse PFG probe.

Applications:
For elucidating complex molecular structures and structural analysis of natural products, proteins and nucleic acids with low concentrations with greater sensitivity Water suppression, Supports and implementing home-designed pulse sequences for greater flexibility in choosing polarization transfers. Selective irradiation experiments using gradients.

Department / Location:
Centre for NMR and Structural Chemistry

700 MHz NMR Spectrometer

Model:
AVANCE III - 700, Bruker, Switzerland

Operational Aspects:
5mm Triple resonance ($^{1}H/^{13}C/^{15}N$) Cryoprobe (CPTCI) and Triple resonance RT Probe (Txi). Modern multi-dimensional and multinuclear. NMR capabilities in liquids. Gradient shimming. Enhanced sensitivity with cryoprobe. Solvent suppression and coherence transfer pathway. Selection through pulse field gradients. Improved line shapes under non-spinning, supported by cryo and room temperature shims. Variable temperature system. Air driven sample spinning, multi-user login system, User friendly menu-driven windows software CD backup. Ethernet compatible networking.

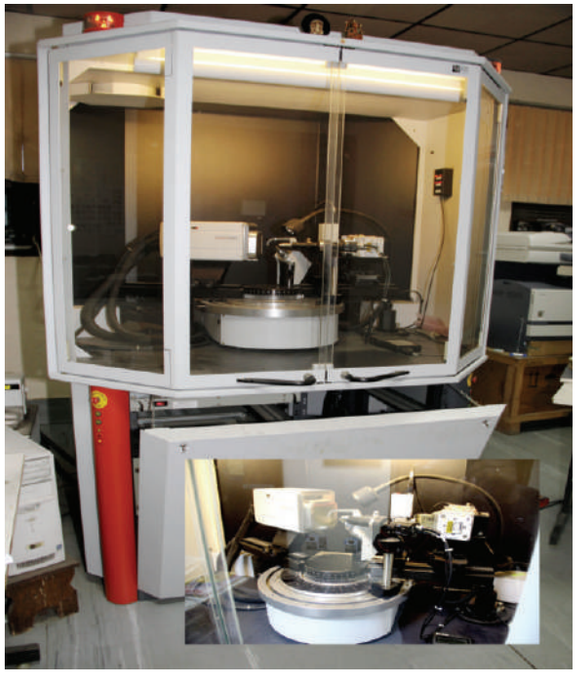
Accuracy:
^{1}H Sensitivity (S/N) – 8500:1
Line width on test samples – 0.42 Hz
Line shape 3.9/8.5Hz.
^{13}C sensitivity (S/N) - 1423:1

Special Provision:
2.5mm MAS/BB probe for bio-solids applications.

Applications:
Biomolecular applications, structural analysis of natural products, proteins and nucleic acids with low concentrations with greater sensitivity, water suppression, Selective irradiation experiments using gradients.

Department / Location:
Centre for NMR and Structural Chemistry

SMART APEX –CCD Single Crystal XRD



Instrument Name / Model:
Bruker- SMART APEX –CCD Single Crystal XRD

Operational Aspects:
Power: 2.0 Kw, at room temperature only

Accuracy/ Detection level:
Atomic / Molecular level

Additional Features:
Three dimensional structure determination

Application:
Pharma industry and Material Science

Department / Location:
Center for X-ray Crystallography /
Main Building, Room No. 148

D-8 Advance Powder XRD

Instrument Name / Model:
Bruker D-8 Advance Powder XRD

Operational Aspects:
Power: 2.2 Kw, at room temperature only

Accuracy/ Detection level:
0.5% (quantitative), 5.0% (qualitative)

Additional Features:
Advanced Lynx-Eye Detector, Sample rotation

Application:
Pharma, Catalysis, Cement, Material Science, etc.,

Department / Location:
Center for X-ray Crystallography /
Main Building, Room No. 150

Wavelength Dispersive X-ray Fluorescence Spectrometer (WD-XRF)

Instrument Name / Model:
Bruker Wavelength Dispersive X-ray Fluorescence Spectrometer (WD-XRF)

Operational Aspects:
Power: 4.0 Kw, at room temperature only

Range of elements: Boron –Uranium.

Accuracy/ Detection level: ppm

Additional Features: Standard-less and Quantitative analysis, Liquids can also be analyzed

Application:
Steel, Cement, Catalysis, Pharma, Material Science, etc.

Department / Location:
Center for X-ray Crystallography / Main Building, Room No. 151

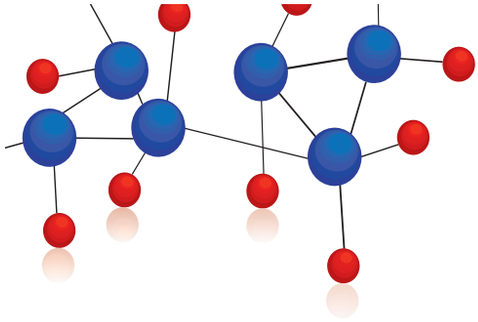
Crop Protection Chemicals

Area of Expertise

- Synthesis of new molecules & screening of natural products (plant & marine) for agrochemical applications.
- Development of selective market driven process technologies for new generation and known pesticides on specific demand by industry.
- Integrated pest management including use of pheromones, kairomones, natural products and biopesticides.
- Impurity profiling, Synthesis of Impurities and toxicological studies of agrochemicals.
- Integrated R&D Program for Agrochemical Processes & Technologies for Off-patent/ Generics
- Isolation, Structure Elucidation and Synthesis of plant based organics
- Total Synthesis of Natural Products and Development of Synthetic Methods
- Organic Photochemical Reactions, Photochemical Processes & Technologies
- Organic Materials for Solar Cells (OPV & DSSC) and Light Emitting Devices (OLEDs)
- Organic Materials for Photoresists

Technologies Developed

- Acephate
- Profenofos
- Glyphosate
- Monocrotophos
- 1,2,4-Triazole
- Imidacloprid
- Esfenvalerate
- 1r-Cis- (S)Cypermethrin
- Cis-Dv Acid
- Lambda Cyhalothrin
- Chlorpyriphos
- Lycopene
- DDVP
- Butachlor
- Diazinon
- Quinalphos
- MBC
- Thiophanate, Methyl
- Dodine



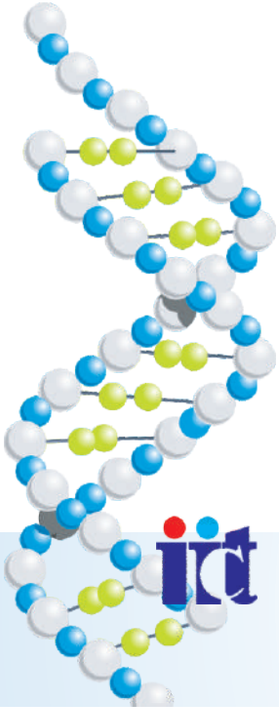
- Bioinsecticide
- Biopesticides from Neem, Annona(custard apple) and Pongamia (karanja) Seeds
- Trifluralin
- Pyriproxyfen.
- Gammaxin
- 4-t-Butylbenzylchloride (intermediate)
- Chloromethylchloroformate (intermediate and reagent)
- Triphenylphsophinedichloride (intermediate and reagent)
- Bioinsecticide
- DNQ- photoactivating compound in photoresists

Semiochemicals

Area of Expertise

- Synthesis of Pheromones and Allelo Chemicals.
- Evaluation of pheromone chemicals.
- Providing knowledge base and technological services to industry and user agencies on the utility of Semochemicals.
- Provide Training for Popularization of Pheromone application technology especially at rural areas.
- Isolation and identification of hither-to unknown Pheromone systems.
- Exploration of insect-plant interactions for the development of management pest management strategies.
- Popularization of PAT as a versatile and potential Agro Practice.
- Extend technical support for Quality, Assurance of Pheromone Components.

Technologies Developed



- Bollworm - Polyohagous (crop) - Z11-Hexadecenal Z9-Hexadecenal (97:3)
- Yellow stem borer - Rice - Z11-Hexadecenal Z9-Hexadecenal (3:1)
- Grounnut leaf miner- Groundnut - (Z,Z)7,9-Decadienyl acetate E7-Decenyl acetate Z7-Decenyl acetate(10:2.0:1.4)
- Brinjal shoot &fruit borer - Brinjal- E11-Hexadecenyl acetate E11-Hexadecenol (10:1.0)
- Housefly – Domestic- Z9-Tricosene
- Pheromones for control of internode borer- a major pest in sugarcane crop
- Process know how for Top and stalk borer sugarcane pest pheromones

Facilities

Differential Scanning Calorimetry

Model:
EXSTAR, Differential Scanning Calorimetry 7020

Operational aspects:
1) Preparation prior to starting measurements
2) Sample preparation.
3) Setting measurement conditions.
4) Measurement start and stop.
5) System shut down.
6) Analysis

Accuracy:
More accurate in measurement of heat capacity of a material.

Additional features:
Equipped features: 1) protect feature.
2) Real time subtraction.

Application:
To observe fusion and crystallization events as well as glass transition temperature of materials.

Department/location:
Crop Protection Chemicals Division

Electrochemical Analyzer

Model:
Model 600D CH Instruments (electrochemical analyzer)

Operational aspects:

Electrochemical analyzer	2 mm dia.Pt working electrode
3 mm dia. GC working electrode	Ag/AgCl Ref.electrode
Non-aqueous Ag/Ag Ref.electrode	Calmel Ref.electrode
Pt wire counter electrode	Electrode polishing kit
Glass cells	Teflon cap

Accuracy:
Capable of measuring current down to picoamperes

Application:

Cyclic voltametry	Linear sweep voltametry
Chronoamperometry	Chronocoulometry
Amperometric i-t curve	A.C.impedence
Impedence-time	Impedence-potential
Chrono potentiometry	Multi current steps
Potentiometric stripping analysis	Open circuit potential-time

Chrono potentiometry with current ram

Department/location:
Crop Protection Chemicals Division

Fluorescence Spectrophotometer

Model:
Cary Eclipse Fluorescence Spectrophotometer

Operational Aspects:
This is a compact spectrofluorimeter with Xenon lamp, Excitation Monochromator
Sample Chamber
Emission Monochromator
Photomultiplier
Peltier

Accuracy:
It has high sensitivity and resolution and can measure micro molar concentrations with high precision.

Additional Features:
Phosphorescence, Kinetics, Anisotropy and Temperature Dependent studies can be carried out.

Application:
This is a steady state fluorimeter which can be used for solid sample. Thin films and solutions.

Department/Location:
Crop Protection Chemicals Division

TG/DTA 7200

MODEL:
EXSTAR, TG/DTA 7200

Operational aspects:
1) Preparation prior to starting measurements
2) Sample preparation
3) Sample container preparation
4) Reference preparation
5) Sampling method
6) Setting measurement conditions
7) System shut down
8) Analysis

Accuracy:
Precisely measured with high sensitivity horizontal balance systems.

Additional features:
New balance control technology
New temperature control functions.
High throughput measurement with full line up options.

Application:
Characterization of thermal stability, material purity.
Comprehensive study of a material thermal behaviour.

Department/location:
Crop Protection Chemicals Division

UV-vis NIR Spectrophotometer

Model:
Cary Series UV-Vis NIR Spectrophotometer

Operational Aspects:
This is a light absorption spectrophotometer having Visible lamp ; Deuterium lamp ; Mercury lamp

Accuracy:
It has high sensitivity and resolution and it can measure micro molar concentrations with high precision.

Additional Features:
Absorption spectra, Transmission spectra, Diffuse reflectance spectroscopy.

Application:
This instrument can be used to study absorption of light in solids, thin films and liquid samples. It can which can be used in the UV, Visible and NIR region.

Department/Location:
Crop Protection Chemicals Division

UV/VIS-Spectroscopy

Model:
Jasco, V-550-UV/Vis-Spectroscopy

Operational aspects:
Starting up/exiting programs and spectral manager.
Quantitative analysis and spectrum measurement.
Standard measurement program reference.
Spectra analysis, Spectra view features
Processing, Commands and data output.

Accuracy:
Having excellent photometric performance.

Additional features:
Compact design.
Excellent optical performance,
Versatility.

Applications:
Determination of maximum absorption wavelength of compounds Detection of impurities.
UV spectroscopy is useful in the structure elucidation of organic molecules, the presence or absence of unsaturation, the presence of hetero atoms.

Department/location:
Crop Protection Chemicals Division

GC/EAD (Gas Chromatograph-Electroantennograph Detector)

Model :
Auto spike EAG, GC/EAD, Syntech 1998

Operational Aspects :
Highly sophisticated and requires special trained hands for the operation. Operational aspects involve:

- Preparation & handling of biological samples for electro-physiological experiments, Continuous monitoring of the elution of biologically Active compounds in the effluent of analytical system (coupled GC-EAD detection) Evaluation of EAD & GC detector signals simultaneously recorded and displayed on the computer screen.

Special Provisions :
GC-effluent splitter, software designed for GC-EAD Recording.

Accuracy :
GC-500 n.gr; EAD: y 10 molecules of pheromone compound.

Applications :
EAG is a bioassay tool widely used in experimental entomology to detect volatiles perceived by the antennal olfactory apparatus of insect. It is a state-of-art equipment coupled to GC in the area of isolation & identification of semiochemicals, specially pheromones

Uses :
a. Screening of biologically active compounds
b. Selection of active synthetic compounds
c. Concentration measurements in the field
d. As a detection Gas Chromatography

Department/Location :
Centre for Semiochemicals

Wind Tunnel

Model :
Laboratory fabricated with the standards of International Agricultural University, Wageningen, The Netherlands and supplied by TNO, Netherlands

Operational Aspects :
Involves regulation of air speed temperature and light conditions as per the experimental requirements. A thorough knowledge of behavioural biology of insects of interest is necessary for the successful operation.

Special Provisions :
Charcoal filters for the pure air, powerful regulator for the Control of air speed and a special provision for light Illumination.

Specifications :
Size of the tunnel 150 cm long and 36 cm width, Dimension of Windows 33.22 cm separated by a distance of 40 cm

Accuracy :
10 Molecules of pheromone component

Applications :
To study behavioural responses of insect specially orientation of insects towards their pheromonal components, host plant volatiles and other behaviorally active compounds, host parasite interactions and kairamonal influence on parasitoids.

Department/Location:
Centre for Semiochemicals

Photo Reverse Day and Night Chamber

Model :
Day/Night control unit, Hoffman Manufacturing Inc. Albani, OR 97321 USA

Operational Aspects :
Regulating temperature humidity and light conditions as per the experimental requirements

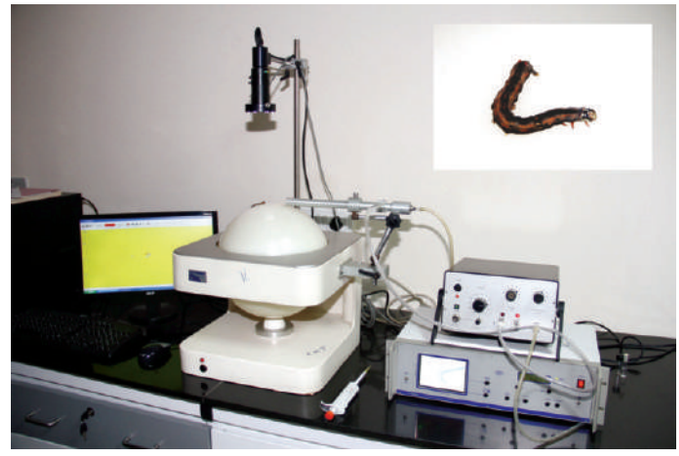
Special Provisions :
Temperature control, timer control, humidity control and super insulated chamber

Specifications :
Size 4x6x7 feet interior dimensions
Temperature Range : 10°C - 35°C

Applications :
The reverse photosphase equipment helps in synchronizing endogenous rhythms of day/night in insects totally reversed to the photo period conditions in the laboratory.

Department/Location:
Centre for Semiochemicals

Tracksphere



Model:
LC 300 Tracksphere ;Syntech, The Netherlands

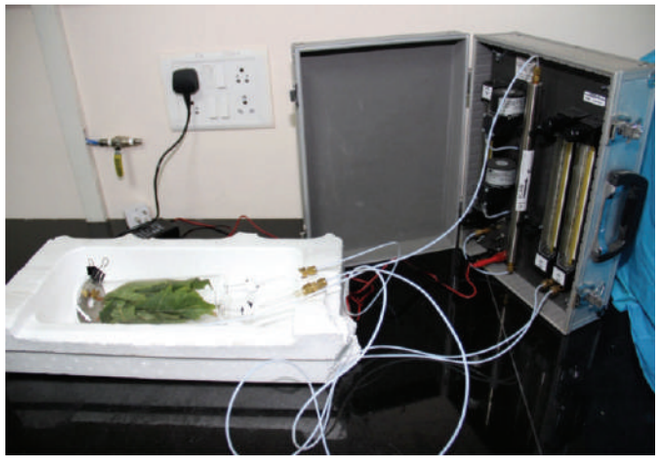
Operational Aspects :
It consists of a sphere, on top of which the insect is placed. The sphere is rotated opposite to the insect's displacements by means of two electric motors. The motors are driven by electrical commands proportional to the displacement of the insect measured by an optical detector located above the insect. Two encoders orthogonally contacting the sphere transmit the rotational movements to a computer, where the displacements are stored as incremental X and Y coordinates.

Special provisions Sensor:
Video CMOS camera with Macro zoom lens ; Light Source- IR and Visible LED illuminators ; the track Sphere software program collects and stores the displacement data, reconstructs the walking path and provides track analysis

Application:
It is a unique device that allows for tracking and recording the close up behavioural movements of insects in a completely unconstrained (freely moving) mode in normal as well as semiochemical exposed conditions.

Department/Location :
Centre for Semiochemicals

Air Entrainment System



Model :
Portable Air Entrainment System (UK)

Operational Aspects :
Comprises of two components
1) Volatile collection chamber,
2) Air delivery system housed in an Aluminium casing. This technique involves the trapping of headspace volatile semiochemicals produced by insects/plants over a period of time on a solid adsorbent such as activated Charcoal, Porapak Q or Tenax. Live insect (s) /plant samples are placed in all glass volatile collection chamber (20cm/6cm)fitted with an inlet and out let ports. Charcoal filtered purified air will be drawn over the samples through the inlet port and volatiles will be collected on an organic adsorbent trap placed at the outlet port box.

Special provisions :
Inbuilt flow meters; pumps; Carbon filter; automatic universal power supply 100 to 250 v ac

Applications and Uses :
Unique device for collection of headspace semiochemicals from insects and plant samples

Department/Location :
Centre for Semiochemicals

4-Choice Arena Olfactometer

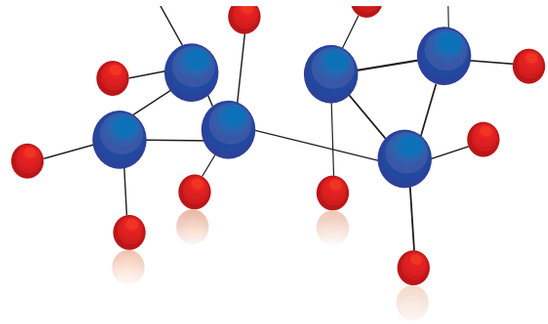
Model :
4-Port / 4-Choice Arena Olfactometer

Operational Aspects :
A four choice olfactometer for small insects is fabricated to study the preferential orientation response of the test insects towards the odour source by regulating the air flow through the odour source as per the experimental requirements. The air flow entering the four inlets is measured and controlled by four variable flow meters supplied with a micro needle valve. The total flow through the central outlet is measured by a similar flow meter with a four times higher range. The whole assembly of olfactometer, flow controllers, glass vials and vacuum pump are placed onto a suitable support and in a dedicated experimental room to enable adjustment of lighting and other environmental conditions to avoid interference from outside. The behaviour of the insect (s) in the arena of the olfactometer can be recorded by direct observation or by using video tracking system and associated analysis software.

Special provisions :
Air Delivery System -4 –port includes 1.3 LPM air inlet flow meters; pressure regulator and gauges; hydrocarbon filters and internal air driven vacuum pump and high purity air generator for 4-way olfactometer.

Applications & Uses :
To study the orientation responses of insects towards their pheromone components/ blend combinations, host plant volatiles and other behaviourally active compounds, host parasite interactions, kairomonal influence on parasitoids

Department/Location :
Centre for Semiochemicals.



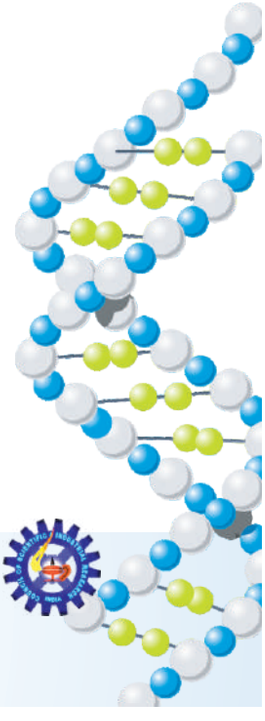
Natural Products Chemistry

Area of Expertise

- Development of new synthetic methodologies for novel scaffolds, hybrid natural products and combinatorial chemistry.
- Phytochemistry, new bioactive molecules, herbal drugs and their standardization
- Hybrid natural products
- Novel solvent media (P&G and Ionic liquids)
- Isolation of marine and terrestrial natural products
- Green chemistry
- Synthesis of natural products and their synthetic analogues
- Library management of small molecules through National Mol Bank
- Automation chemistry
- Process development of APIs and Intermediates
- Deuterium chemistry
- Asymmetric synthesis

Technologies Developed

- Taxol (C-13 side chain)
- Diltiazem
- Misoprostol (prostaglandins drug)
- Carboprost (prostaglandins drug)
- Pyrazinamide (antituberculosis)
- Ondasetron (antiemetic)
- diltiazem (coronary heart disease)
- mefloquin (anti malaria)
- tamoxifen (breast cancer)



Facilities

LC - Q - TOF

Model:
6510 Agilent Technologies 1200 series

Operational Aspect:
High performance Liquid Chromatography hyphenated with mass spectrometer which has quadrupole and time of flight analyzer this system is mainly useful for conformation of molecular formula and obtaining high resolution mass.

Accuracy: ppm level identification.

Additional features: High resolution mass and deconvolution software available

Application:
Main application for analyzing high molecular weight compounds like proteins, peptides and polysaccharides.

Department/Location:
DNPC, NPL ground floor instrumentation.

Mass based Purification System

Model:
Agilent Technologies 1200 series MSD/SL

Operational Aspect:
High performance Liquid Chromatography hyphenated with mass spectrometer. Preparative chromatography will be carried out for the separation of natural product extracts, purest isolates can be obtained by collecting the fractions which has required molecular weight.

Accuracy: Unit mass resolution.

Additional features:
Mass based purification system.

Application:
Mainly used for purification of natural product extracts.

Department/Location:
DNPC, NPL ground floor instrumentation.

LC-MSD Trap

Model:
Agilent Technologies 1100 series.

Operational Aspect:
Analytical HPLC-MS with iontrap analyzer.
Aanlytical scale separation of sample mixtures and identification of molecular weight of individual compounds in the mixture.

Accuracy: Unit mass resolution.

Additional features:
Manual fragmentation possible which will be more useful in structural elucidation.

Application:
Analysis of natural extracts and identication of molecular weight.

Department/Location:
DNPC, NPL ground floor instrumentation.

Auto Plant

Operational Aspects:
(1) Heating / cooling range from -25°C to 250°C (Max)
(2) Overhead stirring range up to 1200 RPM (Max)
(3) Pressure range from Vacuum to 100 bar (Max)
(4) Reflux system for fast cooling and heating
(5) Online pH measurement and controlling
(6) Inbuilt Auto Suite software for designing application, system configuration, system calibration, Simulation of application, online visualization and data logging.
(7) Mini plant reactors (06 Nos.) of 100ml capacity.

Accuracy: 5% relative

Additional Features:
(1) Robotic system for auto liquid handling and solid handling.
(2) Provision for online sample collection during experiment.

Application:
For organic process R&D, Optimization and Scale up. For automated preparative organic and inorganic synthesis. For catalyst testing and preparation.

Department/Location:
DNPC, GCL Building, Ist Floor

Accelerator Synthesizer

Operational Aspects:
(1) Heating / cooling range from -25°C to 230°C (Max)
(2) Vortex stirring range up to 800 RPM (Max)
(3) Pressure range from Vacuum to 90 bar (Max)
(4) Reflux system for fast cooling and heating
(5) Inbuilt Auto Suite software for designing application, system configuration, system calibration, Simulation of application, online visualization and data logging.
(6) Glass reactors (48 Nos.) of 13 ml capacity

Accuracy: 5% relative

Additional Features:
(1) Robotic system for auto liquid handling and solid handling.
(2) Provision for online sample collection during experiment.

Application:
For organic process R&D and Optimization.
For automated preparative organic and inorganic synthesis.

Department/Location:
DNPC, GCL Building, Ist Floor

National MOL Bank

Model :
US 1100

Operational Aspects :
1) Storage of samples at -20°C
2) Retrieval of samples from store

Accuracy :
a) Store Temperature = -20°C ±2°C
b) Oxygen % = 10%±2%
c) Humidity = 0 - 2g/m^3

Applications
1) Sample storage or HTS
2) All samples stored under Nitrogen atmosphere in absence of oxygen, moisture and light
3) Sample shelf life is expected to be upto 20 years without any decomposition/deterioration
4) Totally robotic system and deposit or retrieval of samples with minimal errors.

Department / Location:
National Mol Bank (NMB)

Personal SEP Box

Model :
SEPIAtec, GmbH Germany

Operational Aspects :
Fully automatic - Chromatographic Purification of Bioactive plant extracts

Special Provisions :
Provision to handle six samples continuously for 36 hrs with reproducibility

Accuracy :
Can handle up to 150-200 mg of crude extract

Applications :
Bio-assay guided fractionation of plant extracts of medicinal plants

Department/Location :
DNPC, 1 st floor,
Natural Products Laboratory

Simulated Moving Bed Chromatograph

Model :
Knauer Germany

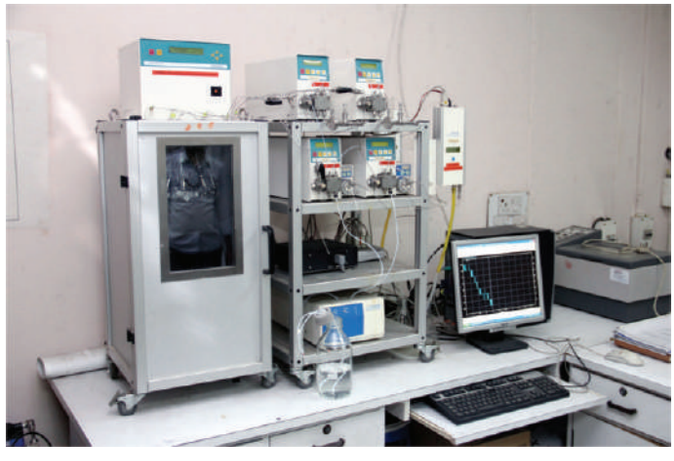
Operational Aspects:
Separation of bicomponent mixtures with advanced mechanism for Continuous separation into the individual components with good Economic viability.

Accuracy : Gram scale

Application:
Mainly used in the field of asymmetric synthesis for Resolution of Individual Enantiomers or Diastereomers.

Additional Features:
Continuous supply of the sample and collection of individual Components.

Department/ Location:
DNPC/ NPL Ist Floor



High Performance Thin Layer Chromatograph

Model :
CAMAG

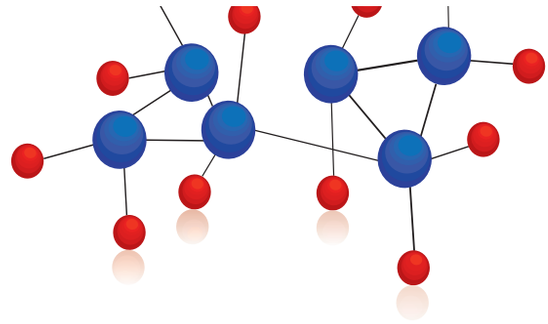
Operational Aspects:
Thin layer Chromatographic technique with automatic control Software WINCATS

Accuracy : ppm level

Additional Features:
HPTLC- MS interface for getting molecular weight of individual Spots.

Application :
Development of chemical fingerprinting of Medicinal Plants and quantification of biomarkers.

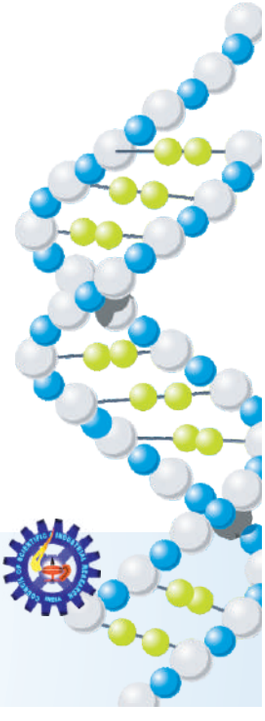
Department/Location:
DNPC/ GCL Ist Floor

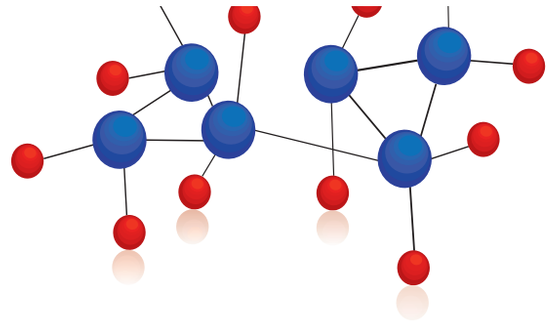


Organic & Biomolecular Chemistry

Area of Expertise

- Synthesis of nonnatural peptides, nonnatural saccharides and other designer molecules.
- Solid/solution phase organic synthesis useful to make combinatorial libraries.
- Synthetic route identification/process development of lead molecules.
- Synthesis of NCEs for their biological evaluation for lead generation.
- Carbohydrates and carbohydrate mimics
- Design of methodologies and their application in the synthesis of carbohydrate mimics and other bioactive compounds
- Development of synthetic protocols and synthesis of heterocycles for biological evaluation
- Organocatalysis and asymmetric transfer hydrogenation (ATH) reactions for synthesis of pharmaceutically active compound.





Molecular Modeling

Area of Expertise

- Computational Quantum Chemistry
- Electronic Structure Methods
- Computer Aided Drug Design
- Non-Bonded Interactions
- Theoretical Organic Chemistry
- Bioinformatics and Computational Biology
- Multi-scale Modeling & Dynamics
- Database Creation and Maintenance
- Modelling Functional Materials
- Materials for Solar Energy and CO2 capture.

Facilities

Hardware

CMM has state of art infrastructure for carrying out large computations. We have 350 cores of computing which includes 3-clusters and 15 workstations.

Clusters

Ganga (60 cores, 15 nodes)	Model: Dell Power edge 1955 Configuration: HDD – 250GB; RAM – 8GB
Kaveri (60 cores, 30nodes)	Model: HCL 4U Servers Configuration: HDD – 80GB; RAM – 8GB
Krishna (116cores, 29nodes)	Model: Dell Power edge 1955 Configuration: HDD - 110GB; RAM - 32GB

Workstations

HP-Z800 workstation (8)	Configuration: HDD – 1TB; RAM – 52GB(3): 32GB(1): 24GB(2): 16GB(2);
Dell workstations (4)	Configuration: HDD – 500GB; RAM – 24GB
HP Elite Small Desktop (6)	Configuration: HDD – 500GB; RAM – 16GB
Six DELL systems	Configuration: HDD – 500GB; RAM – 16GB

Pcs :

No. of PCs : 20

Software

Several software program packages are available in our group for various research activities.

Gaussian 09	SILVER 3.2
GAMESS	Schrödinger Suite
ADF	Desmond
Turbomole	Discovery Studio
Molden	Chem-Shell
Ampac	Charmm
AIM	Amber 8
ORCA	Material Studio
MOPAC	Sybyl 6.9
GOLD 3.2	Autodock
ChemAxon	Codessa
Pymol	VMD
MOE	SIESTA

Molecular Modeling

Methodologies Used:

Multiscale modeling

Energy decomposition analysis

QM-MM

Molecular Mechanics

Atomistic details

Docking

Homology modeling

Molecular dynamics

Virtual screening

QSAR technique

Electronic structure calculations

Strengths:

Electronic structure calculations

Computer Aided Drug Design

Molecular modeling

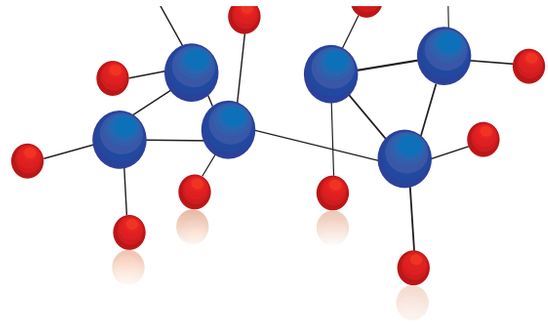
Theoretical organic chemistry

Software development

Database generation

Reliable prediction of properties of biological molecules which involves high end computing and parallel computing.

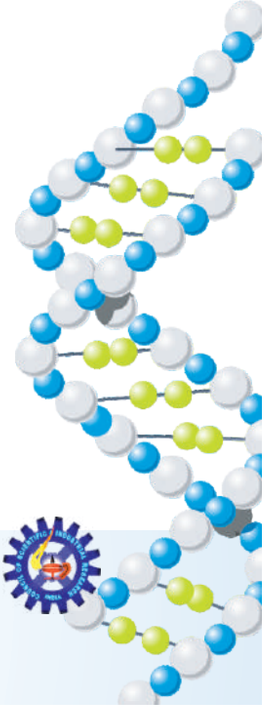
Designing advanced functional materials for various applications in energy and environment.z



Medicinal Chemistry and Pharmacology

Area of Expertise

- Executing various medicinal chemistry and drug discovery programmes
- Synthesis of complex natural products, new molecules and analogue generation
- In-silico design of novel leads
- Understanding drug mechanisms and their mode of action
- Pharmacokinetic/pharmacodynamic studies
- Preclinical toxicity studies
- Development of drug delivery systems
- Bio-transformations and bio-catalysis tools
- Team of Scientists in the areas of synthetic organic chemistry, medicinal chemistry, pharmacology, biochemistry, biotechnology and microbiology
- Excellent facilities for design and development of new methodologies for the synthesis of simple to complex molecules and their libraries
- Equipped with analytical and related instruments such as UV, FT-IR, Polarimeter, GC, HPLC, UPLC, GCMS, LCMS/MS, Microwave synthesizer, Scale-up lab reactor, Parallel synthesizer, Fermentors, Blood cell counter and analyzer, Multimode microplate reader, RT-PCR, Fluorescence microscopes.



Facilities

Gas Chromatograph

Model:
Shimadzu GC-2010

Operational Aspects:
- separates the multiple components and then detects to determine the quantity of each
- Inlet carrier gas program can be in flow, pressure, velocity mode.
- High inlet pressure–the system suitable for fast GC.
- High pressure / flow programming rates.
- Split, septum purge and carrier gas programs can be ramped.
- High heating speed for oven, injectors and detectors.

Accuracy:

Additional Features:
- Electronic flow and pressure controller for inlets
- Electronic flow control for detectors gases.

Application: The capillary gas chromatograph separates the multiple components of a sample in a capillary column, and then detects the components to determine the quantity of each

Department/Location:
Discovery Laboratory / D227

High Performance Liquid Chromatography

Model:
Shimadzu

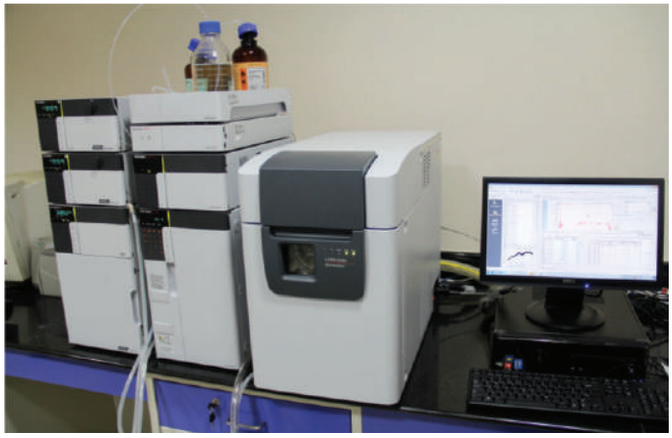
Operational Aspects: It includes
- LC-10A vp dual plunger pumps
- SCL-10Avp System controller
- CTO-10ASvp column oven
- SIL-10ADvp auto injector
- SPD-M10Avp detector It contains prominence photodiode Array detector
  - Wavelength accuracy ± 1 nm
  - Wavelength range: 190-800 nm
  - Light source D2 and W lamps
- Analysis results processed by LC solutions software

Accuracy:

Additional Features:
Application: Separation of the multiple components of a sample, and then identification of target analytes/ unknown and to determine the quantity of each

Department/Location:
Discovery Laboratory / D227

Liquid Chromatography Mass Spectrometer



Model:
LCMS2020 Shimadzu

Operational Aspects:

- LCMS-2020 is a quadrupole mass spectrometer
- Liquid chromatography is ionized by the ESI (or) APCI probes
- The ion signals are detected by secondary electron multiplier with conversion dynode
- Analysis results processed by lab solutions software
- High performance including scan speed of 15000 μ/sec
- High speed polarity switching time (both positive and negative ionization) of 15 msec
- FAST (fast automated scan/SIM Type) helps in simultaneous scan/SIM data acquisition
- It contains prominence photodiode Array detector
  - Wavelength accuracy ± 1 nm
  - Wavelength range: 190-800 nm
  - Light source D2 and W lamps
- It contains LC-20AD liquid pump

Accuracy: Mass range 10 to 2000

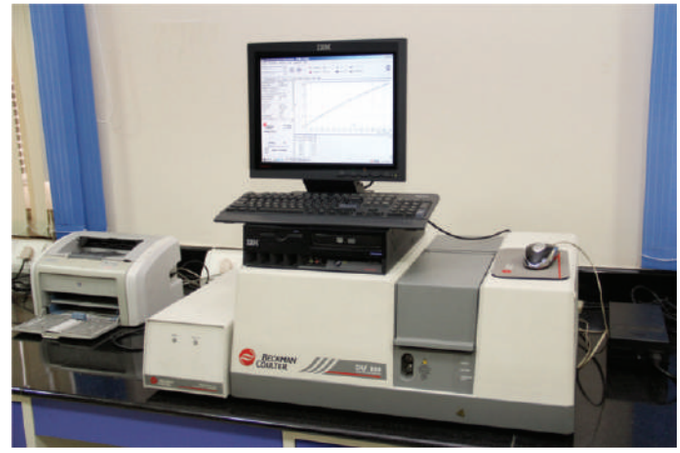
Additional Features:

- Accurate detection of trace impurities.
- Measuring unknown substances
- Structure confirmation or identification
- Determination of molecular weight
- Identification of tart analytes/unknown and to determine the quantity of each

Application: Separation of the multiple components of a sample, and then identification of target analytes /unknown and to determine the quantity of each

Department/Location:
Discovery Laboratory / D227

UV/Visible Spectrophotometer with Peltier Temperature Control Module



Model:
Beckman Coulter: DU 800

Operational Aspects:
Quantitative and qualitative analysis of samples that require spectrophotometric measurements in the UV and visible region of the electromagnetic spectrum

Accuracy:

- Wavelength range of 190 to 1100 nm and bandwidth of <= 1.8 nm.
- Scanning Speed 120, 240, 600, 1200, 2400 nm/min

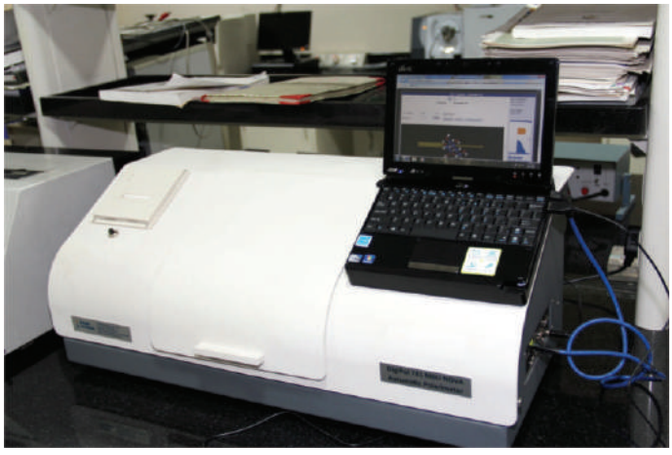
Application:
Concentration: Ideal for essential biological/analytical applications. A single cell holder, and six cell holder with Peltier temperature control Peltier temperature control module

Kinetics: Designed for protein and advanced enzyme kinetics studies. Enzyme Mechanism application, Protein Assay analysis application, standard transport, and Auto 6 cell holder (water-regulated). To perform characterization of enzyme reactions; calculate Km, Vmax, Kcat, and more; generate plots (such as Michaelis-Menten, Lineweaver-Burk); and conduct common protein assay methods.

- DNA, RNA, and oligo quantitation; DNA theoretical melting point (Tm) determination

Department/Location:
Discovery Laboratory / D227

Automatic Polarimeter



Model:
DigiPol 781 M6U Nova

Operational Aspects:
- Meets all the requirements of USP, BP,EP,JP
- All 6 Pharmacopeial wavelengths 325nm, 365nm, 405nm, 436nm, 546nm, 589nm
- High accuracy all across the range
- Complete Pharmacopeia Compatibility and 21CFR Part 11 Compliance
- Automatic Calculation of Specific Rotation / Concentration
- Correction for Moisture & Temperature

Accuracy: wavelength coverage from 325nm to 633nm

Additional Features:
- Provision for two more field installable wavelengths for new methods

Application:
- Optical Rotation measurements in Pharmaceutical & Chemical testing.
- Characterization of New chiral compounds in Chemical Research

Department/Location:
Discovery Laboratory / D227

FT-IR Spectrometer

Model:
Thermo Nicolet 380 FT-IR

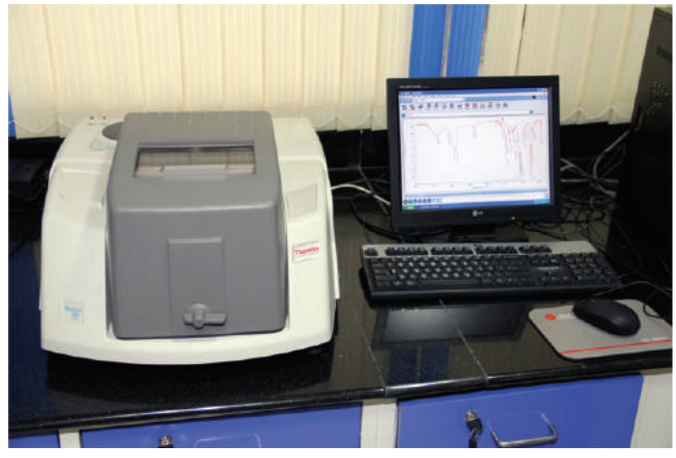
Operational Aspects:
- Spectral range: 7800 - 350 cm-1 using proprietary KBr beamsplitter
- FT-IR complete with Smart Multi-Bounce HATR cell
- Nicolet OMNIC software

Accuracy: Spectral range: 7800 - 350 cm-1

Additional Features:

Application:
- To obtain an infrared spectrum of absorption, emission, photoconductivity or Raman scattering of a sample
- Simultaneously collects spectral data in a wide spectral range

Department/Location:
Discovery Laboratory / D227



Gas Chromatograph Mass Spectrometer

Model:
Shimadzu GCMS- QP2010 Plus

Operational aspects:

- High-sensitivity ion source provides an ion optics system with high transport efficiency and achieves temperature homogenization of the ion source box
- The high sensitivity for Octafluoronapthalene (OFN) in Electron Impact (EI) and Chemical Ionization (CI) modes
- GCMS solution Software with versatile functionality for data acquisition, qualitative or quantitative data analysis to highly flexible report creation.
- AOC20i automatic injector
- FAAST (Fast Automated Scan/SIM Type) helps in simultaneous Scan/SIM data acquisition

Accuracy Mass range: 1.5 to 1090 Daltons

Additional Features:

- Precise and reliable measurement of trace level compounds
- Highly accurate identification of target analytes
- Highest sensitivity of target compounds and easy identification of unknowns in the same run, Scan and SIM can be set in one method file

Appliacation: Separation of the multiple components of a sample in a capillary column, and then identification of target analytes/unknown and to determine the quantity of ach.

Department/Location:
Discovery Laboratory / D227

Blood Cell Counter

Model:

Bakers System 9120 +Li,

Biochem Immuno Systems, USA

Operational aspects*Tests:

WBC, RBCK, HGB, HCT, MCV, MCH, MCHC, RDW, PLT, MPV, %LY, %MO, %GR, %EO, BA

*10 l whole blood is sufficient for complete Hematological picture in a minute

Special provisions: Standardized methods of operational aspects

The equipment has a bar code and ID facility

The unit can be used for cell counting in human beings and animals

Accuracy:

Applications: Hematological studies in human, rat, rabbit, mice

Department/Location:
Pharmacology Laboratory

Cell Culture Facility

Cell culture facilities in pharmacology consist of newer analytical tools for pharmacological screening of new chemical entities under aseptic conditions and molecular mechanistic studies of synthetic and natural molecules.

Laminar Hood

Model :
LCB – 1501V (Labtech India)

Operational conditions :
Select from Vertical and Horizontal Type 99.97% Particle Removal Class 100 HEPA Filter. Microprocessor PID Controller Back Light LCD Display 9 Step Air Velocity Control UV, FL Lamp and Timer Filter Replacement Warning Lamp

Applications:
In vitro evaluation under asceptic conditions

Department/Location:
Pharmacology Laboratory

CO_2 INCUBATOR

Model :
3305 (Thermo scientific)

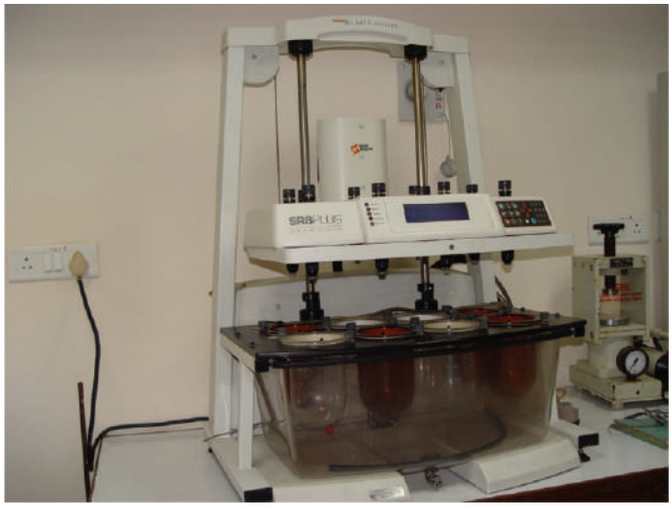
Operational conditions :
Requires expertise in cell culture handling

Incubator conditions for Maintenance of cultures :
Temparature-370C
CO2-5%
Humidity-60-80%

Applications :
Maintenance of cultures of various cancerous cell Lines for evaluating the pharmacological activities.

Department/Location:
Pharmacology Laboratory

Dissolution Test Station



Model:

New Hanson SR8-Plus-65 PBX Hanson Research Corporation, USA

Operational aspects:

* Spindle speed range 25-200 rpm
* The unit is provided with water bath 30 lit. capacity with bath support, controller, 8 flasks and paddles
* Spindle speed range 25-200 rpm*Flask temp. range 30°C to 40°C

Special provision:

* It is provided with computer and software version 0.6
* Five status lights to know instrument status

Accuracy :
New approach with special sampling condition establishment

Applications :

Dissolution test facility for sustained released drugs, ointments and pesticides

Department/Location:
Pharmacology Laboratory

Multimode Microplate Reader

Model : Biotek Synergy-4

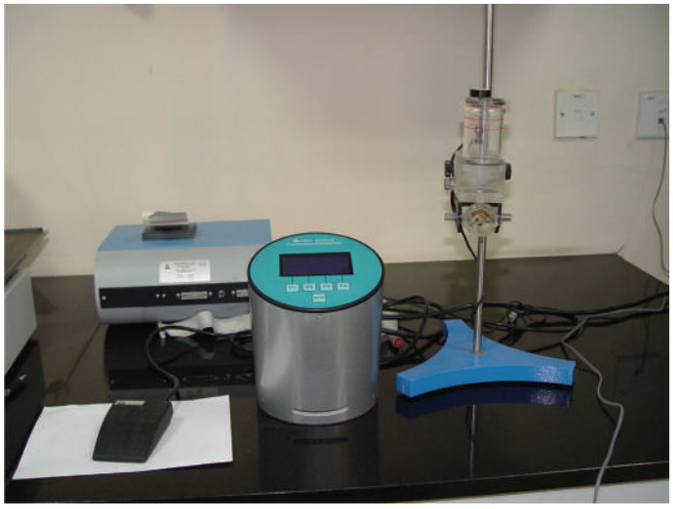
Operational aspects :
96 and 384 well microplates can be read.
End point, Kinetic, spectrum and well scan modes.
Temperature control system and shaking are standard.

Special Provisions : Gen –5 Software

Applications : Modular microplate reader that offers Monochromator-Based Fluorescence Intensity UV-Visible Absorbance.ELISA, Biochemical and kinetic parameters can be studied.

Department/Location :
Pharmacology Laboratory

Plethysmometer



Model:
UGO, Basile, Italy

Operational aspects:
Requires expertise in clinical chemistry

Special provisions :
Reads and prints accurately the precise volume of paw of rat/mice

Accuracy :
Error-free readings of volumes displaced
Applications : Pharmacological evaluation of antiarthritic agents in rats/mice

Department/Location:
Pharmacology Laboratory

RT-PCR

Model:
Step One Plus- Real Time PCR

Operational aspects:
✓ Easy-to-use
✓ High-quality qPCR results
✓ 4-color, 96-well PCR instrument
✓ Innovative VeriFlex™ Block for convenient PCR optimization

Special Provision
The StepOne and StepOnePlus systems use fluorescent-based polymerase chain reaction (PCR) reagents to provide:

- Quantitative detection of target nucleic acid sequences (targets.
- Qualitative detection of targets using post-PCR (endpoint) analysis.
- Qualitative analysis of the PCR product (achieved by melt curve analysis that occurs post-PCR).

The StepOnePlus instrument contains six independently thermally regulated VeriFlex™ blocks to help you optimize your thermal cycling conditions. You can set a different temperature for one or more of the VeriFlex blocks, creating up to six different zones for samples, or you can set the same temperature for each of the VeriFlex blocks.

Application: Gene expression analysis, Pre-Designed/ Validated Assays,TaqMan® SNP Genotyping Assays and TaqMan® Drug Metabolism Genotyping Assays, Pre-Developed TaqMan®, Assay Reagents for Allelic Discrimination and Presence and absence experiment.

Department/Location :
Pharmacology Laboratory

Pharmacology

Experimental facilities for pharmacology and pharmaceutical technology consist of newer analytical tools for pharmacological screening of new chemical entities and in vitro and in vivo evaluation of commercial formulations based on synthetic and natural products. Facilities also exist for conducting toxicity studies of drugs on laboratory animals viz. mice, rat, rabbit etc.

Auto Blood Analyzer

Model :
Siemens, (Dimension x pand plus)

Operational aspects :
Requires expertise in clinical chemistry

Special Provisions :
Capacity to carry out different biochemical parameters and can analyze 180 tests per hour.

Applications :
Biochemical studies in humans and animals, which include liver function, kidney function, lipid profile and other general biochemical parameters.

Department/Location :
Pharmacology Laboratory

Langendorff Apparatus

Model :
ML870B2 Langendorff System, AD Instruments, Australia

Special Provision :
Blood Pressure – Automatically detects, analyzes and reports parameters from arterial or ventricular pressure recordings
ECG Analysis – detects and reports the onset, amplitude and interval times of PQRST from human and animal ECG signals

Applications:
Ischemic repurfusion studies, Preconditioning & Postconditioning studies, Coronary vessel function, Left ventricular developed pressure, Left ventricular dP/dt maximum and minimum, Perfusate temperature, Cardiac electrical activity, Bioelectrical parameters (ECG, monophasic injury potentils) Cardiac cycle rhythm and Heart rate can be recorded.

Department/Location :
Pharmacology Laboratory

Fermentor

Model :
BioFlo 410 Benchtop Fermentor / Bioreactor
New Brunswick Scientific Co., Inc. USA

Operational Aspects:
Controlled fermentation studies

Specifications : Stirred tank fermentor

Special Provisions :
* Temperature, pH, gas flow, DO, foam level, aeration and stirring speed controls
* Touchscreen display of process controls
* Batch, fed-batch and continuous modes of operation
* Benchtop unit, 20 liters working volume

Applications :
Process optimization of microbial enzymes, antibiotics and other bioactive compounds

Department/Location :
Main Building, Cellar

Gel Documentation System

Model :
Uvidoc DOC-008.XD, Unitec Co., UK

Operational Aspects :
UV gel photodocumentation system

Special Provisions :
* 6 keys touch panel membrane keypad
* Image saturation indicator
* 10 presets from 0.04s to 10s for integration time
* In-built B/W video outputs for video monitor and video printer
* 3.5 inch floppy disk drive for saving images
* Provided with UVIsoft Image acquisition and analysis software for image processing.

Applications : Photo-documentation of agarose gels and related molecular biology work

Department/Location :
Main Building, Cellar

Phase Contrast/ Fluorescence Microscope

Model :

BX51/BX-RFA Phase contrast-Fluorescence Microscope, Olympus Corporation, Japan.

Operational Aspects :

Bright-field, Phase contrast and Fluorescence microscopy

Special Provisions :

* Universal Infinity System (UIS) optical system with built-in transmitted Koehler illimunation
* Revolving nosepiece with 4x, 10x, 40x and 100x objectives
* Fluorescence illuminator and filters
* Interfaced with Image-Pro Express software for image-processing

Applications :

Bright-field and Fluorescence microscopic observation of microorganisms and other biological material

Department/Location

Main Building, Cellar

Lyophilizer

Model :

BenchTop 6K Freeze Dryer, Virtis, USA

Operational Aspects :

Lyophilization of biological materials

Special Provisions :

Mechanically refrigerated manifold freeze drying module

* Provides condenser temperatures of -53°C to -105°C
* Freezes samples as low as –90°C
* CFC-free refrigeration
* Pressure control
* Auto start-up
* Freeze/Freeze dry
* Hot gas defrost
* 18 port stainless steel drum manifold
* 6.0 litre trapping capacity

Applications :

Freeze drying of biological samples, enzymes, antibiotics and other bioactive compounds

Department/Location :

Main Building, Cellar

Refrigerated High-speed Centrifuge

Model :
Sorvall RC-5C Plus,
Kendro Laboratory Products, USA

Operational Aspects :
High-speed refrigerated centrifuge

Special Provisions :
_ Microprocessor-controlled 21,000 rpm model
_ Heavy-torque, direct drive motor system 1.86 kW
_ Refrigeration system: Heavy-duty sealed compressor 1.49 kW
_ CFC-free coolant
_ Automatic Relative Centrifugal Force (RCF)
_ Maximum speed: 21,000 rpm
_ Speed control accuracy: ± 100 rpm
_ Precise temperature control: + 2°C to 40°C ± 1°C
_ Digital LED Timer: 0-99 hours 59 minutes for Timed Runs
_ Rotors with handling capacities of 400 and 3000 ml

Applications :
Downstream processing of fermented medium and other bioactive compounds

Department/Location :
Main Building, Cellar

Lab Reactor

Model:
Reactor Ready; RS37 Digital Plus

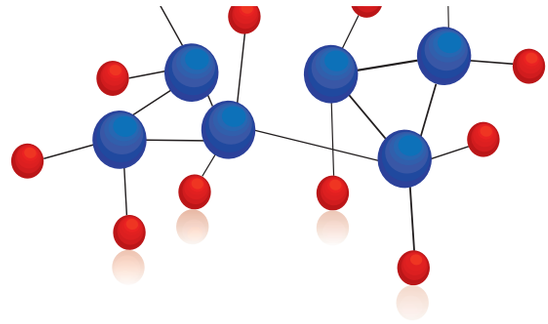
Operational Aspects:
- One liter reaction vessel is used for various bulk scale reactions.
- Connected temperature control unit provides an opportunity to perform reactions at various temperatures in the range of -60°C to +190°C. Hose manifolds allow easy thermo fluid to drain down.
- Self aligning stirrer gives smooth and hassle free operation of the instrument.
- Quick release hose coupling allows rapid exchange of vessels to perform next reaction without any delay.

Accuracy: Very Good

Additional Features:
Safe, Quick and convenient for scale-up purposes.

Application:
Scale-up reactions, batch preparation of starting materials for organic synthesis.

Department/Location:
Discovery Laboratory



Chemical Biology

Area of Expertise

- Design, Synthesis and development of gene-targeting small molecules that can recognize and bond to specific sequences of DNA with potential therapeutic application in the treatment of genetic disorders including cancers, and as probes and for use in molecular biology.
- Prodrugs for selective therapy of cancer
- Lipid –based delivery systems
- Role of RNAi in the formation of heterochromatin
- Diagnostic marker in neurodegeneration
- Development of microbial and chemoenzymatic

Facilities

Flow Cytometry Facility

Model:
MoFlo LEGACY
Operational aspects:
- Cell sorter & Cell Analyzer
- 3 laser (488nm Blue, 635nm Red, 405nm UV) and upto 9 colours detection
- FSC & SSC standard detectors
- Manual Sample station
- Flat Top beam shaping optics
- Cyclone plate sorter
- Dell Precision T3400 PC with XP and Summit 4.3 software.

Accuracy: 100%
Additional Features: •2way and 4 way sorting
- Manual Alignment of lasers

Application: •Cell Cycle Analysis using PI
- Annexin V FITC-PI for Apoptosis and necrosis
- Mitochondrial membrane potential measurements
- Measurement of GFP & RFP expressions
- Cells Counter & Cell size measurements
- Cell Sorting Experiments

Department Location:
Flow Cytometry Facility, Ground Floor,
Room No: G 012, Centre for Chemical Biology

Direct Detector Protein Quantification

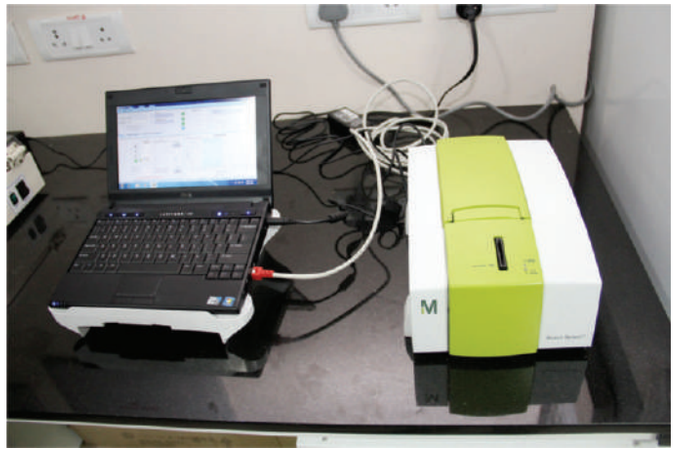
Model:
Biospectrum 810 Imaging System
Operational Aspects:
Just spot your sample, blank, and read! No sample prep, standard curves, messy cuvettes or liquid waste. By using the mid-IR spectrum, the Direct Detect system distinguishes proteins and peptides from interfering sample components, providing more accurate results without the pitfalls of colorimetric assays.

Accuracy: 100%

Additional Features:
- Independent of amino acid composition
- No extinction coefficient required, unlike UV-Vis/A280 methods
- Improves speed and accuracy over traditional colorimetric assays
- Works in the presence of detergents and reducing agents
- Compatible with lysates and membrane preps

Application: IR-based Protein Quantitation

Department Location: Wet Lab II, Ground Floor,
Room No: G013, Centre for Chemical Biology



Microscopy Facility

Dissection Microscope

Model:
Olympus Szx16

Operational Aspects:
1. 10 X objective lens is attached.
2. Rim white light is there.
3. 100W UV lamp.
4. Two fluorescence filters are available, 488nm and 405 nm filters.

Accuracy: 100%

Additional Features:
1. Merge the images by Pro-view software which is in built in the system.
2. ROI (region of interest) selection.
3. CROP the image.
4. Auto save option is there.
5. White balance can be done.

Application
1. To capture pseudo 3D images of Drosophila fly eye, larvae and pupae.
2. Screen the genotypes by using fluorescence filter.
3. Identify and screen the different stages of embryos.

Department Location:
Drosophila Fly Lab, Ground Floor, Room No: G008, Centre for Chemical Biology

Inverted Flourescence Microscope

Model:
IX2-ILL100

Operational Aspects:
1. 10 X, 20X, 40X Phase-contrast objective and one 20X DIC objective are attached.
2. 100W UV lamp is power source.
3. Three fluorescence filters are available, 543nm, 488nm and 405 nm filters.
4. Manual stage is present.

Accuracy: 99%

Additional Features:
1. Merge the images by Pro-view software which is in built in the system.
2. ROI (region of interest) selection.
3. CROP the image.
4. Auto save option is there. 5.DIC image can be captured. 6.We can rotate the image by software.
7. White balance can be done.

Application:
1. To capture pseudo 3D images of cells.
2. Localization study of any protein by using fluorescence 1° or 2° antibodies.
3. Screening of transfected cells by using fluorescence.

High Throughput Liquid Handling System

Model:
JANUS

Operational Aspects:
Automated Workstation offers multiple pipetting technologies on a single instrument platform with options to automate lab ware movement. The instrument consists of a modular platform that expands and combines the flexibility of a 4- or 8-tip Varispan arm with the speed of a 96- or 384-channel Modular Dispense Technology™ (MDT) dispense head. The JANUS provides an automated liquid handling solution that provides flexibility in throughput, plate capacity, and dynamic volume range

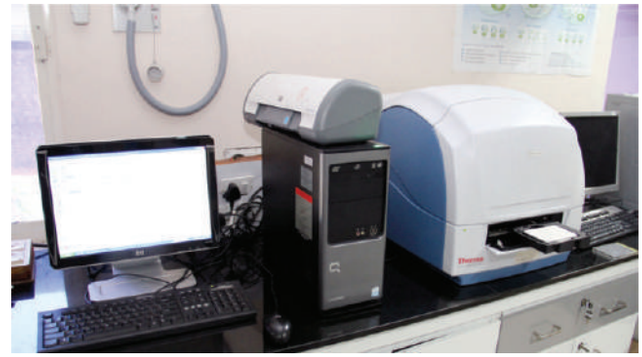
Accuracy: 100% (Tentative)

Additional Features:
- Computer-controlled Cartesian X-Y-Z robotic liquid handling platform with options to upgrade various pipetting and labware movement arms
- Carry-over elimination via a peristaltic pump for high volume/high throughput sample tip washing for carryover to less than 1:1,000,000 with appropriate washing or use of disposable tips for improved elimination of carry-over.
- Ability to automate plate movement and access off-deck plates without the need for an additional robotic arm.

Application:
- Molecular Biology and Genomics
- Drug Discovery
- Sample Preparation
- Toxicology
- Immunoassays
- Molecular Diagnostics
- Cellular Assays

Department Location:
HTS LAB, First Floor, Room No: F007, Centre for Chemical biology

Multimode Reader



Model:
Varioskan Flash

Operational Aspects: Varioskan Flash spectral scanning multimode reader includes fluorescence intensity, time-resolved fluorescence (TRF), photometric, and optional luminometric detection technologies. It is designed for optimization and analysis of various assays, such as binding assays, ADMETox, molecular biology assays, enzyme kinetic studies, ion-channel and cell signalling assays.

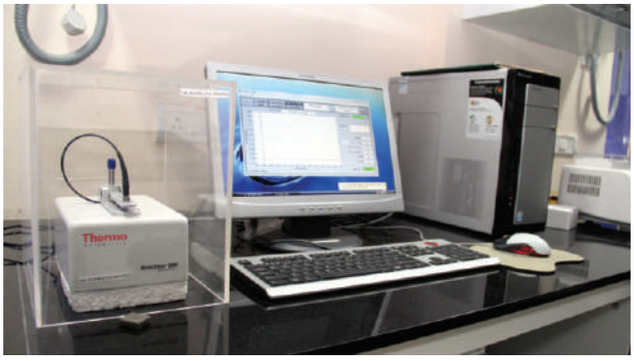
Accuracy: 100%

Additional Features:
- Unlimited wavelength selection for spectral analysis and measurement at any single wavelength—the optimal measurement wavelengths can be identified and easily selected for any assay at any time
- Extremely easy measurement setup with automated internal functions ensuring maximal sensitivity and full dynamic range for every assay
- Onboard dispensers for exact follow-up of kinetic reactions—essential for flash luminescence assays, Ca2+ flux studies and other rapid kinetic applications
- Increased assay throughput—reads up to 1536-well plates and can easily be integrated with automated systems
- High performance incubator for temperature critical assays
- Easy assay setup, flexible data handling and convenient report formatting with SkanIt Software

Application:
Apoptosis assays; Ca2+ flux assays; Cell proliferation; Cellular assays; Cytotoxicity and ADMETox; Direct DNA, RNA and protein quantitation; ELISA/FIA/TRF-ELISA assays; Enzyme kinetic studies; Europium assays; FRET assays; TR-FRET assays; BRET assays; GPCR assays; Ion channel assays; Kinase assays; Multilabel assays; Reporter gene assays; Signal transduction; Tryptophan and tyrosine UV fluorescence

Department Location: Wet Lab II, Ground Floor, Room no: G013, Centre for Chemical biology

Nanodrop Spectrophotometer



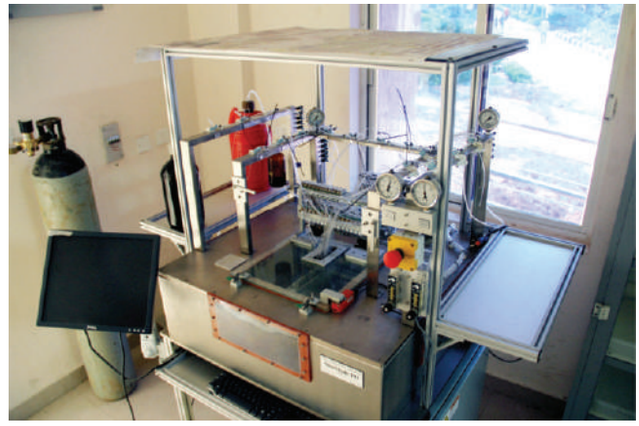
Model:
NANODROP 1000
Operational Aspects:
- The NanoDrop1000 is a full spectrum (220-750nm) spectrophotometer that provides scientists with a simple and robust instrument for quantification and evaluation of purity of samples, such as proteins and nucleic acids
- The technology is based on a patented sample retention system, which allows for the analysis of sample sizes as small as 0.5ul, without the need for awkward cuvettes or capillaries
- In addition, there is no need for sample dilution in most cases and the high absorbance capability of the instrument is reported to be 50 times that of traditional spectrophotometers.

Accuracy: 100%
Additional Features:
- The NanoDrop 1000 has several features that are unique and very useful to researchers. Besides using very small quantities of sample for measurement, the size of the instrument itself is attractive
- NanoDrop 1000 is an excellent instrument for measurement of nucleic acid concentrations.

Application:
- Suitable for measuring Nucleic acid concentration and purity of nucleic acid samples up to 3700 ng/ul (dsDNA) without dilution
- Fluorescent dye labeling density of nucleic acid microarray samples
- Purified protein analysis (A280) up to 100 mg/ml (BSA)
- Expanded spectrum measurement and quantization of fluorescent dye labeled proteins, conjugates, and metalloproteinase
- Bradford Assay analysis of protein
- BCA Assay analysis of protein and Lowry Assay analysis of protein

Department Location:
Wet lab-I, Ground Floor, Room No: G007 ,
Centre for Chemical Biology

Oligosynthesizer



Model:
MerMade 192

Operational Aspects:
Up to 192 oligos (two 96 well plates) in a single run
Ability to synthesize in a column or plate format
Flexible and easy to use software
Run Logging
10 Amidite Ports
Dedicated Thio reagent bottle
Dell PC w/Flat screen monitor
Cleavage Apparatus
Deprotection Apparatus

Accuracy: 95% (tentative)

Additional Features:
192, 20mer PCR primers can be synthesized in a very less time.

Application:
Synthesis of standard and custom oligos (DNA & RNA)

Department Location:
Oligosynthesizer Facility, Ground Floor,
Room No: G 001
Centre for Chemical Biology

Real Time Cell Analyzer

Model:
1X96 RTCA

Operational Aspects:
The RTCA Analyzer is an electronic analyzer that can, under the control of RTCA Software, measure electronic impedance of sensor electrodes at various signal frequencies. The RTCA Analyzer is capable of computer-controlled signal generation, processing and analysis, automatic frequency scanning and rapid measurement. The average measurement rate is approximately 15 seconds for a 96-well plate, or approximately 150 milliseconds for each well.

Accuracy: 100%

Additional Features:

- Output test signal: 22 mV rms ± 20% with max. 5 mV DC offset at 10, 25, and 50 kHz
- Impedance Measurement

Accuracy: ± (1.5% + 1 Ω)

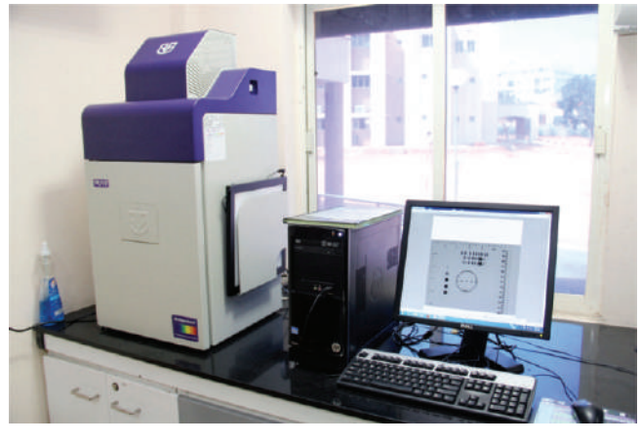
- Impedance Measurement Repeatability: 0.8%
- Impedance Dynamic Range: 10 Ω to 5 kΩ

APPLICATION:

- Real-time and Dynamic Monitoring of Cell Proliferation and Viability for Adherent Cells
- Dynamic Monitoring of Cell Adhesion and Spreading
- Dynamic Monitoring of G-protein Coupled Receptor Activation in Living Cells
- Dynamic Monitoring of Receptor Tyrosine Kinase Activation in Living Cells
- Label-Free Assay for NK Cell-mediated Cytolysis

Department Location:
Ground Floor, Room No: G009 (Cell Culture Facility)
Centre for Chemical Biology

UVP Biospectrum Gel Doc System



Model:
UVP BIOSPECTRUM 810 IMAGING SYSTEM

Operational Aspects:

- MegaCam 810 Camera, OptiChemi 610 Camera, BioChemi 510 Camera, GelCam 310 Camera
- Uniform LED white light plate and Light tight
- Wide access door with UV safety shutoff
- Gel viewing window and Chemi tray
- Sliding tray for transilluminator
- Epi white and UV illumination (365nn and 480nm)
- Emission Filters - five positions:
- SYBR Green 515-570nm, SYBR Gold 485-655nm, EtBr Red 570-640nm

Accuracy: 100%

Additional Features:

- Source: Directed epi or transillumination fiber optic source with filters for excitation of fluorescent multiplexed Western blots, DIGE 2D gels, PAGE gels, microplates and more.
- Transilluminators: Select from the First Light or Benchtop models
- Converter Plates: Visi-Blue Converter Plate and Longwave Converter Plate
- Gel-Tools: Gel-Sentry Step Tablet Gel-Cutter Gel-Ruler Gel-Scooper Gel-Trays

Application:
Chemiluminescence, Western Blot, Multiplex Fluorescent Western Blots, Plant Imaging, Fluorescence, Colorimetric, 2D Gels, GFP.

Department Location:
Wet Lab I, Ground Floor, Room No: G007
Centre for Chemical Biology

Real Time PCR

Model:
7900HT

Operational Aspects:

- 7900HT Fast Real-Time PCR System is the only real-time quantitative PCR system that combines 384-well plate compatibility with fully automated robotic loading—and offers optional Fast real-time PCR capability
- Give real time PCR results in both the standards 96 well format and 384 well format
- Hands- free plate loading and unloading
- The 7900HT system accommodates higher density plates without compromising speed, resolution, or robust performance
- The 7900HT system extends high-throughput performance beyond sample analysis by streamlining operation and making results easy to interpret
- To induce fluorescence, the 7900HT Fast Real-Time PCR System distributes light from an argon-ion laser excitation source to all sample wells.
- Continuous wavelength detection from 500-600 nm allows the use of multiple fluorophores in a single reaction

Accuracy: 100%

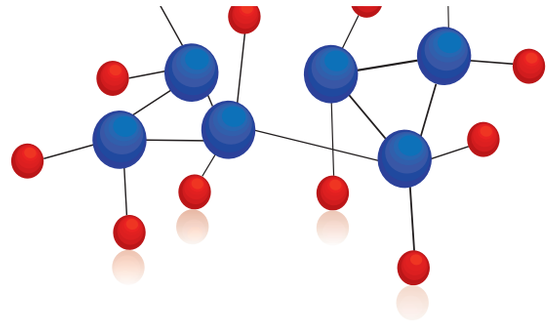
Additional Features:

- Peltier-based thermal cycling system with interchangeable block capability
- Extended-life 488 nm argon-ion laser excitation source
- Excitation light distributed to all wells via a dual-axis synchronous scanning head
- A custom ZymarkTwister® Robot with five plate-stacking positions provides automatic plate-loading capability
- Sequence Detection Software

Application:

- Gene Expression study
- SNP Genotyping
- Pathogen Detection
- Viral Load Analysis
- miRNA Quantitation

Department Location: Wet Lab II, Ground Floor, Room No: G013, Centre for Chemical Biology.



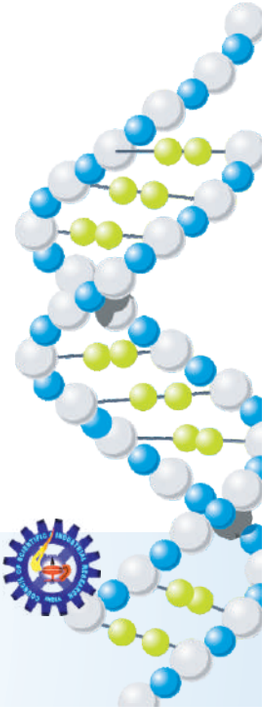
Biology

Area of Expertise

- Bio-Control & Bio-evaluation of new molecules and natural product extracts employing entomological, toxicological evaluation & profiling.
- Toxicological studies
- Standardization of alternate methods for toxicological studies
- Biomarkers as biological indicators of xenobiotic exposure.
- Development of alternate methods for pest control
- Studies on insect plant interactions for development of better & safer pest control.
- Information Technology for Rural Development and Integrated Vector Management.

Technologies Developed

- Information technology for Rural Management
- Information technology for Integrated Vector Management.



Facilities at IICT have been established to undertake regularly toxicological studies for screening of pesticides and generation of toxicity data as per Central Insecticide Board guidelines. The newly acquired facilities for undertaking oral, dermal and delayed toxicity including histopathological studies are adequately automated. The toxicity studies are also being carried out on new chemicai entities from marine sources for pesticidal or drug applications.

Facilities

Paraffin Embedder

Model :
Leica EG 1160, LEICA, Germany

Operational aspects :
Average temperature ranges 35-70°C (± 1°C increments)

- Paraffin reservoir 45° - 70°C ± 1°C increments
- Mold warmer 35° - 60°C + 1°C increments
- Cassette bath 45° - 70°C ± 1°C increments
- Work area 45°- 70°C ± 1°C increments
- Cold plate -5°C ; Forceps holder 70°C
- Paraffin dispenser + pump 45 - 70°C
- User Menu available in 5 languages
- All heated components include overheat protection

Special provisions :
Paraffin outlet flexible, either manual or via foot pedal.

The unit is operated and programmed via a menu driven control board

Applications :
Modern tissue embedding unit provided with special feature of rapid processing. Data generated helps sponsors for registration of product with Central Insecticide Board

Accuracy :
Rigid and very efficient paraffin embedding of tissues

Department/Location :
Biology Division /Toxicology

Slide Stainer

Model :
HMS 70, MIcrom GmbH, Germany

Operational aspects :
Temperature range 10 to 40°C
Current consumption 250 W
Slide carrier capacity 2 x 30 optionally
Slide carrier capacity 2 x 30 optionally

Special provisions :
Water pressure (min-max) 1....4 bar/1.... 2 bar
Trough capacity 600 cm3
Stains 70 slides at a time for Histopathological provision studies, 20 programmable device

Accuracy : ± 1%

Applications :
Bulk staining of slides for Histopathological studies

Department/Location :
Biology & Biotechnology Division/Toxicology

Tissue Processor

Model:
Leica TP 1020, GmbH Germany

Operational Aspects:
It is an automatic tissue processor used for fixation, dehydration and infiltration of histological tissue samples with fixatives, alcohol, solvents and paraffin wax. Memory capacity maximum 9 programmes
Working temperature range 5-40^{0}C

Relative humidity 80%
Programmable infiltration time per station – up to 99 Hrs 59 mins
Delayed start time of processing – up to 9 days

Applications:
Histopathological studies

Department/Location:
Biology & Biotechnology Division / Toxicology

Liquid Scintillation Counter

Model :
LS 6500, Beckman, Switzerland

Operational aspects :
- Ambient temperature range 15°C to 35°C Calibration must be performed within 5°C as operating temperature
- LS Calibration Standards are as per National Bureau of Standards whose efficiency for 3H : 60% in a wide open window 14C : 95% in a wide open window

Special provisions :
Automatic power up diagnostics with calibration and verification, Isotope library

Accuracy : ± 1% counting efficiency (Reproducibility)

Applications :
In vitro evaluation studies by use of radio Isotopes study of DNA damage and repair

Department/Location :
Biology Division/Evaluation Laboratory

Climatic Chamber

Model	:	CRE-D2R Nippon Medical & Chemical Instruments Co Ltd, Japan
Operational aspects	:	Temp, range 5-60°C ± 2°C Humidity 55-90 %
Special provisions	:	Compliance with GLP, designed to study accelerated storage stability
Accuracy	:	±2%
Applications	:	Biology / Biotechnology experiments
Department/Location	:	Biology Division/Toxicology

Autoclave Steriliser

Model :
MLS-3020-B-01,
Sanyo Electric Co LTD Japan

Operational aspects :
Temp. range 110°C-134°C
Time 1-9 mins.
Thermostat with manual reset

Special provisions :
Automatic electric autoclave for steam sterilization

Accuracy : -

Applications : For microbiological evaluation

Department/Location:
Biology Division/Toxicology

UV- VIS Spectrophotometer

Model :
S/N P02158, Molecular Devices - USA

Operational aspects :
- Wavelength range 190 - 900 nm
- Data collection rate 20 samples per second
- 96 samples can be scanned at a time
- Single & Multi-component analysis by full Spectrum quantification

Special provisions :
- Micro-computer operated by SOFT max (R) Pro(2.1.1) software
- Capable of running Biotrans s/w for biochemicalr analysis of DNA, proteins & enzymes

Accuracy : Wavelength accuracy + 0.2 nm

Applications :
Normal UV-VIS spectra! analysis of samples, in vitro entomological and toxicological evaluation biochemical studies, kinetic studies, enzymology & UV spectral analysis.

Department/Location :
Biology Division/In vitro Evaluation Laboratory

Ethovision (Video Microscope)

Model	:	KH-220B-01/C, CrescentInternational, Japan
Operational Aspects	:	High resolution, variable magnification zoom Function
Special Provisions	:	* Video microscope with camera attachment Probe with lens holding stand with 14" colour Monitor * Compact and extremely convenient unit for Behavioural studies
Accuracy	:	Precisely accurate readings

Toxicological Studies with Evaluation of Pesticides

Mortality is obviously not the only endpoint to consider and there is a growing interest in the development of behavioural markers to assess the sub-lethal affects of toxicant. Behaviour is considered a promising tool in ecotoxicology and is a sensitive measure of toxic stress for a wide range of environmental contamination. A setup

of computer-assisted electronics, videocamera tracking systems (Ethovision, Noldus, The Netherlands) has been introduced to strengthen the toxicological evaluations on target organisms by quantification of locomotor behaviour, with a high degree of precision in the exposed organisms.

Department/Location : Biology Division/Toxicology

Ultra Centrifuge

The Beckman Coulter Optima TLX Ultracentrifuge is a tabletop ultracentrifuge thatcan be used for many types of high-speed applications. Some of the features of the Optima TLX has include an easy to use control panel, a temperature control system, a self-purging vacuum system, a programmable memory that can store up to 10 different profiles and a versatile acceleration/deceleration program. In addition, because this instrument has a maximum speed of 120,000 rpm, it comes with many safety features.

Specifications : 120,000 rpm, 625,000 x g max

Air cooled drive,

single tube volume range 0.2-5.4 ml.

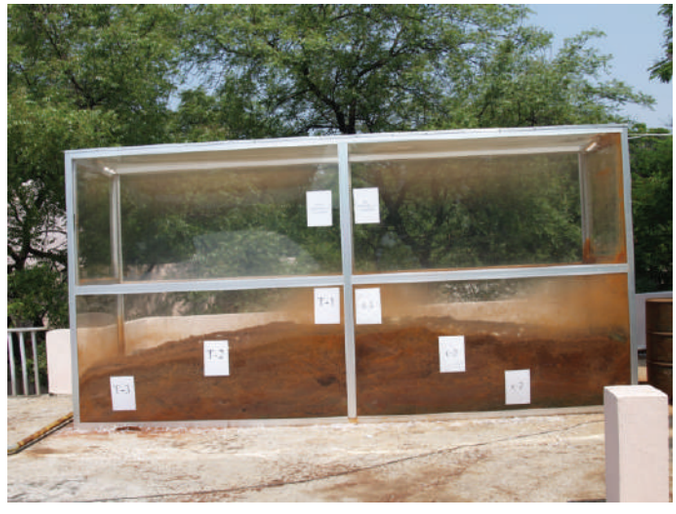
Solid state refrigeration, 2 to 40oC in 1 degree Increment; 10 user programmes,

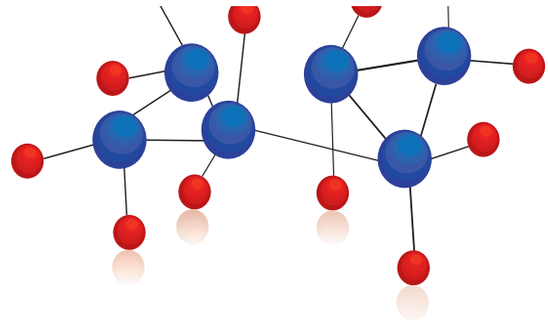
10 accel /10 decel profiles, etc.

Department/Location :

Biology Division / Toxicology

Antirodent Field Test Enclosure

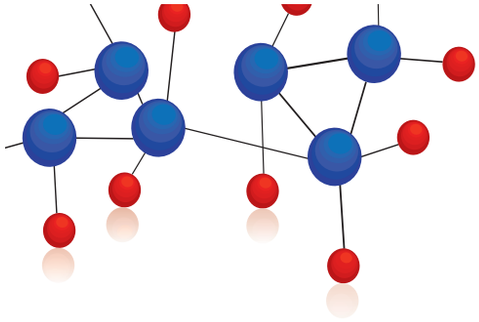




Centre for Lipids Research

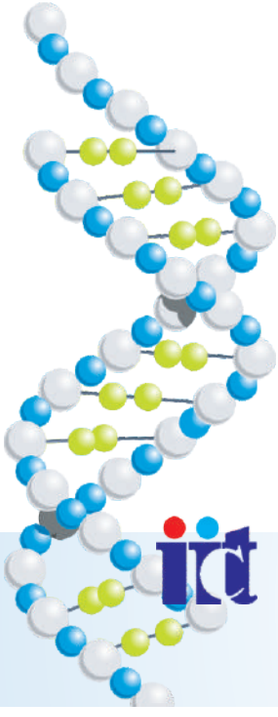
Area of Expertise

- Technology development for the processing of vegetable oils with a major thrust to enzymatic and membrane approaches.
- Newer methods for the extraction of oils without disturbing its natural integration.
- Process development for value added products from the by products of vegetable oil processing industry.
- Preparation of oleochemicals for surfactant, perfumery, lubricant and specialty applications.
- Glycerol-based Carbon acid and base catalysts for developing green process for the preparation of Oleochemicals including biodiesel.
- Development of newer fats like trans-free vanaspati, reduced calorie fats, diacylglycerol and structured fats with designed fatty acid composition.
- Preparation of nutraceuticals (food grade lecithin, novel phospholipids, glycolipids, oryzanol, tocopherols, polycosanol, phytosterols, stanol esters, GLA, CLA, etc.) of vegetable oil origin.
- Screening of lesser known and unknown vegetable oils for edible and industrial applications.



Technologies Developed

- Enzymatic Degumming of Rice Bran Oil
- Biodiesel Process from Non-edible Oils
- Upgraded Rice Bran Wax
- Hydrogenated Rice Bran Wax
- Triacontanol / Octacosanol (Polycosanol) from Sugarcane and Rice Bran Waxes
- Food Grade Lecithin from Soybean Oil Gums
- Tocopherols and Phytosterols from Soybean, Sunflower, Deodorizer Distillates
- Dehydrated and Hydrogenated Castor oil
- Undecenoic Acid / Heptaldehyde from Castor Oil
- 11-Bromo and 11-Amino Undecanoic acid
- Sodium Stearoyl Lactylate
- Reduced Calorie Fats
- Diacylglycerol
- Eripupal Oil
- Emu Oil
- Synthetic Oryzanol
- Cetyl Myristoleate
- Protein-based Surfactants and Bioactive Components from Karanja Cake
- Castor, Jatropha, Sal and Karanja Oil-based Biolubricants
- Sal Fat-based Biocandles
- Carbon Acid / Base Catalyst for Esterification and Transesterification



Facilities

Gas Chromatograph

Make:
AgilentTechnologies, USA

Model : 6890N

Operational Aspects:
Software (Windows XP) based data processor. Built in flow /Pressure /Temperature Programmer for Capillary Column

Special Provisions:
FID and μ-ECD Detectors

Accuracy: ±0.1 %

Applications:
Analysis of Lipids and their Derivatives

Department / Location:
Centre for Lipid Research

Gas Chromatograph with Head Space Analyser

Make:
AgilentTechnologies, USA

Model :
7890A with Headspace (G1888)

Operational Aspects:
Software (Windows XP) based data processor. Built in flow /Pressure /Temperature Programmer for Capillary Column

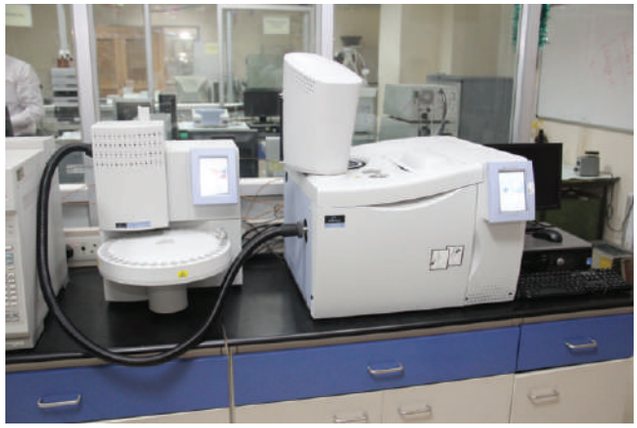
Special Provisions:
FID and NPD Detectors, Split/ Splitless and Cool on Column Inlets

Accuracy: ±0.1 %

Applications:
Analysis of Lipids and their Derivatives, including Biodiesel

Department / Location :
Centre for Lipid Research

Gas Chromatograph with Head Space Analyser



Make:
PerkinElmer, Inc. USA

Model:
Clarus 500 with Headspace (TurboMatrix40)

Operational Aspects:
Dual column GC with head space analyser

Special Provisions:
TwoFID Detectors, Split/ Splitless and Cool on Column Inlets

Accuracy: ±0.1 %

Applications:
Analysis of Lipids and their Derivatives, including Biodiesel

Department / Location :
Centre for Lipid Research

GC - MS

Make:
AgilentTechnologies, USA

Model:
GC 6890 Coupled with 5973N MSD

Operational Aspects :
Software (Windows 2000) based data processor. Built in flow /Pressure/Temperature Programmer for Capillary Column,EI Source

Accuracy: ±0.1 %

Applications:
Analysis of Lipids and their Derivatives

Department / Location :
Centre for Lipid Research

GC-MS-MS

Make:
Agilent Technologies, USA

Model:
GC 7890 Coupled with 7000B Quadruple

Operational Aspects:
Built in flow /Pressure /Temperatureprogrammer for Capillary Column. Multi reaction monitoring scan, precursor ion scan, neutral loss -neutral gain scan modes.

Special Provisions:
Triple Quadruplewith EI and CI Sources

Accuracy: ±0.1 %
(LOD 1ppb and LOQ 10ppb in matrix)

Applications:
Trace level analysis of Pesticides, Lipids and their Derivatives

Department / Location:
Centre for Lipid Research

Semi Preparative HPLC

Make:
Waters Corporation, USA

Operational Aspects:
Binary Pump (1.00 – 50mL/min)

Special Provisions:
HPLC coupled with ELSD (Model: 2424),
UV-Visible (Model: 2489)
Detector and Fraction Collector.

Applications:
Analysisof Lipids and their Derivatives

Department / Location :
Centre for Lipid Research

LC-MS-MS

Make:
Waters Corporation, USA

Model: Waters e2695

Operational Aspects:
Binary Pump (0.1 – 9.99 mL/min), High Pressure System.

Special Provisions:
Electro Spray Ionization and
ESCI mode (ESI and APCI) Enabled.

Accuracy: ±0.01 %

Applications:
Qualitative and Quantitative Analysis of Pesticides, Lipids and their Derivatives

Department / Location:
Centre for Lipid Research

Flash Chromatograph

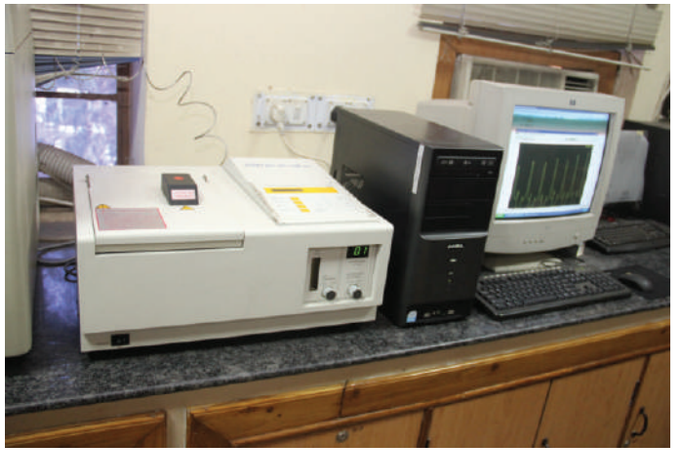
Make:
Teledyne Isco, USA

Model :
Companion XL

Applications:
Chromatographic Separation of Organic Compounds

Department / Location :
Centre for Lipid Research

TLC-FID



Make:
Mitsubishi Kagaku Inc. Japan

Model : Iatroscan MK-6s

Operational Aspects :
Separation of mixtures on Chromo rods and Scanning under FID

Applications:
Qualitative and Quantitative Analysis of Lipids and their Derivatives

Department / Location :
Centre for Lipid Research

Fluorescence Spectrophotometer

Make:
VarianInc, USA

Model :
Cary Eclipse

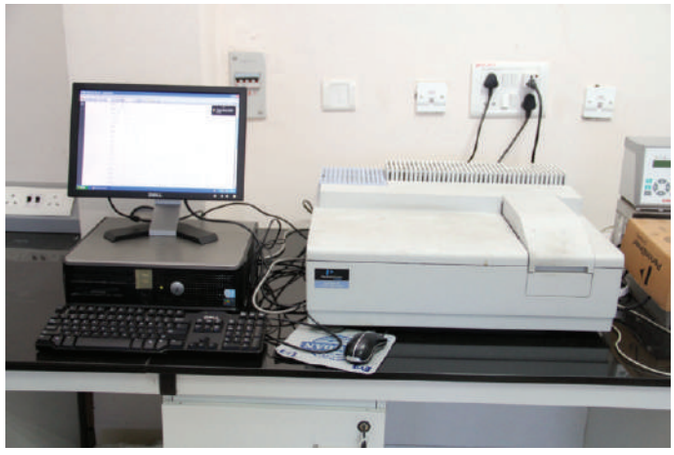
Operational Aspects :
UV-Visible range. Temperature limits -30°C to 60°C

Accuracy: 0.01%

Applications:
Emission, Excitation, and Transmittance Studies

Department / Location :
Centre for Lipid Research

UV-Visible Spectrophotometer



Make:
Perkin Elmer Inc., USA

Model :
Lambda 35

Accuracy: 0.01%

Applications:
Spectral studies of Lipids and their Derivatives

Department / Location:
Centre for Lipid Research

Lovibond Tintometer

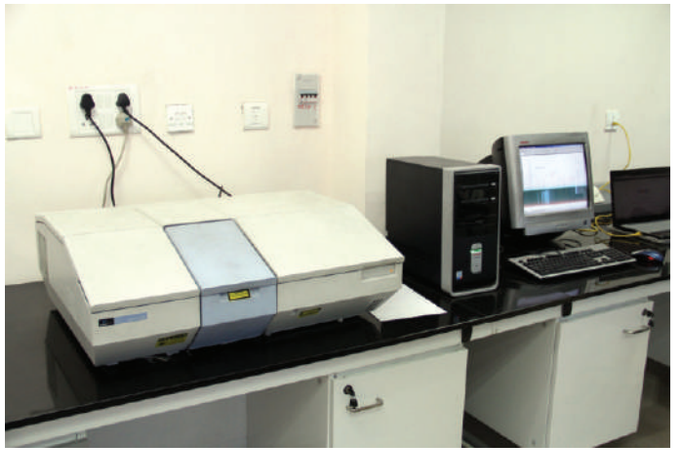
Make:
The Tintometer Limited,UK

Model : PFX 995

Applications:
Measurementof Color of Oils

Department / Location :
Centre for Lipid Research

FT-IR Spectrophotometer



Make:
Perkin Elmer Inc., USA

Model :
Spectrum BX

Operational Aspects:
Liquid and Solid Samples

Applications:
Spectral studies of Lipids and their Derivatives

Department / Location:
Centre for Lipid Research

NIR Product Analyser

Make:
Dickey – JohnCorp. USA

Model:
Instalab 600

Applications:
Oil Content in Different type of Seeds

Department / Location:
Centre for Lipid Research

Refractometer

Make:
Bellingham Stanley Ltd, UK

Model :
RFM 870 BS

Operational Aspects:
Determination at Different Temperatures

Accuracy: 0.01%

Applications:
Refractive Index of Oils and Fats

Department / Location:
Centre for Lipid Research

IR Concentrator

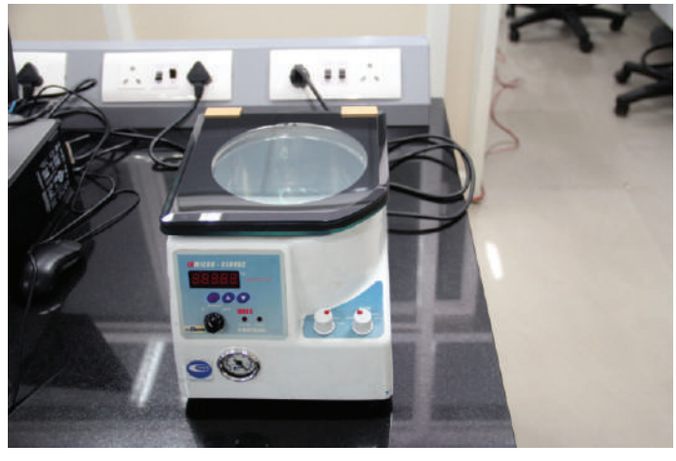
Model:
ACO-7

Manufacturer:
Tanaka Scientific Ltd, Japan
Operational as per: flash point of lubricants

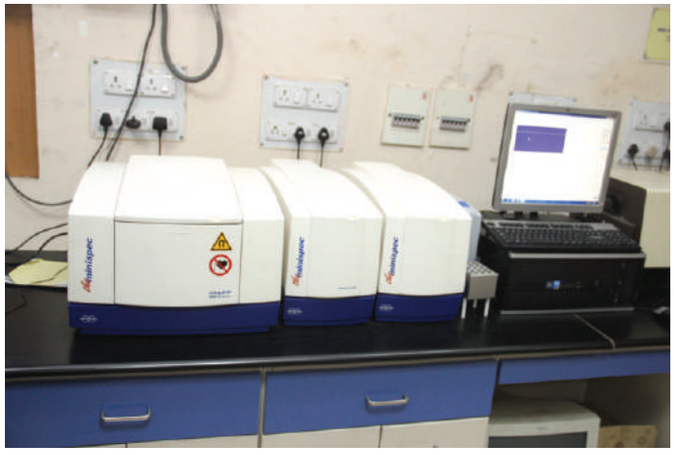
Accuracy:
As per ASTM D92-98a

Application:
Evaluation of lubricants

Department / Location:
Centre for Lipid Research



Pulsed NMR Analyser



Make:
Bruker Corp. USA

Model: mq 20

Operational Aspects:
At Different Temperatures

Applications:
Determination Solid Fat Content and Particle size in Emulsion

Department / Location:
Centre for Lipid Research

Density Meter

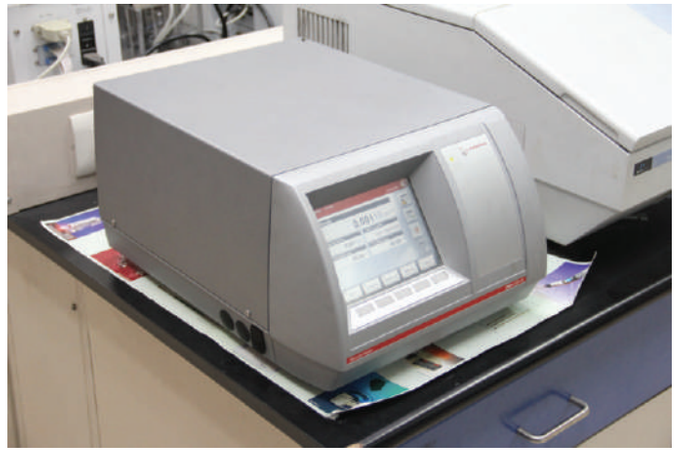
Make:
Anton PaarGmbH, Austria

Model :
DMA 4500M

Operational Aspects:
Determination at Different Temperatures

Applications:
Measurement of Density and Specific Gravity

Department / Location:
Centre for Lipid Research



Flash Point Apparatus (Pensky-Martens)

Make:
PACLP, USA

Model :
ISL-FP935G2

Operational Aspects:
Close cup

Applications:
Determination of Flash Point

Department / Location:
Centre for Lipid Research

Rancimat

Make:
Metrohm Ltd, Switzerland

Model :
743 Rancimat

Applications:
Determination of Oxidative Stability of Vegetable Oils and Biodiesel

Department / Location:
Centre for Lipid Research

Rheometer

Make:
Bohlin Instruments, Spectris plc, UK

Model : C-VOR

Applications:
Determination of Viscoelastic Properties

Department / Location:
Centre for Lipid Research

Karl Fischer Auto Titrator

Make:
Metrohm AG, Switzerland

Model :
702 SM Titrino

Accuracy: 0.01ppm

Applications:
Moisture Content and Total Acid Number

Department / Location:
Centre for Lipid Research

Tensiometer

Make:
KrussGmbH, Germany

Model : K100

Applications:
CMC, Surface Tension and Interfacial Tension

Department / Location:
Centre for Lipid Research

HP - TLC

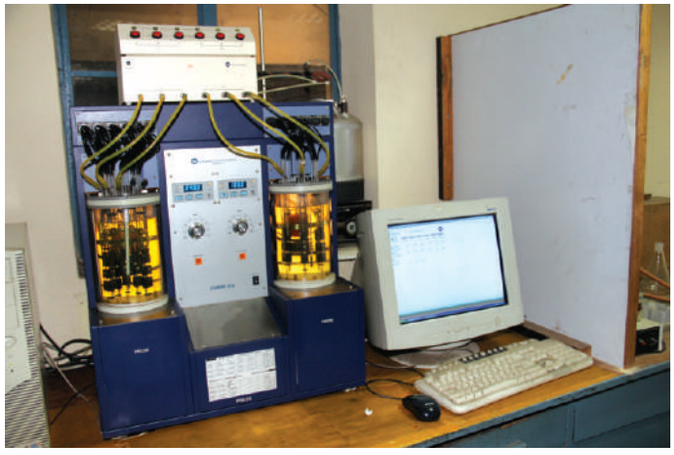
Make:
Camag Chemie-Erzeugnisse & Adsorptionstechnik AG, Switzerland

Model :
TLC Scanner 3

Applications :
Qualitative and Quantitative Chromatographic Analysis of Lipids and their Derivatives

Department / Location:
Centre for Lipid Research

Kinematic Auto Viscometer



Make :
Stanhope-seta Ltd., UK

Model:
83545-2 SETAVIS "Double 6 "with Auto clean Module

Operational Aspects:
Viscosity of lubricants at 40°C and 100°C
Viscosity Range 15-2000 cSt at 40°C
Viscosity Range 2.5-60 cSt at 100°C

Application :
Viscosity Determination of Oils, Biodiesel, Lubricants etc.

Accuracy:
As per ASTM D445 specifications

Department / Location:
Centre for Lipid Research

Low Temperature Viscometer

Make :
Koehler Instrument Company Inc.,USA

Model: K22752

Operational aspect:
Determination of Kinematic Viscosity of Lubricants at minus 40°C

Accuracy: As per ASTM D2532specifications

Application:
Viscosity determination of Oils, Biodiesel, Lubricants etc.

Department / Location:
Centre for Lipid Research

Kinematic Viscometer

Make :
Cannon InstrumentCompany,USA

Model :
CT-500 F

Operation Aspects :
Temperature range 20 to 100°C

Accuracy :
As per ASTM D 445 specifications

Application :
Viscosity Determination of Oils, Biodiesel, Lubricants etc.

Department / Location:
Centre for Lipid Research

Twin Foam Test Apparatus

Make:
Koehler Instrument Company Inc, USA

Model :
K43092

Accuracy:
As per ASTM D892 specifications

Application:
Determination of Foaming Characteristics of LubricatingOils

Department / Location:
Centre for Lipid Research

AutomaticFlash Point Tester (OpenCup)

Make :
Tanaka Scientific Ltd., Japan

Model: ACO-7

Operational aspect:
Flash Point of Lubricants

Accuracy:
As per ASTM D92 specifications

Application:
Determination of Flash Point of Oils and Lubricants

Department / Location:
Centre for Lipid Research

Apparatus for Determination of Evaporation Loss of Lubricating Greases

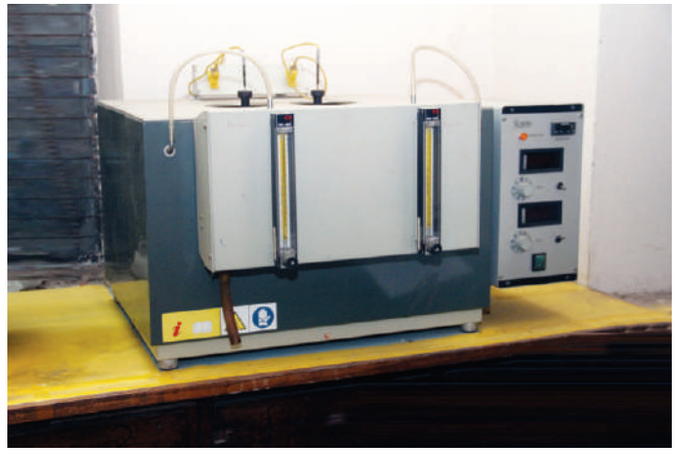
Make:
Dott. Gianni Scavini &Co., Italy

Operational aspect:
Determination of evaporation loss up to a temperature of 300°C

Accuracy:
As per ASTM D2595 specifications

Application:
Determination of Loss of Volatile Materials from Greases

Department / Location:
Centre for Lipid Research



Automatic Pour Point Tester

Make:
Dott. Gianni Scavini &Co., Italy
ott. Gianni Scavini &Co., Italy

Operational aspect:
Determination of pour point up to minus 60°C

Accuracy:
As per ASTM D97 specifications

Application:
Evaluation of Lubricants

Department / Location:
Centre for Lipid Research

Inductively Coupled Plasma - Optical Emission Spectroscope (ICP-OES)

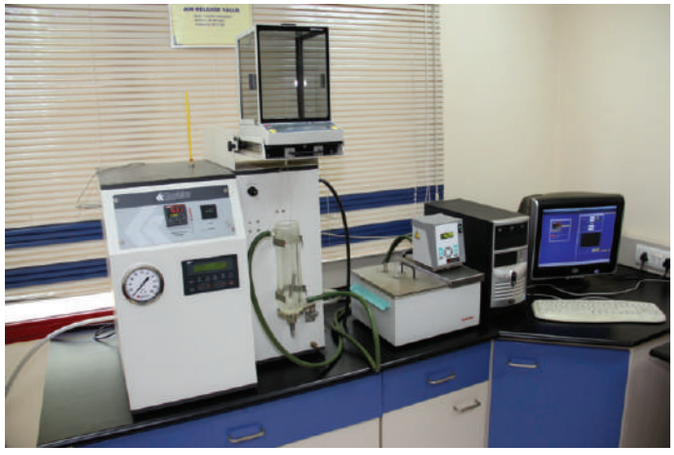
Make :
VarianInc., USA

Model :
725ES

Application:
Estimation of Elements in Aqueous Solutions,Vegetable Oil and Biodiesel

Department / Location:
Centre for Lipid Research

Apparatus for Air Release Value



Make :
Koehler Instrument Company Inc.,USA

Model :
SGL4, K88501

Operation Aspects :
Ambient to 75°C

Accuracy :
As per ASTM D 3427 specifications

Application:
Determination of Air Release Properties of Lubricants

Department / Location :
Centre for Lipid Research

Copper Strip Corrosions Bath

Make:
Koehler Instrument Company Inc., USA

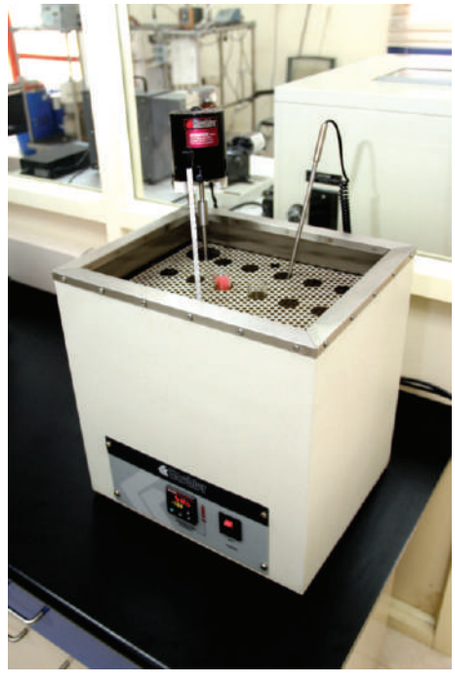
Model: K25393

Operation Aspects:
Temperature ranging from Ambient to 100°C

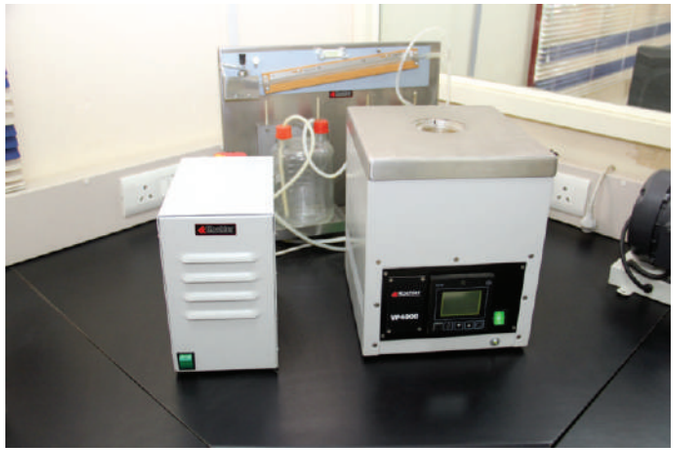
Accuracy:
As per ASTM D3427 specifications

Application:
Detection of Copper Corrosion of Petroleum Products andLubricants

Department / Location:
Centre for Lipid Research



Apparatus for Noack Evaporation Loss Tester



Make :
Koehler Instrument Company Inc., USA

Model : K44091

Operation Aspects:
Ambient to 250°C

Accuracy:
As per ASTM D5800 specifications

Application:
Determination of theEvaporation Loss of LubricatingOil

Department / Location:
Centre for Lipid Research

Apparatus for Oxidative Stability(RotatingBomb Oxidation Tester)

Make:
Koehler Instrument Company Inc., USA

Model : K70290

Operation Aspects:
Temperature Ranging from Ambient up to 200°C

Accuracy:
As per ASTM D 2272

Application :
Determination of Oxidation Stability of LubricatingOil by Rotating Bomb

Department / Location :
Centre for Lipid Research

Apparatus for Rust Prevention Characteristics

Model :
K30165

Make :
Koehler Instrument Company Inc., USA

Operation Aspects :
At temperature 60°C

Accuracy :
As per ASTM D 665specification

Application :
Determination of Ability of Lubricants toPrevent the Rusting of Metal Surfaces

Department / Location :
Centre for Lipid Research

Apparatus for Determination of Hydrolytic Stability

Make :
Dott. Gianni Scavini& Co., Italy

Model :
K 080752

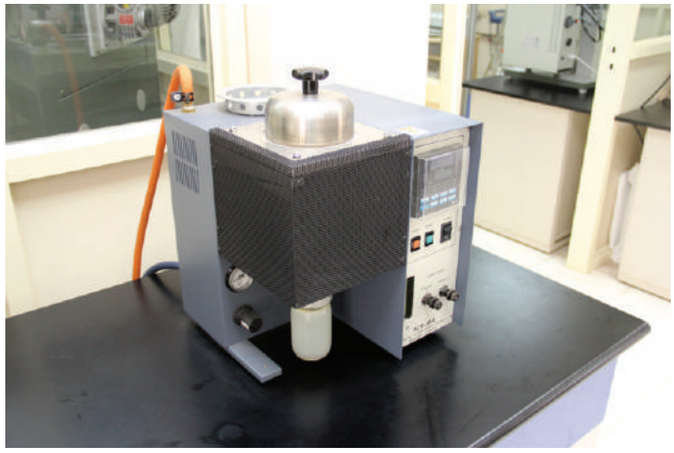
Operation Aspects :
At temperature 93°C

Accuracy :
As per ASTM D2619 specification

Application :
Determination of Hydrolytic Stability of Lubricating Oils

Department / Location :
Centre for Lipid Research

Apparatus for Micro Carbon Residue



Make :
Tanaka Scientific Ltd., Japan

Model :
ACR-M3

Operation Aspects :
At 500°Ctemperature

Accuracy :
As per ASTM D4530specification

Application :
Determination of Amount of Carbon Residue Formed after Evaporation and Pyrolysis of Lubricating Oils and Biodiesel

Department / Location:
Centre for Lipid Research

Apparatus forDemulsiblity Characteristics of Lubricating Oils

Make :
Koehler Instrument Company Inc., USA

Model : k 39199

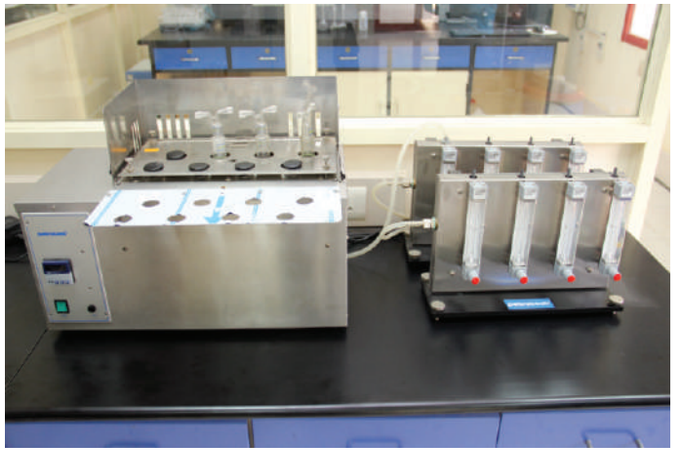
Operation Aspects :
At temperature 82°C

Accuracy :
As per ASTM D2711specifications

Application :
Determination of Demulsibility Characteristics of Lubricating Oils

Department / Location:
Centre for Lipid Research

Apparatus for Determination of Oxidation Stability of Lubricating Oil



Make :
Petrotest GmbH, Germany

Operation Aspects :
At temperature 200°C

Accuracy :
As per IP 48 specifications

Application:
Determination of Tendency of Lubricating Oil to Deteriorate on Oxidation under Specified Condition

Department / Location :
Centre for Lipid Research

Apparatus for Emulsion Characteristics

Make :
Dott. Gianni Scavini&Co., Italy

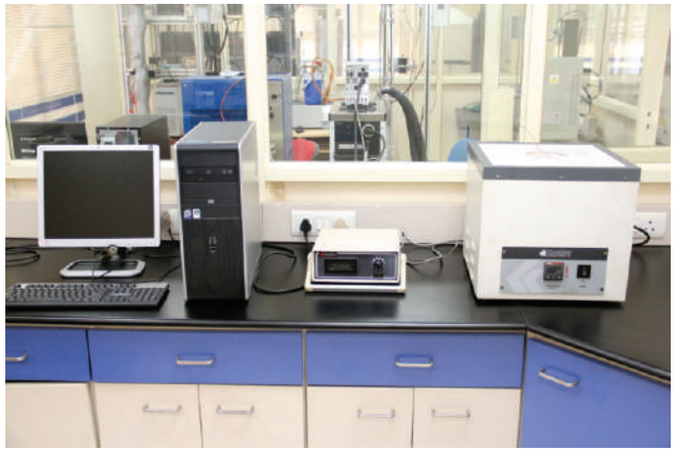
Operation Aspects :
At temperature 53°C

Accuracy :
As per ASTM D1401specifications

Application:
Measurement of Ability of Lubricating Oil to Separate from Water

Department / Location :
Centre for Lipid Research

Apparatus for Determination of Rams Bottom Carbon Residue



Make :
Koehler Instrument Company Inc., USA

Model : k 27190

Operation Aspects :
Ambient temperature to 550°C

Accuracy :
As per ASTM D524 specifications

Application :
Determination of Amount of Carbon Residue Formed after Evaporation and Pyrolysis of Lubricants and Biodiesel

Department / Location :
Centre for Lipid Research

Apparatus for Determination of Auto Ignition Temperature

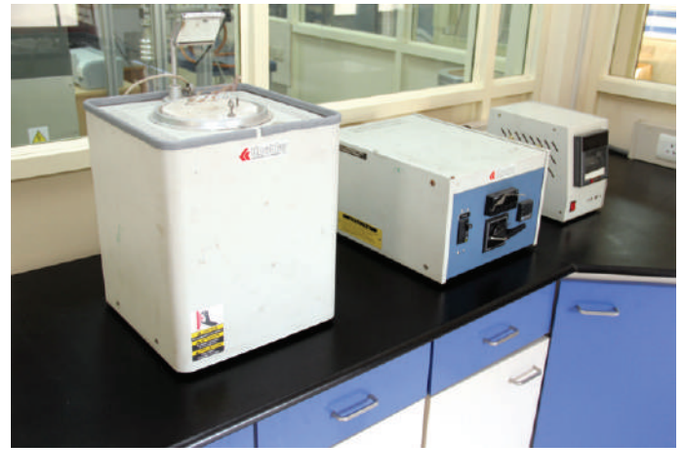
Make :
Koehler Instrument Company Inc., USA

Model : K47000

Accuracy :
As per ASTM E659 specifications

Application :
Determination of Auto Ignition Temperature of Lubricating Oilsin Air at Atmospheric Pressure in a Uniformly Heated Vessel

Department / Location :
Centre for Lipid Research



Apparatus for Determination of Evaporation Loss of Lubricating Oils

Make :
Koehler Instrument Company Inc., USA

Operational Aspects :
Determination of Evaporation Loss of Lubricating Oils as per ASTM D972 specifications

Accuracy :
As per ASTM D972

Application :
Determination of Evaporation Loss of Lubricating Oils

Department / Location :
Centre for Lipid Research

Corrosiveness and Oxidation Stability Apparatus

Make :
Dott. Gianni Scavini &Co, Italy

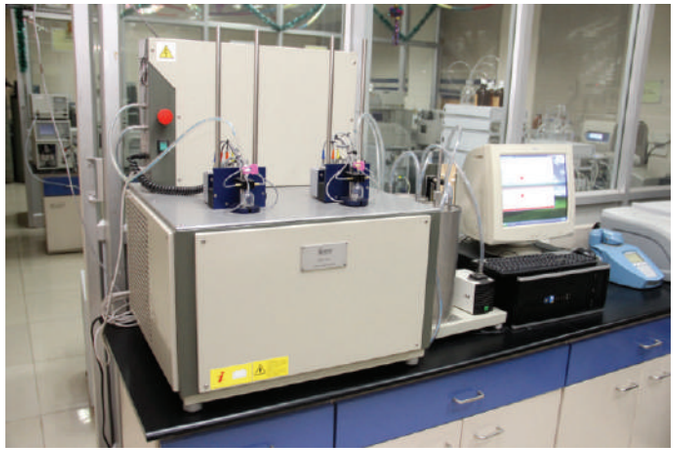
Operational Aspects :
As per FTMS 791C - 5308.7

Application :
Testing of Lubricant Oils to Determine their Ability to Resist Oxidation and their Tendency to Corrode Various Metals

Accuracy:
As per FTMS 791C - 5308.7 specifications

Department / Location:
Centre for Lipid Research

Automatic Cold Filter Plugging Point Apparatus



Make :
Dott Giani Scavini &Co., Italy

Model :
CFPP-CFDD/D

Accuracy :
As per EN116-IP309specifications

Application:
Determination of the Low Temperature Operability of Biodiesel

Department / Location :
Centre for Lipid Research

4 Ball Testers

Make :
Stanhope setaLtd, UK

Model :
19800-6-T

Operation Aspects :
At ambient temperature to 100°C

Accuracy :
As per ASTM D 4172/ I P 139 specifications

Application :
Determination of Load Carrying Capacity of Lubricating Oils

Department / Location :
Centre for Lipid Research

Timken Tester

Make :
Falex Corporation, USA

Model : Falex

Applications :
Determination of Load Carrying Capacity of Extreme Pressure Lubricants

Accuracy :
As per ASTM D2509 and D2782 specifications

Department / Location :
Centre for Lipid Research

Differential Scanning Calorie Meter (DSC)

Make :
Perkin Elmer Inc., USA

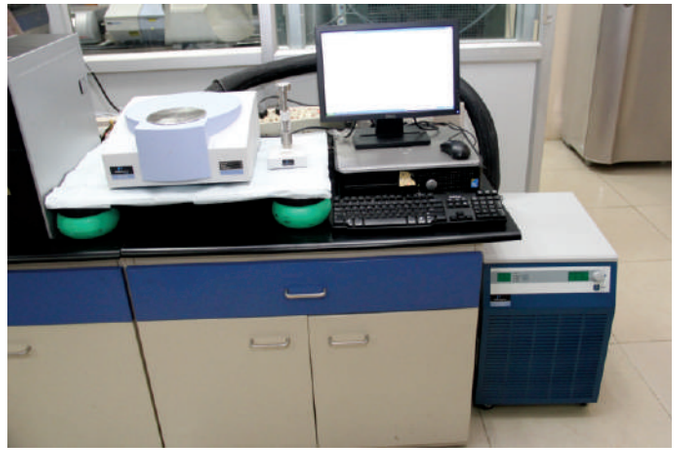
Model: DSC 6000

Operational Aspects :
Temperature Limits (-80°C to250°C)

Accuracy : ±0.1 %

Applications :
Determination of Thermal Stability of Lipids and their Derivatives

Department / Location :
Centre for Lipid Research



Pilot Scale Membrane Separation Unit

Supplier :
Nishotech Systems Pvt. Ltd, India

Model :
50 litres and 100 litres

Operational Aspects :
Pressure up to 80Bar, membrane filtration area 2 square metres, solvent resistant ultra-filtration membrane

Applications :
Vegetable Oil Degumming, Waste Water Treatment

Department / Location :
Centre for Lipid Research (Fatty acid Plant)

High Efficiency Distillation System

Make :
B/R Instruments Corporation,USA

Model :
24/100A, 36/100A

Operational aspect :
Spinning Band fractionating column, 50 to 5000 ml boiler capacities, up to 200 theoretical plate distillation column (maximum at atmospheric pressure), 1-100 mm Hg vacuum distillation

Accuracy :
Close Boiling Point Material Separation

Application :
Distillation/ Vacuum Distillation

Department / Location :
Centre for Lipid Research

Short Path Distillation Unit

Make :
UIC GmbH, Germany

Model : Kd6

Operational aspect :
Short path distillation of high molecular weight materials under high vacuum

Application :
Separation and Purification of Monoglycerides, Diglycerides, Fatty Acids, Tocopherols, Tocotrienols, Lubricants etc.

Department / Location :
Centre for Lipid Research

Supercritical Carbon-di-oxide Extraction Pilot Plant

Make :
Thar Process Inc., USA

Model :
Pilot Plant 12 litres capacity

Operational Aspects :
Pressure upto 600 Bar, Temperature 90°C (max.), Option for co-solvent

Applications :
Vegetable Oil Extraction,
Natural Product Extraction

Department / Location :
Centre for Lipid Research /Pilot Plant-2

Hydrogenation Reactor

Make :
Thales Nano, NanotechnologyInc., Hungary

Model :
H-Cube Midi

Operational Aspects:
Temperature 0°C to 150°C,
Pressure 0 to 100 bar and
Flow 3 to 25 mL/min

Applications:
Hydrogenation of Organic Compounds

Department / Location:
Centre for Lipid Research

Microwave Accelerated Reaction System for Synthesis

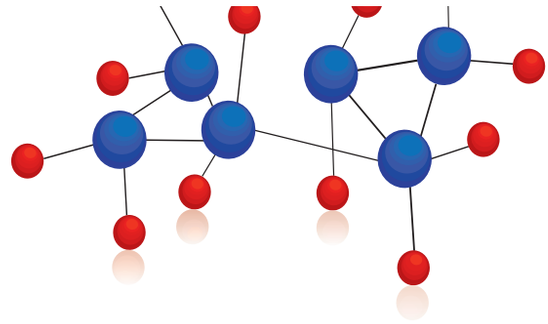
Make:
CEM Corporation,USA

Model : Mars 5

Operational Aspects:
Output of 0 – 1200 Watts ±15 % of Microwave energy
Temperature range 0 - 330°C
Fluoropolymer – Coated Microwave Cavity
Micro Computer to Control and Monitor the operations

Special Provisions:
Turntable rotates when Microwave power is on
Rapid heating of samples to digest or dissolve
Applications: Digesting, Dissolving Hydrolyzing or Drying a Wide Range of Materials. Rapid Preparation of Samples for Analysis. Reaction under Pressure and Open Conditions with Stirring.

Department / Location :
Centre for Lipid Research



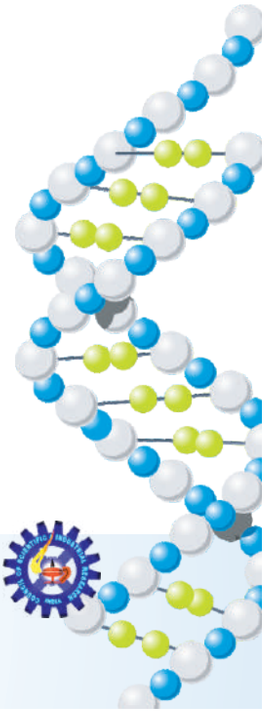
Inorganic and Physical Chemistry

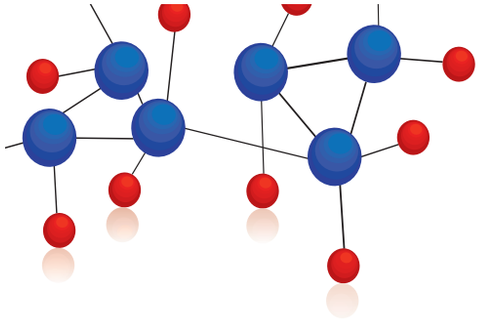
Area of Expertise

- Catalysis and catalyst development
- Green technologies for bulk organics and drugs
- Advanced materials for strategic and commercial applications
- Molecular and homogenous catalysis
- Base catalysis
- Supra molecules
- Enzyme mimics
- Molecular imprinting / recognition
- Catalyst structure activity
- Nano systems
- Design and synthesis of smart materials
- Ceramic composites
- Photo chemistry for materials
- Catalysis for petrochemicals and organic intermediates
- Zeolite based catalysts for organics
- Catalysis for energy / waste management
- Adsorbents for CO_2 capture.
- Catalysts for development for CO_2 utilization
- Catalysts for biomass conversion

Technologies Developed

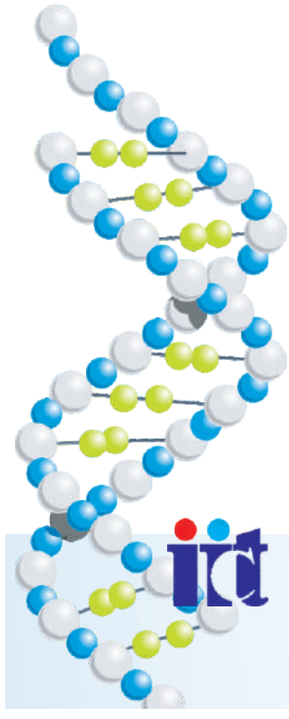
- 4-Acetyl-6-Methoxy Naphthalene
- Benzophenone
- Cathode material for Lithium ion cell.





- Paradioxanone from Diethylene glycol.
- Catalyst for conversion of waste plastic into oil.
- Green process for preparation of ammonium dinitramide (ADN).
- Activated Carbon
- Anhydrous Calcium Sulphate
- X-Ray Grade Barium Sulphate
- Beneficiation of off colored barites
- Hydrazine Sulphate
- Hydrazine Hydrate (Urea route)
- Barium /Potassium/ Sodium Chromate
- Potassium Permangenate
- Wettable Sulphur
- Activated Bleaching Earths
- Sodium Azide
- Catalysts developed for :

a) Pyrazinamide
b) Tetrabromobisphenol
c) Dimethyl Ether
d) P-Methoxyphenylacetic acid
e) Methyl mercaptan to p-methane sulfonic acid
f) Furfural
g) Ammonium dinitramide
h) Triphenylphosphine
i) Nitrotoluenes
j) Dioxanone
k) Malononitrile
l) Vinyl chloride monomer



Facilities

Insitu FT - Infrared Spectrometer

Model	:	FT-IR Digital Excalibur 3000
Operational aspects	:	Scanning background, scanning sample, baseline corrections, recording, etc.
Special provisions	:	Library search, smoothing, peak pick plots, etc. Win IR PRO software DTGS MCT detectors, Diffuse reflectance accessory, environmental chamber
Accuracy	:	Resolution 0.1 cm-1 (maximum)
Applications	:	Analysis of organic and inorganic chemicals, polymers, biological samples, in-situ adsorption studies
Department/Location	:	I & P C Division / Catalysis Laboratory

Fourier Transformed Infrared Spectrometer (FT-IR)

Model/Type :
Perkin-Elmer, Spectrum –GX,
FT-IR equipped with DTGS detector

Special Provisions :
In-situ Harrick chamber (DRIFTS accessories)

Operational Aspects :
Resolution: 2 cm-1,
Scanning range: 400-4000 cm-1

Applications :
To identify the functional groups in organic, inorganic and polymer compounds Surface acidity-basicity studies of solid catalysts In-situ reaction studies over catalysts

Department/Location :
I & P C Division / Catalysis Laboratory

Powder X-ray Diffractometer

Model/Type :
RIGAKU MINIFLEX, JAPAN

Special Provisions :
Equipped with an auto sampler

Operational Aspects :
X-ray tube: Ni filtered Cu target, output, voltage 30 kV, output current: 15 mA, 2Ø scanning range: 2o to 150o

Applications :
Analysis of solid samples Identification of phases and impurities present

Department/Location :
I & P C Division / Catalysis Laboratory

KRATOS ESCA

Model :
KRATOS ESCA model AXIS 165

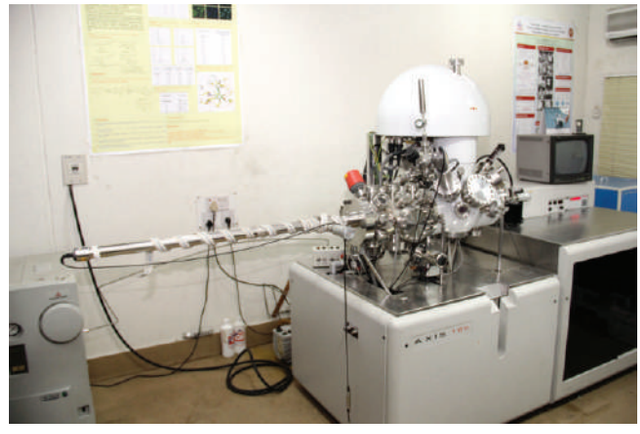
Operational Aspects :
When X-rays strike solid, electrons are ejected. From the measured energy of the ejected photoelectrons, it's Binding Energy can be calculated. The BE values provide important facts about the elements from which it is made and relative quantity and chemical state of the elements present in the solid.

Special Provisions :
- Static Auger and Imaging facilities
- In situ sample heating and cooling facility
- Special sample preparation chamber with gas dosing facility

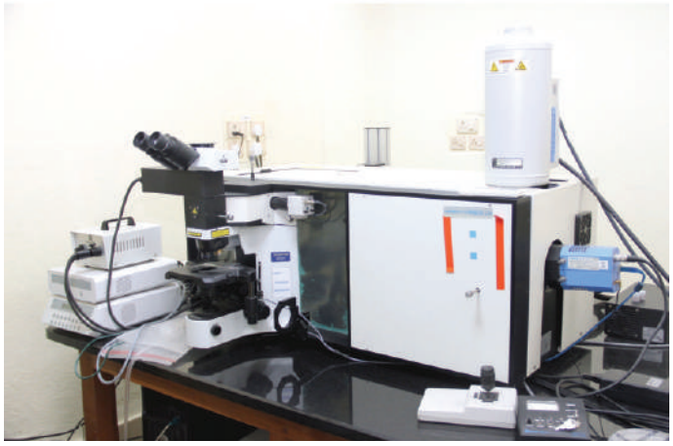
Accuracy : < 0.3 eV (Resolution)

Applications :
Catalysis, Materials Science, Polymers, Organic Chemistry

Department/Location:
I & P C Division / Catalysis Laboratory



Micro-Raman Spectrometeter



Model :
Horiba Jobin-Yvon LABRAM HR

Operational Aspects :
MicroRaman spectrometer with integrated microscope with 10x, 50x and 100x objectives. Focal length 800 mm He-Ne 633nm Laser Argon 514nm Laser with Edge filters Gratings 600 and 1800 grooves/mm. Spectral range 60-5500cm-1. Resolution 0.3cm-1 per pixel at 633nm with 1800g/mm. Confocal coupling optics Detector –CCD-1024x256 pixels

Special Provisions :
Motorized X, Y, Z stage GaAs detector for Photoluminescence measurements. Facility for liquid sample analysis

Applications :
Characterization for Nanomaterials, semiconductors Polymers, pharmaceuticals, forensic materials.

Department / Location :
Nanomaterials Lab,
Inorganic and Physical Chemistry Division.

Gas Chromatograph-Mass Spectrometer

Model/Type :
SHIMADZU, GCMS-QP5050, JAPAN

Special Provisions :
Equipped with electron ionizer, Quadrapole mass analyzer and a micro therma conductivity detector Six-port on-line auto sampling valve for gas Analysis Class-5000 ver.2.2 software for MS Workstation

Operational Aspects :
Mass range: 10-900 a.m.u.

Applications :
To identify volatile organic compounds

Department/Location :
I & P C Division / Catalysis Laboratory

High Pressure Differential Scanning Calorimeter (HPDSC)

Model :
57/27, Mettler Toledo, Switzerland

Operational aspects :
Temperature and rate of heating Measurement at sub-ambient temperaturefrom – 60 to 600°c

Special provisions :
Measurement can be performed upto 100 bar Pressure

Accuracy :
Temperature accuracy ± 0.2°C

Resolution: < 0.7 w

Applications :
Polymers, pharmaceuticals, foods, rubber and safety investigations

Department/Location :
Inorganic & Physical Chemistry Division,
Main Building (Room No.133)

TGA/SDTA

Model :
851e, Mettler Toledo, Switzerland

Operational aspects :
Temperature and rate of heating , weight of sample and gas atmosphere. Room temperature to 1600°C

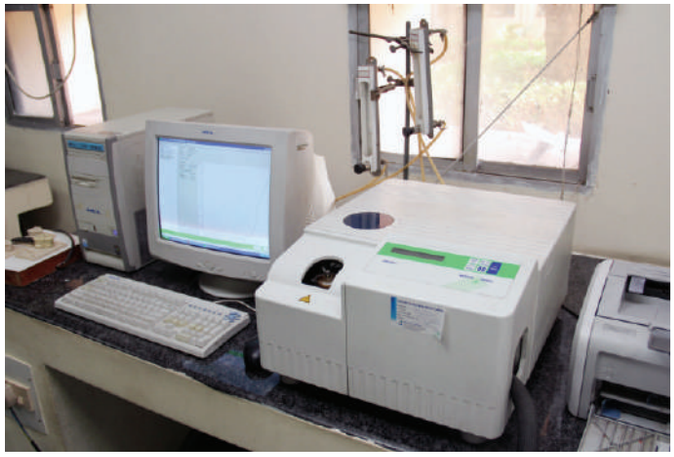
Special provisions :
Single run gives TGA and DTA. Option of gas atmosphere (reactive).

Accuracy : ± 0.25°C Resolution 0.1 g

Aplications :
Polymers, inorganic and organic chemicals, building materials, minerals, ceramics and composites

Department/Location :
Inorganic & Physical Chemistry Division,
Room No.133/Main Building

Differential Scanning Calorimeter (DSC)



Model :
DSC 821e, Mettler Toledo, Switzerland

Operational aspects :
Temperature and rate of heating: Measurement at sub-ambient temperature from -60°C to 600°C

Special Provisions : Nil

Accuracy : ± 0.2°C ;

Resolution: < 0.7 W

Applications :
Polymers, pharmaceuticals, rubber, safety investigations and food industry.

Department/Location :
Inorganic & Physical Chemistry Division, Main Building.

MICROSCOPY Scanning Electron Microscope (SEM)

Model :
SEM Hitachi- S520, Japan;
Oxford Link ISIS-300 UK

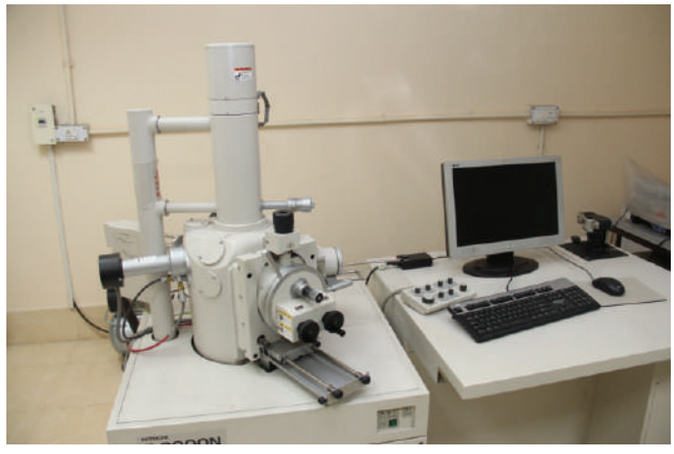
Operational aspects :
- Acceleration Voltage: 1 – 30 KV
- Magnification: 20x to 2,00,00x (SEM)
- Qualitative and quantitative estimation of the elements, carbon to uranium can be done without disturbing the sample

Special provisions :
EDX-accessory ; specimen tilts, split imaging rotation SI LI detector, detects the x-ray emission by the sample when subjected to the electron beam. Data generation is computer compatible

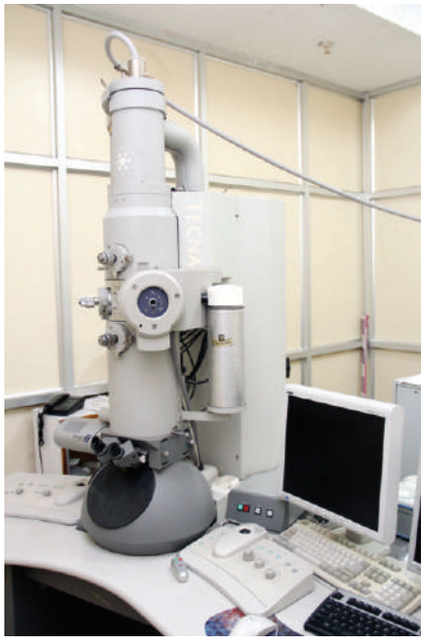
Accuracy :
Resolution 133 EV (EDAX) &
6nm (SEM) ± 0.5%

Applications :
Study of surface Morphology (3D) of specimens in various branches of science

Department :
Electron Microscopy Center, Discovery Laboratory



Transmission Electron Microscope (TEM)



Model :
Tecnai-12, FEI, Netherlands

Operational Aspects :
Acceleration Voltage 20 –120 KV
Magnification 6,00,000x

Accuracy : Resolution 2A°

Application :
Ultra structural studies, characterization of nano particles and Viruses

Department/Location :
Electron Microscopy Center, Discovery Lab

Particle Size Analyzer

Model :
Malvern Mastersizer 2000

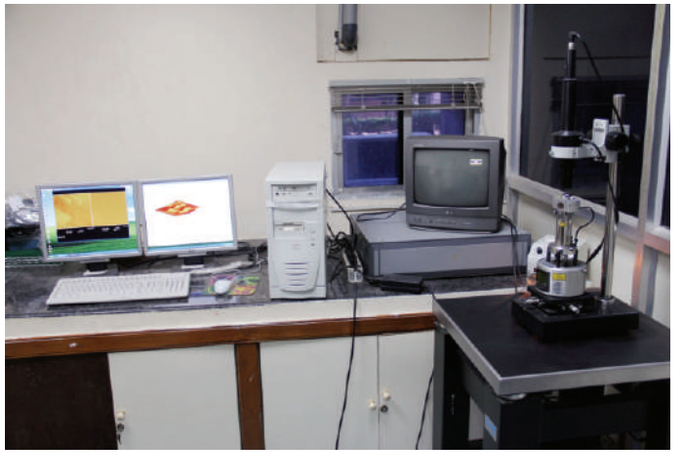
Operational aspects :
Particle size between 0.02 m to 2000 m can be measured depending on the particle shape and density

Special provisions :
Measurements can be performed in both wet and dry mode

Applications :
Minerals, Fillers, Chemicals, Foodstuff, Emulsions, Dry Powders, Pharmaceutical excipients, Cements, Flour, Powder Coatings

Department/Location :
Inorganic and Physical Chemistry Division
Room No.133, Main Building

Atomic Force Microscope



Model :
Veeco, USA, Multimode – Nanoscope Iva

Operational Aspects :
Heater / Cooler Stages (-35 to 250°C)

Special provisions : Canning Tunneling Microscope (STM); Contact/Non-Contact Atomic Force Microscope; Magnetic Force Microscope, Fluid Cell Imaging, Force Modulation, Low Current scanning Tunneling Microscope

Accuracy : Scanner A:
Scan size: 0.4 mm x 0.4 mm x 0.4 mm
Scanner E:Scan size: 10 mm x 10 mm x 2.5 mm
Scanner J: Scan size: 125 mm x 125 mm x 5 mm

Applications : Applications for atomic force microscopes include the visualization and measurement of surface features having nanometer sized dimensions in research and development laboratories as well as process control environments. Specific applications include Nano Metal oxides, Polymers, Peptides, Coated Quartz Structures and Substrates, Microfabricated Patterns.

Department/Location :
I & P C Division / Catalysis Laboratory

Gas Chromatograph-Online

Model/Type :
SHIMADZU, GC-17A ver.3, JAPAN

Special Provisions :
Flame ionization detector, thermal conductivity detector and a methanizer, two six-port auto-sampling valves for on-line gas analysis

Operational Aspects :
Class GC-10 software

Applications :
On-line analysis of organic compounds

Department/Location :
I & P C Division / Catalysis Laboratory

Advanced Ion-Chromatograph

Model/Type :
Metrohm, Advanced Ion-Chromatography system

Special Provisions :
Equipped with conductivity detector, Voltage-Ampere detector, UV-Visible detector, two terinary pumps and two peristaltic pumps

Accuracy : ± 1 ppb

Operational Aspects :
Metrodata IC Net 2.3 SR1 software

Applications :
Analysis of anions & cations

Department/Location :
I & P C Division / Catalysis Laboratory

BET Surface Area Analyzer

Model/Type :
QUNTACHROME, AUTOSORB-1

Special Provisions :
Equipped with two built in degassing ports allow for simultaneous sample Preparation independent analysis

Applications :
Capable of measuring BET surface area (single and multipoint), Langmuir surface area, adsorption and desorption isotherms, pore size and surface area distributions, micro pore volume and surface area using an extensive set of built-in data reduction procedures.

Department/ Location :
I & P C Division / instrumentation room

Structural Characterization

For structural characterization of material & catalysts the following facility exists at IICT which includes porosity and pore volume, tensile strength and related properties:

Mercury Penetration Porosimeter

Model	:	Autopore III 9410, Micromeritics, USA
Operational aspects	:	Mercury porosimetry uses Washburn equation to measure intrusion of mercury into a porous material as a function of pressure applied to mercury
Special provisions	:	The Autopore III software lets you enter the precise angle of contact between mercury and a solid sample surface
Accuracy	:	± 1% of maximum penetrometer stem value
Applications	:	Measurement of sample density, pore volume, pore area, pore size distribution and intrusion volumes in catalyst samples and other materials
Department/Location	:	I & P C Division / Catalysis Laboratory.

OTHER UNITS

Unit	Make	Applications
• Polarimeter	Jasco Dip 370	Measurement of Optical Rotation
• Counter Current Chromatograph	1998 model, Serial No.154, PC Inc USA	Isolation & purification of active principles from natural products

TPR / TPD Unit

Model :
Micromeritics, Autochem 2910 USA

Operational aspects :
- Temp. Programmed Desorption (TPD)
- Temp. Programmed Reduction (TPR)
- Temp. Programmed Oxidation (TPO)
- Pulse Chemisorption
- BET Surface Area

Special provisions :
2910 Software for Windows forconvenience and control of temp. programmed analysis With full automation

Accuracy : ±0.01%

Applications :
- Redox properties of catalysts by TPR and TPO Determination of surface acidity by TPD of ammonia and pyridine
- Metal dispersion and active particle size pulseChemisorption

Department/Location :
I & P C Division / Catalysis Laboratory

Lab-Scale De NOx Reactor

Model/ Type :
Fixed bed catalytic reactor

Special Provisions :
6 MFC's for gases;
1 microprocessor based feed pump for liquid flow

Operational Aspects :
Pessure: Ambient Quartz reactor, electrically heated, Programmable temperature option (upto 900°C)

Analysis :
Online gas product analysis by Varian micro-gas chromatograph

Department/Location :
I & P C Division, VCM Laboratory

AutoClave

Model :
4542, PARR Instrument Co. USA

Operational aspects :
- Stirring speed from 0-600 rpm,
- Capacity : 2 gallon
- Bomb material :T316 SS
- Maximum pressure : 1900 psi
- Maximum temperature : 350°C

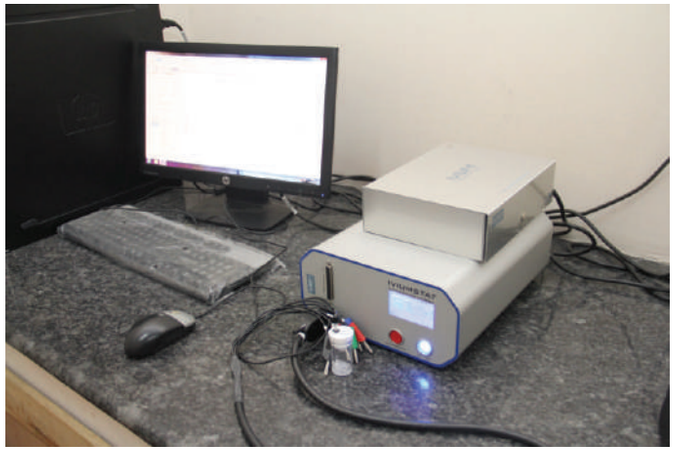
Special provisions :
- Higher speed upto 700 rpm can be obtained
- Micro-processor based ramping control
- The series 982 provides 6-step programme capability with upto 4 files

Accuracy :
Broad range I/O Options allows control of virtually any process variable

Applications :
Organic chemical - High pressure reactions

Department/Location :
Fine Chemical Laboratory and I & P C Division

Electrochemical Work Station



Model:
IVIUM STAT (IVIUM Technologies, Netherlands)

Operation Aspects:
Computer based software
✧ IVIUM software

Accuracy: --

Additional Features:
Liquids and device analyzing facility

Applications:
Redox & Oxidation potentials
1. I-V measurements of samples.
2. Impedance measurements of solar cells.

Department/Location:
I & P C Division; Catalysis Building, 1st floor

Electric Flat Screen Printer

Model:
AT-25 PA (Dye Sol, ATMA, Taiwan)

Operation Aspects:
Manual operation
LCD Touch Screen Operation

Accuracy:
Single & multiple layers of coatings of desired pastes on screens

Additional Features: --

Applications:
Coating of different pastes on screens (Glass, Plastic and polymer screens)

Department/Location:
I & P C Division; Catalysis Building, 1st floor

Solar Simulator

Model:
Sol 3A ORIEL (Newport; U.S.A.)

Operation Aspects:
Computer based software
1. TRACQ Basic
2. Oriel IV Test Station

Accuracy: 300-1100 nm

Additional Features:
Quantum Efficiency (QE) measurements

Applications: Solar cell device characterization
1. I-V measurements (up to 8×8 inches device)
2. Quantum efficiency measurements (300-1100 nm region)

Department/Location:
I & P C Division; Catalysis Building, 1st floor

Spectrofluorometer

Model:
Fluorolog-3 (Horiba Jobin Yvon, U.S.A.)

Operation Aspects:
Computer based software
❖ FlurEssence V3 software

Accuracy: PMT detector; 200-850 nm

Additional Features:
TCSPSC Triple Illuminator accessories for lifetime measurements

Applications:
Electronic transitions and band gap estimation
1. Fluorescence and quantum yield measurements of samples.
2. Fluorescence lifetime measurements of samples.

Department/Location:
I & P C Division; Catalysis Building, 1st floor

UV-Vis-NIR Spectrophotometer:

Model:
UV-3600, (Simadzu, Japan)

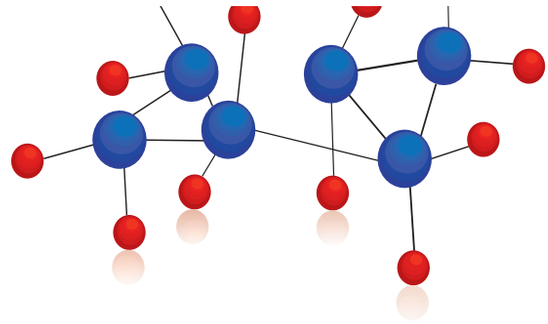
Operation Aspects:
Computer based software
❖ UV-Probe software

Accuracy: 200-3600 nm

Additional Features:
Solids, films and polymer sample holder

Applications:
Electronic transitions and band gap estimation
1. Absorption spectrum recording
2. Transmittance & Reflectance
3. Kinetics study

Department/Location:
I & P C Division; Catalysis Building, 1st floor



Polymers and Functional Materials

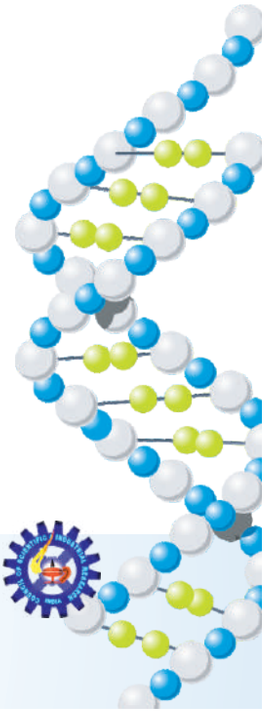
Area of Expertise

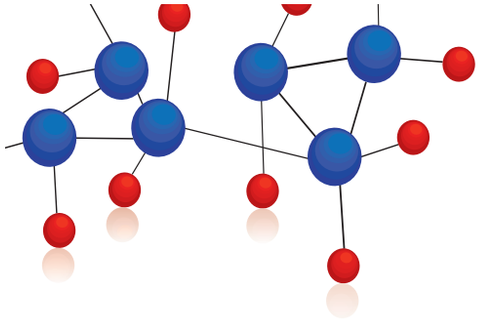
- Specialty Functional & Protective Coatings
- Hyperbranched polymers and their applications in coatings, adhesives & sealants
- Functional organic-organic hybrids and Organic-inorganic hybrid systems
- Fluoropolymers & Fluoroelastomers
- Nitrogen and Sulphur containing Hyperbranched polymers
- Trizole containing hyperbranched polymers
- Energy materials for Solar, Batteries, Supercapacitor and solar paints
- Conducting polymers
- Polyurethane Foams & Sealants
- Supramolecular Chemistry & Self Assembly, Supramolecular Artificial Photosynthetic System
- Bio polyols for various applications
- Adhesives and Photo Polymers
- Hydrophobic and hydrophilic polymers
- Monomers design and Polymerization
- Controlled Radical Polymerization, Atom transfer Radical Polymerization, Reversible Addition Fragmentation chain Transfer (RAFT), Novel Polymerization Techniques, Di-block and Tri-block copolymers.
- Polymer blends and Nanocomposites
- IPNs and nano materials, Graphene, Carbon Nano tubes, core shell micro/nano particles
- Opaque Polymer pigments using Core shell technology
- Polymer and biomaterials for controlled drug delivery

Technologies Developed

Defense and Air force Applications (Strategic Applications)

- Hydrophobic coating for laminates
- Silicone high temperature glue





- Polyurethane adhesive for honey comb structures
- Cyanoacrylate adhesive
- Rain erosion resistant coating
- Composite resin LCA radome
- Fluoroelastomer
- FEP Resin
- High temperature resistant glue

Specialty Polymers

- Resin for Radome
- Polymers for Composites
- Polymers for Wood Substitute
- Monomers for specialty Polymers

Automobile Industry

- Polyurethane adhesive
- Rubber-metal bonding PU adhesive

Biomaterials

- Chemically and photochemically cured surgical sealants
- Biopolymer based hemostats
- Preparation of Collagen and Gelatin films, foams etc..
  - Degradable polyurethane binders.
  - Synthesis of specialty monomers and polymers.

Conducting Polymer

- Polyaniline material
- Electrostatic discharge film

Organic Coatings

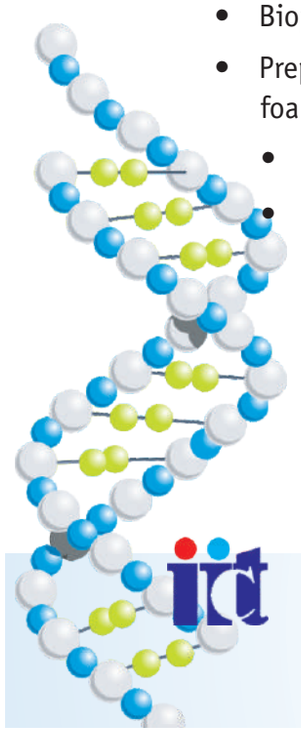
- Polyurethane Wood Lacquer
- Epoxy Paints
- Epoxy-phenol Baking
- Chlorinated Rubber Paints
- Masonry Paints
- Moisture Curing Lacquer
- PU Filling Compounds
- Polyurethane Laminating Adhesive
- PU based systems for ink applications
- Thermal insulating coatings for GI roof
- Abrasion resistant coating for PET fibre
- PU laminating adhesive

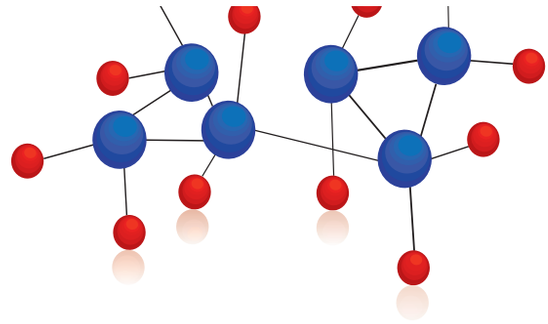
a) Polyols for PU Coatings

- Polyester polyols
- Castor polyols for coatings and foams
- Acrylic polyols
- Polyester Urethanes
- Acrylic Urethanes

b) Anti-Corrosive Coatings Based On

- SINGLE pack PU
- Two pack PU
- Epoxy resins
- Moisture cured polyurethane systems
- Water based polyurethanes and acrylics
- Solvent free polyurethanes





c) Other technologies

- Nuclear radiation resistant coating for Nuclear Power Plants
- Thermal insulting coatings
- Polyurethane resins for ink formulations
- Anti-static rain erosion resistant coating for LCA
- Rebar coating formation
- UV resistant coating for outdoor exposure
- Anti-static floor coatings for electronic and pharmaceutical industry
- Irreversible Temperature Sensitive Labels
- Moisture cure polyurethanes
- Nitrogen and Sulphur containing heperbranched polyurethanes
- Organic & Inorganic Hybrid coatings
- Acrylic urethanes dual cure IPN coatings
- Epoxy-urethane-acrylic hybrid coatings
- Urethane-siloxane hybrid coatings
- Solvent free polyurethanes
- Core-shell Styrene Acrylic emulsions
- Acrylic and Styrene-acrylic emulsions
- Polyurethane Dispersions

CSNL Technologies

- Cardanol from CNSL
- Anticorrosive paints from Cardanol
- Polyols from Cardanol
- Cardanyl Acrylate and Methacrylate
- Allyl Cardanols
- Phenalkamines
- CSNL oil to CSNL resin preparation

Natural Oils

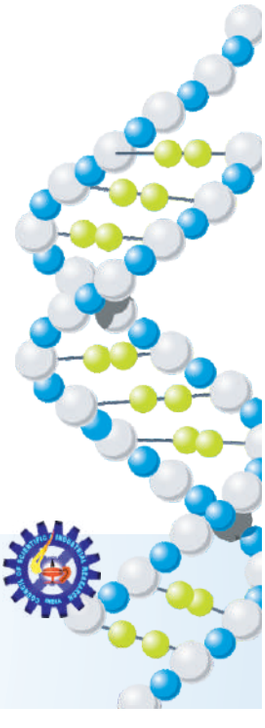
- CNSL based polyols
- Other Oil based polyols like castor, cotton seed oil etc.,
- Reactive surfactants etc,

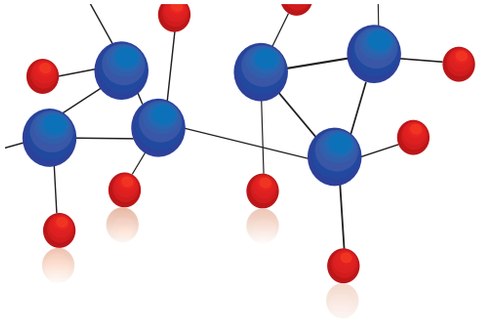
Packaging Industry

- Corrugation and pasting gum
- Corrugation and pasting gum liquids
- Hot melt general purpose adhesive
- Acrylic pressure sensitive adhesive for tapes, labels etc.
- Conversion of starch to white dextrin
- Conversion of starch to yellow dextrin
- Paper to oil coated tin label (POCT) adhesive
- Glue stick
- Polyurethane Laminating Adhesive

Stationary Industry

- Self sealing envelope adhesive
- Pressure sensitive adhesive for envelopes
- Synthetic vinyl stationary adhesive
- Bottle labeling adhesives for beer, whisky and medical bottles
- Adhesive for book binding (hot melt)





Shoe Industry

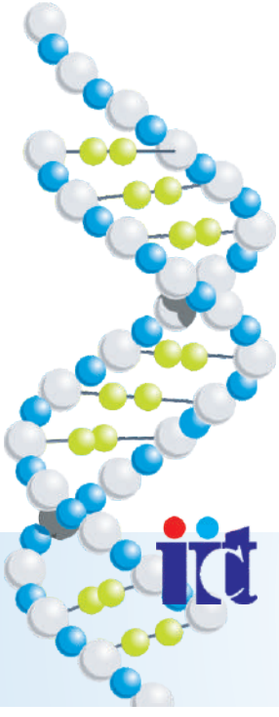
- Polychloroprene adhesive for bonding shoe soles (Leather)
- Water based polyurethane adhesive for permanent sole

Construction Industry

- Polyvinyl acetate adhesive
- Polyurethane grouting compounds
- Water proofing compounds like acrylics, urethanes, epoxies, silicate compounds etc.,
- Grouting compounds and add mixtures
- Protective coatings

Electronic Industry

- Methyl 2-Cyanoacrylate for metal-metal bonding
- Acrylic copolymers for Polyurethane coating
- Epoxy Urethane Acrylates for printed circuit boards



Facilities

Universal Testing Machine

Model:
Autograph Model AGS 10 ANG, M/s Shimadzu, Japan

Operational aspects:
* Auto load zero function
* Auto calibration
* Automatic reading of load cell properties
* Preset cycle counter
* Measurement of tensile properties, comprehensive strength, peel strength, adhesive strength as per ISO, EN, JIS ASTM Standards at room temperature.

Special provisions:
Programme control timer
Elongation function (m)
Autograph control software Win AG

Accuracy: Precise results with accurate readings

Application:
Metallic material tensile testing, compression testing, bend testing and peel testing.
Analysis and testing of commercial samples on payment.

Department/Location:
Polymers & Functional Materials Div./ Main Building

Dynamic Mechanical Thermal Analyzer (DMTA)

Model:
DMTA-IV, Rheometries, England.

Operational Aspects: Temperature range 15°C to 50°C at 0.01 C/min. to 20°C/min. Frequency range 0.033/0.001 to 200 Hz.

Specialprovisions: This unit provides (a) Auto load zero function (b) Auto Calibration (c) Stress display (d) Stroke Output (e) Elongation display function (f) ProgrammeControl timer,etc.

Accuracy: +0.01%

Applications: To study and monitor cured and uncured coatings. Used for the measurement of degree of cross-linking in a coating during reaction. Provides accurate information on stiffness, cure, aging , melt behaviour, stress and strain, mechanical hysteresis, finger printing etc. Material characterization of polymers including Thermoplastics and thermosets Analysis and testing of commercial samples.

Department/Location:
Polymers & Functional Materials Div./ Main Building

Taber Abraser Model 5131

Model :
Digital Abraser with LED Readonts.
Taber Industries, North Tonawada, NY,
with wheels CS-10 & H-18

Operational aspects :
Can be programmed as per the requirement

Applications :
As per ASTM. Designed to evaluate the resistance of surfaces to rubbing abrasion.
Test of solid materials, Painted, Lacquered electroplated surfaces, Plastic coated materials, Textile fabrics, metals etc.

Department/ Location :
Polymers & Functional Materials Div./ Main Building

UV Spot Curing System

Model :
Spot-Lite curing system, UVP Inc, USA

Operational aspects :
Spot lite is a portable ultra violet curing system with a flexible, 3mm diameter wand.

Special Provisions :
Automatic timer to control exposure from fraction of a second to several hours

Accuracy :
Not mentioned

Applications :
Spot curing and cross-linking of UV sensitive resins

Department/ Location :
Polymers & Functional Materials Div./ Main Building

Contact Angle Goniometer

Model :
G10, Kruss, Germany

Operational aspects :
Manual

Special provision : Nil

Accuracy :
Not mentioned

Applications :
Measurement of contact angles of single drops of test liquids on a solid surface Measurement of advancing and receding contact angles by volume control of sample drops

Department / Location :
Polymers & Functional Materials Div./ Main Building

UV Cross - Linker

Model :
Bio-link BLX

Operational Aspects :
Maximum UV energy exposure.
Ranges from 0 to 9.999 Joules & 0 to 99.99 Joules.
Maximum UV exposure time: 999.9 minutes

Applications :
UV 365 nm eradicating system

Department/ Location :
Polymers & Functional Materials Div./ Main Building

Cycloviscograph

Model :
Cyclo-viscograph-E, Brabender, Germany

Operational aspects :
Fully programmable heating schedules

Special Provisions :
DOS based software

Accuracy : Not mentioned

Applications :
Cycloviscograph is an oscillating disc torque rheometer used to measure gelation times in thermoset curing

Department/ Location :
Polymers & Functional Materials Div./ Main Building

Fourier Transform Infrared Spectroscopy(FTIR)

Model:
Spectrum 100, Perkin Elmer, USA

Operational aspects:
Software controlled spectrum, Optical system to collect data over a range of 7800 to 370 cm-1 with best resolution of 0.5 cm-1,Absolute transmission accuracy, advanced electronics for high fidelity signal sampling

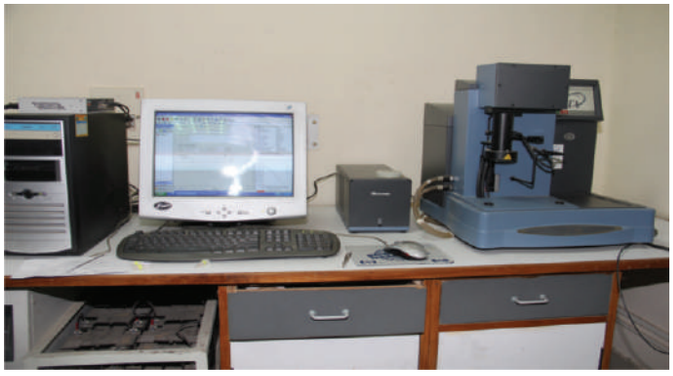
Special provisions:
Study the transmission properties of high-refractive-index materials

Accuracy:
Abscissa precision better than 0.01 cm^{-1}

Applications:
Identification of functional group and structure elucidation, identification of substances and progress of reaction, detection of impurities

Department / Location:
Polymers & Functional Materials Div./ Main Building

Thermo Gravimetric Analyzer (TGA)



Model:
Q500, TA Instruments, USA

Operational aspects:
Widest temperature range in a single oven, Ultra-sensitive high precision thermobalance, operating temperature from ambient to 1000 °C and heating rate 0.01-100 °C

Special provisions:
Dynamic or Isothermal temperature control

Accuracy:
Sensitivity 0.1 microgram

Applications:
Measure thermal stability, composition of materials, Oxidative Stability, heat flow and weight changes as a function of temperature or time

Department / Location:
Polymers & Functional Materials Div./ Main Building

Differential Scanning Calorimeter (DSC)

Model:
Q100, TA Instruments, USA

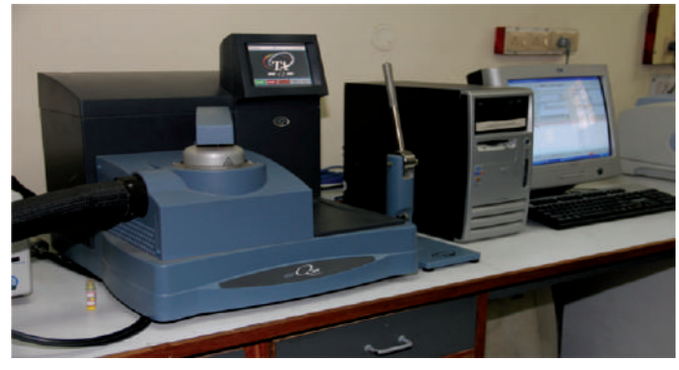
Operational aspects:
Software controlled Digital mass flow cont
T zero Technology for enhancing resolution and base line flatness, Refrigerated cooling system operates from (90 °C to 700 °C)

Special Accuracy:
Enables characterization of photocuring materials

Accuracy:
Sensitivity 0.2 microwatt

Applications:
Transition temperatures, Heat flow measurements, Reaction kinetics

Department / Location:
Polymers & Functional Materials Div./ Main Building



High Performance Liquid Chromatography (HPLC/GPC)

Model:
Shimadzu Prominence Gradient HPLC with ELSD Detector

Operational aspects:
Software controlled detectors which includes UV detector, Refractive Index (RI) detectors

Special provisions:
Measures the molecular volume of polymers

Accuracy:
To determine molecular weights within ± 5% accuracy

Applications:
Determination of polydispersity index (PDI), molecular weight and weight distribution of the polymers

Department / Location:
Polymers & Functional Materials Div./ Main Building

Dynamic Light Scattering (DLS)

Model:
Precision Detector Inc, USA

Operational aspects:
Multi detector Plat form, Cell volume 10 l,
Light scattering angle 90 °C

Special provisions:
Precision Elucidate software, DLS detector Pd4043

Accuracy:
Hydrodynamic radius 1.5 to 1000nm

Applications:
Particle size and distribution, hydrodynamic radius of Macromolecules

Department / Location:
Polymers & Functional Materials Div./ Main Building

Ultraviolet-Visible Spectroscopy

Model:
Spectro UV-VIS Double Beam PC,
Labomed, Inc

Operational aspects:
Microcomputer controlled

Special provisions:
8 Scanning Auto Cell

Accuracy:
Precise testing with a variable bandwidth of 0.5, 1.0, 2.0 and 5.0

Applications:
Detection of impurities, Structure elucidation of organic compounds, Quantitative and Qualitative analysis of compounds, Chemical kinetics and detection of functional groups

Department / Location:
Polymers & Functional Materials Div./ Main Building

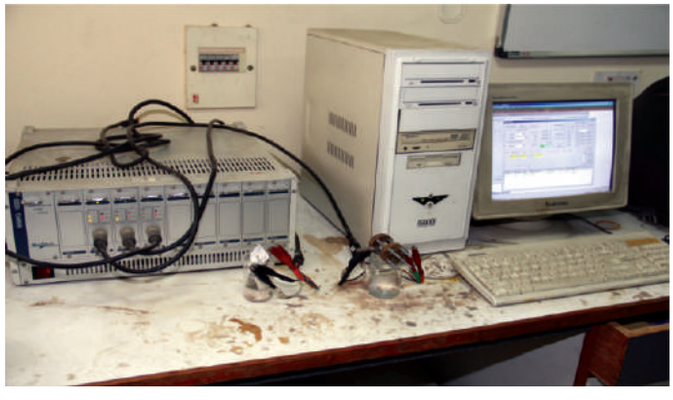
Cyclic Voltammetry

Model:
WonATech Potentiostat &
Galvanostat WMPG-1000, South Korea

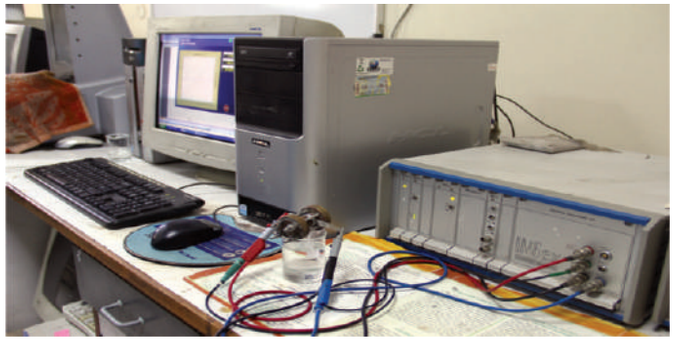
Operational aspects:
Can be programmed as per the requirement

Applications:
Electrochemical synthesis of organic & inorganic molecules and properties study of energy storage devices

Department / Location:
Polymers & Functional Materials Div./ Main Building



Electrochemical Impedance Spectroscopy



Model:
ZAHNER IM6ex, Germany

Operational aspects:
Can be programmed as per the requirement

Applications:
Electrochemical impedance analysis and corrosion analysis of energy storage devices

Department / Location:
Polymers & Functional Materials Div./ Main Building

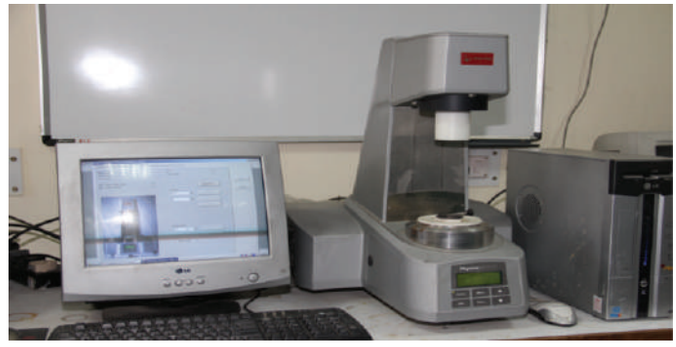
Rheometer

Model:
Anton Paar, USA

Operational aspects:
Can be programmed by the software as per the requirement in the solution state

Applications:
Measurement of viscosity of polymers in liquid or gel state

Department / Location:
Polymers & Functional Materials Div./ Main Building



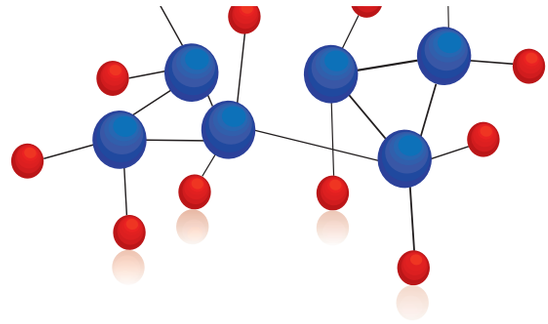
Nano Voltmeter

Model:
Keithley 4-probe, USA

Operational aspects:
Software controlled measurement

Applications:
Measurement of conductivity in pellet form

Department / Location:
Polymers & Functional Materials Div./ Main Building



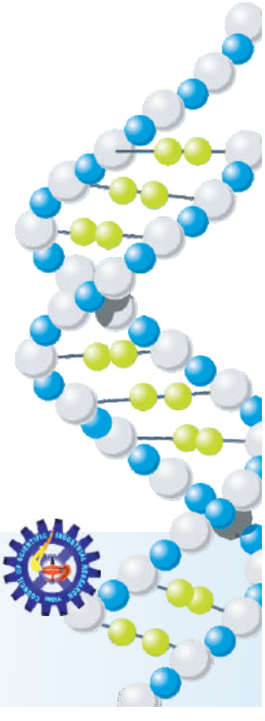
Fluoroorganics

Area of Expertise

- Hydrofluorination reactions
- Halogen exchange reactions
- Hydrodechlorination reactions
- Denitrochlorination
- Reagent based synthesis
- Synthon based synthesis
- Process development for refrigerants, halon substitutes, pharma intermediates, fine chemicals, fluoropolymers or telomers
- Synthesis of novel bio-active molecules as antibacterial / fungal, anti-cancer or anti-diabetic agents

Technologies Developed

- HFC-134a
- CFC-113a
- Trifluoroacetic acid
- 2,4-DichloroFluorobenzene
- 3-Chloro-4-fluoroaniline
- HFC-143a
- Acetohydroxamic acid
- 2H-Heptafluoropropane
- SXFA
- Chlorotrifluoroethene
- 1,1-Difluoroethylene
- HCFC-142
- Formadhydroxamic acid
- 1,1-Dichlorotrifluoroethane (HCFC-123)
- 3,5-Dinitro-4-chlorobenzotritluoride
- 4-Fluoroaniline
- p-Nitrobenzylbromide
- 2,2,2-Trifluoroethanol (CF3CH2OH)



Facilities

Pyrolyser Reactor System

Working pressure : 5 kg

Working temperature : max 1000°C

MOC : Inconel 600

Length : 1 m

Electrical heating using control facility

Pyrolyser Reactor System

Working pressure : 5 kg

Working temperature : max 1000°C

MOC: Inconel 600

Length : 2 m

Electrical heating using control facility

Vapor Phase Fluorination Unit
Micro Reactor System

Catalyst capacity : 50g

Working pressure : Atmospheric

Working temperature: Max. 500°C

MOC : Inconel-600

Electrical heating and control facility

Mini reactor - Catalyst screening

Catalyst capacity: 10-15g

Working pressure : atmospheric

Working temperature: Max. 450°C

MOC : Inconel-600

Electrical heating and control facility

Automated vapor phase reactor system

Catalyst capacity : 75g

Working pressure : max 12 kg/cm^2

Working temperature : max 600°C

MOC : Inconel 600

Fully automated control system

Laboratory reactor - Catalyst evaluation

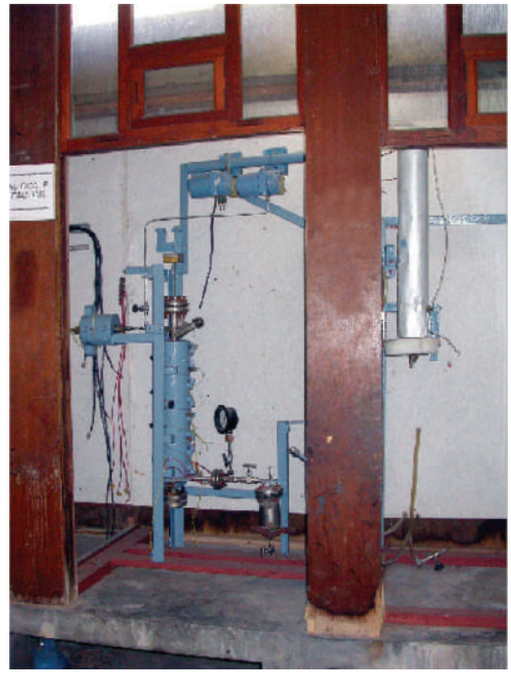
Catalyst capacity : 75-100g

Working pressure: Max. 10 kg/cm^2

Working temperature : Max. 450°C

MOC : Inconel-600

Electrical heating and control facility



Pilot Scale Reactor - Process Upscaling Unit

Catalyst capacity : 1000-1500g

Working pressure : Max. 5 kg/cm^2

Working temperature : Max. 400°C

MOC : Inconel-600

Air heating with control facility and on-line data acquisition facility

Batch stirred reactors Parr Instrument

Working volume : 2000 ml.

Working pressure: 1000 psi

Working temperature : 450°C

Magnetic drive: 1000 rpm

MOC : Haste-alloy-C

Autoclave (Batch Reactor)

Working volume : 2000 ml.

Working pressure : 1000 psi

Working temperature : 250°C

Magnetic drive: 1000 rpm

MOC : Haste-alloy-C

Batch pressure distillation unit

Capacity : 3 & 5 kg

Working Temperature : max 400°C

Working pressure : 10 kg/cm^2

MOC : Inconel 600

Electrical heating using control facility

Batch cryogenic distillation system

Working pressure: atmospheric

Working temperature: –70°C

Analytical Instruments:

Instrument	Model	Quantity
GC	HP 5890	2 nos.
GC	HP 6890	1 no.
GC	Thermo-scientific	1no.
HPLC / GPC	UFLC (Shimadzu)	1no.
GC-MS	Q2010(Shimadzu)	1no.
IR	Cary 630 FTIR	1no.
Karl-Fischer Titrator	787 Tritro (Metrohm)	1 no.
Melting point apparatus	Veego	1 no.

Gas Chromatography

HPLC / GPC System

Model :
UFLC (Shimadzu)

Operational aspects :
HPLC dual pump
(Flow rate : 0.01 to 9.99ml/minequippedwith RI detector)

Accuracy : 0.01%

Applications :
Used for analysis of drugs, fine chemicals, polymers etc.

GC - MS

Model :
Q2010 (Shimadzu)

Analysis type:
Gas Chromatography, Mass spectrometry with DI probe facility

Use :
For the analysis of mixture containing volatile and semi volatile compounds like HFCs, Organic compounds etc.

I R

Model :
Cary 630 FTIR, Agilent Technologies

Operational aspects :
Scanning background, scanning sample, baseline corrections etc.

Special provisions :
Library search, peak pick plots, etc.

Accuracy:
Resolution 0.1cm-1 max.

Applications:
Analysis of organic and inorganic chemicals, polymers, biological samples etc.

Ultralow Cryogenic Unit

Make :
Deepee Cooling Systems
(Custom design)

Working temperature : -120°C

Accuracy: + 5° C

Bioengineering and Environmental Sciences

Area of Expertise

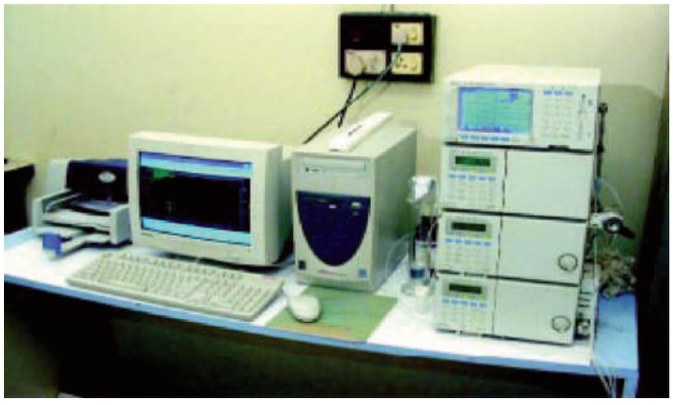
- Tackling Environment related problems in industries
- Wastewater treatment
- Performance evaluation of effluent treatment plants
- Design of effluent treatment facility
- Environmental Impact Assessment (EIA) studies
- Odor abatement from process industries.
- Solid waste management
- Self mixed anaerobic digester (SMAD) for high rate biomethanation of solid waste.
- Biomass to biofuels
- Production of industrial important compounds and biocatalysts by fermentation process
- Value added products from renewable materials by biotechnological routes
- Bio-hydrogen production through treatment of waste
- Bio-electrochemical systems for energy recovery and waste treatment
- Pre-concentration of Non methane hydrocarbons (NMHCs) from atmosphere
- Chemistry of Ozone and its precursor trace gases
- Bioremediation of contaminated soils

Technologies Developed

- Generation of biogas from poultry waste
- High rate modular digester for solid waste treatment
- Periodic discontinuous batch process for wastewater treatment
- Biofilters to remove odor from process industries

Facilities

High Performance Liquid Chromatograph (HPLC)



Model :
LC-10 A VP, Shimadzu, Japan

Operational aspects :
HPLC dual pump (Flow rate: 0.01 to 9.99 ml/min equipped with UV detector)

Accuracy : 0.01%

Applications :
Used for analysis of drugs, pharmaceuticals, Agrochemicals, fine chemicals and environmental samples. The instrument is fitted with gradient system and UV detector.

Location:
Bio-engineering and Environmental Sciences (Discovery Lab)

Total Organic Carbon Analyser

Model:
High TOC, Elemental, Germany

Operational aspects:
TC, TIC, TOC, NPOC (Both solid and liquid)

Special provisions:
Both solid and liquid samples

Accuracy:
< 1% at >100 mg/l of C;
< 2% at > 10 mg/l of C; < 5% at > 0.2 mg/l of C (in reference to the total range)

Working range:
0.1 to 1000 mg/l of carbon

Applications:
Used for the determination of TOC of various types of water and environmental samples

Location:
Bio-engineering and Environmental Sciences (Discovery Lab).

Fermentor/Bioreactor

Make:
Biostat

Operational aspects:
1.5 liters capacity
Controlled temperature condition
Online pH adjustment
Online foam control
Online sample removal
Multi step operation

Special provisions:
Dissolved oxygen measurement,
Online monitoring of fermentation factors
Variable speed operation of stirrer

Accuracy:
Precise Operation at defined pH, DO and temperature

Application:
Production of microbial products eg. Antibiotics, biofuels, cell mass, etc.

Department/Location:
Bio-engineering and Environmental Sciences (Discovery Lab)

Bioreactor for Alcohol Production

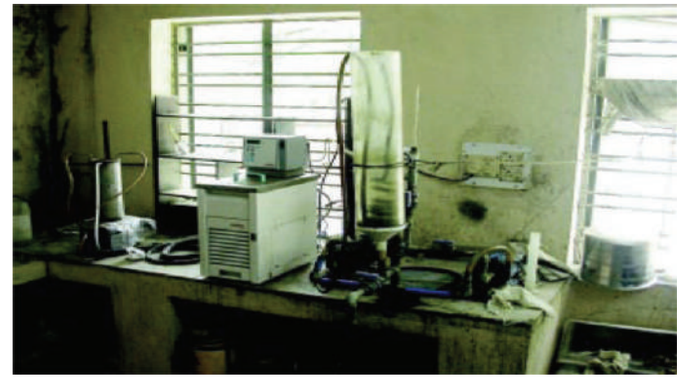
Make :
Fabricated in the laboratory

Operational aspects :
3 liter capacity
Upflow liquid movement, Temperature control
Online sample collection,Submerged catalyst
Online temperature measurement

Special provisions :
Continuous operation
Upflow/downflow liquid operations
Easy separation of catalyst & medium
Adjustable liquid variation

Application :
Production of primary metabolite/product, using immobilized microbial cells. under controlled temperature conditions

Department/Location :
Bio-engineering and Environmental Sciences (Discovery Lab)



Multilevel Bioreactor for Alcohol Production

Make :
Fabricated in the laboratory

Operational aspects :
Maximum of 12 liters level
Upflow/downflow, operation/recycling, Variable medium operation, Continuous operation

Special provisions :
Online sample removal, Online level indicator, Online temperature indication, Special outlet for used catalyst removal input device for temperature control used for production of alcohol using immobilized yeast under controlled temperature conditions. This bioreactor offers variation of fermentation medium volume with up flow and down flow, movement.

Department/Location :
Bio-engineering and Environmental Sciences (Discovery Lab)

Ecological Engineered System

Model:
Ecological Engineered System to treat waste water is Fabricated in laboratory.

Operational aspect:
Continuous mode operation with gravitational flow.

Applications:
To treat low strength waste water (specially the effluent generated from the bioreactors) and domestic sewage.

Additional features:
Harnessing of Bio-electricity with simultaneous waste water treatment.

Department/Location:
LTC Building, Bio-engineering and Environmental Sciences (BEEC).

Anaerobic Bioreactor

Model :
Bioreactor designed and fabricated in the laboratory.

Operational Aspect :
Semi pilot scale hydrogen bioreactor, Bench scale hydrogen bioreactor and sequencing bioreactor running in batch mode with varying organic loading rate (OLR) and hydraulic retention time (HRT) depending on the biogas required.

Application :
All the reactors are used for wastewater treatment with simultaneous energy generation in the form of biohydrogen / methane. Used for bioprocess optimization.

Department/Location:
LTC building, Bioengineering and Environmental Sciences (BEEC)

Semi Pilot Scale Bioreactors

Model :
Semi pilot scale Bioreactor designed and fabricated in the laboratory.

Operational Aspect :
34 litres capacity can operate in up-flow / down-flow with recycling in batch mode (Void ratio~ 0.85).

Application :
Biohydrogen production through utilization of wastewater such as spent wash, food waste, chemical and pharmaceutical wastewater,etc.

Department/Location:
LTC building, Bio-engineering and Environmental Sciences (BEEC).

Microbial Fuel Cell (MFC)

Model :
Microbial fuel cell designed and fabricated in the laboratory.

Operational Aspects :
Singh and Dual Chambered Microbial Fuel Cell (MFC) with non catalyzed graphite plates as electrodes used for bioelectricity generation and from wastewater treatment.

Department/Location:
LTC building, Bio-engineering and Environmental Sciences (BEEC).

Microbial Electrolysis Cell (MEC)

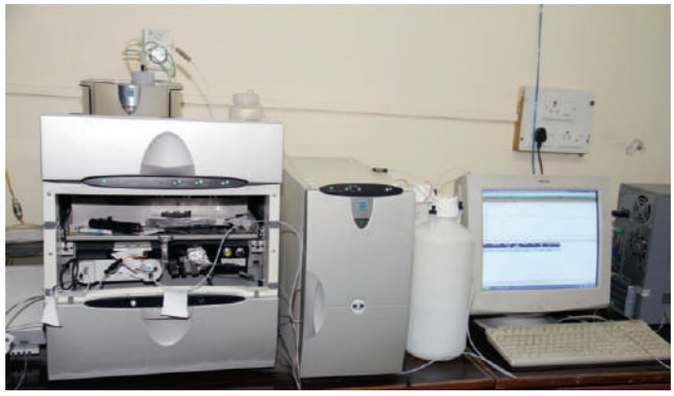
Model :
Microbial electrolysis Cell designed and fabricated in the laboratory.

Operational Aspects :
MEC reactors with 1.6 L capacity fabricated with non-catalyzed graphite plates as electrodes. A small input of voltage is applied to generate biohydrogen.

Applications :
Biohydrogen production by utilizing wastewaters.

Department/Location:
LTC building, Bio-engineering and Environmental Sciences (BEEC).

Ion – Chromatography



Model :
ICS – 3000 SP

Make :
Dionex

Operational Aspect :
Equipped with conductivity detector, electrochemical detector & anion suppressor.

Additional feature :
Auto sampler is attached.

Applications :
Analysis of cations, anions & organic ions qualitatively & Quantitatively in aqueous medium.

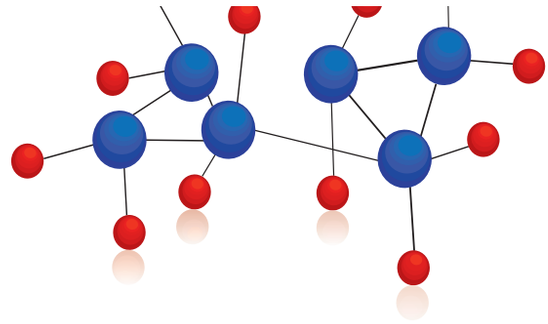
Department/Location:
Bio Engineering and Environmental Sciences

Pre-concentrator of Non-Methane Hydrocarbons (NMHCs) in air with Model 17A GC attachment

Department / Location:
Bio-engineering and Environmental Sciences

Environmental Observatory for Online Monitoring of O_3, NO_X, CO and SO_2

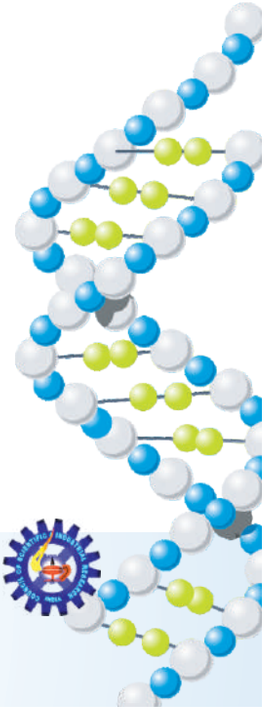
Department / Location:
BEEC, Located at TIFR – BF, ECIL Cross Roads.



Chemical Engineering

Area of Expertise

- Process Engineering and scale up of batch/continuous chemical processes.
- Pilot/Commercial plant design/operation.
- Techno economic evaluation.
- Startup assistance for commercial plants.
- Trouble shooting in commercial plants.
- Modelling, simulation and optimization of Chemical/Petro Chemical Plants.
- Process Safety and Risk Analysis.
- Advanced real time process control strategies for batch reactors.
- Intelligent hybrid control systems for complex processes.



Facilities

Differential Scanning Calorimeter(DSC)

Model :
DSC-7

Operational aspects :
Temperature range - 50 to 600°C

Special provisions :
Intra cooler for sub-ambient temperature upto - 60°C

Accuracy : ±0.1°C

Applications : Phase transitions, Specific heat, Isothermal curing, Reaction kinetics

Department/Location :
Chemical Engineering Laboratory / Properties Group

Reaction Calorimeter

Model :
RCIe Mettler Toledo, Switzerland
Operational aspects :
- Temperature range -20 to 250°C
- Reactor volume 0.5 to 1.5 lit (Hastalloy Reactor) 0.5 to 2.0 lit (Glass Reactor)
- Pressure upto 60 bar (Hastalloy Reactor)
- Atmospheric (Glass Reactor)
- Batch reactor (computer controlled)

Special Provision:
- Automatic thermosetting & control systems
- Safety housing for protection from splinters in accident situation
- Computation of thermochemical reaction kinetics & hazard potential of reaction system
- Reaction observation facility
- PC Support for data generation on thermal, kinetic heat transfer.

Accuracy : ±0.01%(abs)
Applications :
- To monitor course of chemical and physical reaction in a process
- Optimization scale up of chemical process

Department/Location :
Chemical Engineering /
Reaction Engineering Laboratory

Accelerating Rate Calorimeter

ARC is an adiabatic calorimeter where heat energy is neither lost from nor added to the system under test. Sample is always kept at same temperature as surroundings. The temperature of the sample is continuously monitored and calorimeter temperature is changed to follow the sample temperature by feed back control, which adjusts the power into surroundings. ARC simulates an exothermic reaction and store the information of this process in terms of time, temperature and pressure. The ARC allows extrapolation of results from small sample size to any commercial size.

It consists of Heavy Signal Unit (HSU) which controls all AC driven components like heaters, solenoid valves etc. The Light Signal Unit (LSU) handles the sensory signals from thermocouple pressure transducer of the calorimeter, the Power System Unit (PSU) and ancillary equipment. PC-ARC software provides the primary interface with the user. It provides means to set up test parameters, monitor tests, logging data to hard disk, checking integrity of data and analysis.

Model :
ARC-Thermal Hazard Technology, UK

Operational aspects :
- Temperature range Ambient to 500°C
- Maximum pressure 200 bar
- Heat rate 15°C/min

Special provisions :
I. Assessing thermal stability of self-heating compounds and reaction
II. Thermal Parameter Evaluation:
  - Onset temperature
  - Temperatures/Pressure rise Vs time
  - Temperature of no return
  - Time to Explosion
  - Vent sizing
  - Auto catalytic behaviour

III. Thermodynamic Parameter Evaluation:
  - Rate and order of reaction
  - Activation Energy and Frequency Factor

Accuracy :
Sensitivity to base line draft 0.005°C/min Worst Case curve shift 20C

Applications :
All chemical process industries where thermally Unstable or self heatingmaterials are handled or Where exothermic reactions are involved.

Department/Location :
Chemical Engineering/ Reaction Engineering Laboratory

Services available at IICT: IICT can either generate required data for a particular system or offer comprehensive consultancy services on strategies for controlling exothermic reaction systems and thermally sensitive compounds.

Hopler Viscometer

Model :
BH-12, Germany

Operational aspects :
temperature range 30°C to 80°C

Special provisions :
A compact unit for rapid and accurate Determination of viscosity

Accuracy : ± 1%

Application :
Measurement of clear solutions at the indicated temperature range and Viscosity range of 0.6 to 80,000 cP

Department/Location :
Chemical Engineering Laboratory / Properties Group

Process Modelling and Simulation

Model :
Aspen Plus and Aspen Hetran are integrated components of the Aspen Engineering Suite (AES) software, Version 11.1 from ASPEN TECHNOLOGY Inc, USA

- ANSYS FLUENT 6.3.26 and GAMBIT 2.3.16 advanced CFD modelling software to study multiphase reactions, reactions with particle formation, heat transfer with phase-change, surface and catalytic reactions etc., in complex vessel geometries such as stirred reactors, packed beds, static mixers burners, screw extruders etc.
- COMSOL 4.3b Multi physics modules coupling the CFD modules with chemical reaction kinetics and heat transfer modules and also with other specific modules for applications in Batteries, Fuel cells, Filters, Membrane reactors etc.
- ReaxFF Molecular dynamics simulator along with ADF program suite (GUI) to model chemical reactions, transition-metal-catalyzed nanotube formations, high-energy materials etc., working on a 4 Node-Cluster 4x AMD Opteron™ 6134, 2.3GHz, 128GB Memory (32x4GB), 4x1TB 7.2K RPM Hard Disk).

Applications :
Aspen Plus can be used for the simulation of chemical, petrochemical and refining processes involving organic, inorganic, aqueous, ionic species and solids. Aspen Hetran covers all major industrial shell & tube heat exchanger types and applications, including single phase, condensation and vaporization.

Department/Location:
Chemical Engineering Division /Modeling & Simulation group.

Integrated Solid Liquid Extractor

Model :
ENFAB, Hyderabad, India

Operational aspects :
Operates at atmospheric pressure, Temp. range 30 - 120°C. Basket capacity 30 kg. extractor volume 200 lit. per unit / batch.

Special provisions :
* All units are provided with nitrogen blanket to prevent fire hazards and toxic exposures
- Fully automated with computer control system for batching schedules of sequential operations with programmable logic controllers
- Unit provided with 5 digesters in series
- Extractors provided with reflux condensers to avoid solvent loses
- All operations from central control room

Applications :
Multistage solvent extraction process to get value added products from plant sources as drugs, pesticides, perfumes and flavours from natural products

Department/Location :
Chemical Engineering Division / Online Pilot Plant

Vapour Phase Reactor

Model :
BTRS 900, Autoclave Engineers Ltd., USA

Operational aspects :
- Temperature range ambient to 650°C
- Pressure range atmospheric to 100 bar
- Material of construction-Hastalloy C (wetted parts)

Special provisions:
- Modern fail-safe capabilities
- Integrated & analytical sampling provision for 10 ml to 50 ml with gas & liquid exit. Computer control for process control & data manipulation independently.
- Fail-safe operations through programmable logical controllers.

Accuracy: Precise & accurate readings

Applications :
Kinetic studies of catalytic vapour reactions, process optimization and catalytic screening and evaluation

Department/Location : Chemical Engineering/Reaction Engineering Laboratory

Model:
Batch Reactors - 5 litres & 2litres (SS)

Operational aspects:
Batch and semi-batch operation

Accuracy:

Additional features:
Completely automated

Application:
For batch and semi-batch processes of fine chemicals, pharmaceuticals, polymerization processes etc

Department/Location:
Chemical Engineering / PP2

Model:
Fermentor - 5 litres & 2litres (glass)

Operational aspects:
Batch and semi-batch operation

Accuracy:

Additional features:
Completely automated

Application:
For biochemical reactions

Department/Location:
Chemical Engineering / Pp2

Model :
Distillation column with packing (40mm dia) & 5L reboiler capacity - glass

Operational aspects:
Batch and semi-batch operation

Accuracy:

Additional features:
With flexible height (1.5 m to 3m), liquid-liquid separator for reflux, reboiler with electric heating and control panel with temperature display

Application:
For separations and reactive separations

Department/Location:
Energy & Chemical Engineering / Pp2

Model:
Distillation column with packing (40mm dia, 1.5m height) & 5L reboiler capacity - glass

Operational aspects:
Batch and semi-batch operation

Accuracy:

Additional features:
With condenser and reboiler temperature controllers, provision for use of bubble cap tray column and sieve tray column

Application:
For separations and reactive separations

Department/Location:
Energy & Chemical Engineering / Pp2

Model :
Tubular reactor with 2 liquid feeds and 3 gaseous feeds with furnace (300 ml capacity)

Operational aspects :
Continuous operation

Accuracy:

Additional features:
Automated

Application:
For endothermic gas-liquid or liquid-liquid reactions

Department/Location:
Energy & Chemical Engineering / Pp2

Dust Explosion Unit

Model : KSEP 20/332 Ver 5.0

Operational Aspects : The tests are conducted at NTP Dust samples used during tests are of 200 mesh size (particle size 63 m) or sometimes tests are conducted based on specific samples supplied by client.

Special Provisions : The tests for mixture of solvent vapours, flammable gases, hybrid mixtures (dust and gases) can be conducted.

Specifications : Volume of sphere : 20 litre

Design pressure : 30 bar

Design temperature : 60°C

Accuracy : ± 0.2%

Applications : The unit is very much useful to find the explosion indices of a dust, gas and hybrid mixtures. It is also useful for determination of limiting oxygen concentration (inerting), lower and upper explosion Limits of gases and solvent vapours.

Department/Location:
Chemical Engineering Division /
Process Safety Centre

Varied Unit Operation

Distillation Unit with Stainless Steel material of construction 20 lit, 50 lit and 100 lit its capacity to distill or recover the liquids from solids.

Stirred Tank Reactors: Stirred tank reactors of 20 lit. 50lit and 100 lit. capacity in Stainless Steel, MSGL with all the accessories like reflex condenser, receiving condenser and heating arrangement to the jacket with steam or hot oil or cold water circulation and with variable speed to stirrer.

Dryers: Electric tray dryers 24 tray capacity vacuum shelf dryers 12 trays, Rotacone dryer, 130 lit volume with heating arrangements, Stainless steel spray dryers to separate solids from liquid having 10 lit per hour capacity. A mini Glass Spray dryer of 1 lit capacity, Buchi make .

Centrifuge: Basket type used to recover the very dilute suspended particle from liquids water Stainless Steel Rubber lied and ebonite lining to the basket

Fractionation Unit: Porcelain filter, SS vacuum filter, high pressure filter

Units for physical separation of coarse materials: The required mesh size can be achieved by usage of sieve shakers, hammer mills fitted screen and roller mill.

ALL GLASS Reactor / Distillation / Separation units

Distillation Fractionation units with 20, 50, 100 lit capacity having facility to control the reflux action, reflux condenser, receiving condensers having media steam Electric used to recover the solvents

Stirred tank reactors: 10, 20, 50 and lits capacity with reflux condensers and jacked to circulate cold or hot fluids to get the required temperatures and with variable rpm.

SOXHlets: 10 Lit and 100 liters Solid liquid extraction units available

1" dia and 3" dia Shuffle column for liquid-liquid continues extractor

Rotavapour: 10, 20 and 100 lit units capacity to separate or to recover solvents under vacuum, reaction mixture which contain solvents can be removed immediately after reaction.

Units available in Pilot Plant I

	Specifications/ Unit Description	Capacity	MOC	Details
1.	Distillation & Fractionation unit	20 lit	All glass	Max work Temp. 200oC Max. work Pr. 1kg/cm2 Reflux head, Elec. Heating mantel
2.	Distillation & Fractionation unit	20 lit	All glass	Max work Temp. 200oC Max. work Pr. 1kg/cm2 Reflux head, Elec. Heating mantel
3.	Distillation & Fractionation unit	50 lit	All glass	Max work Temp. 200oC Max. work Pr. 1kg/cm2 Reflux head, Elec. Heating mantel
4.	Reactor unit	10 lit	All glass	Agitator speed 150 rpm Max. work Pr. 1kg/cm2 Jacket Heating /cooling
5.	Reactor unit	10 lit	All glass	Agitator speed 150 rpm Max. work Pr. 1kg/cm2 Jacket Heating /cooling

Units available in Pilot Plant I

	Specifications/ Unit Description	Capacity	MOC	Details
6.	Reactor unit	20 lit	All glass	Agitator speed 150 rpm Max. work Pr. 1kg/cm2 Jacket Heating /cooling
7.	Reactor unit	50 lit	All glass	RDA 2"diax3' Length Max. work Pr. 1kg/cm2 Jacket Heating / cooling
8.	Reactor&Distilation unit	100 lit	All glass	Agitator speed 750 rpm Max. work Pr. 1kg/cm2 Jacket Heating /cooling
9.	Rotary Evaporator units	20 lit x 3nos	All glass	Electrically heated water bath with condenser receiver
10.	Rotary Evaporator unit	10 lit	All glass	Electrically heated water bath with condenser receiver
11.	Rotary Evaporator unit	100 lit	All glass	Electrically heated water bath with condenser receiver
12.	Distillation & Fractionation unit	200 lit	All glass	12"Dia. Column10'Height Electrically heated water bath Reflux head, Elec. Heating mantel
13.	Solid Liquid Extraction unit	100lit	All glass	Feeding 10 kg solid to feeder Feeder flask, packed column 6" dia x 10" height, steam Heating
14.	Short column dist. unit	100 lit	All glass	Electrically heated mantel with condenser receiver 5&10lit
15.	Solid liquid extraction unit	20 lit	All glass	Extraction by socking with condenser receiver
16.	Vacuum filtration unit	10 lit	SS	--

Units available in Pilot Plant II

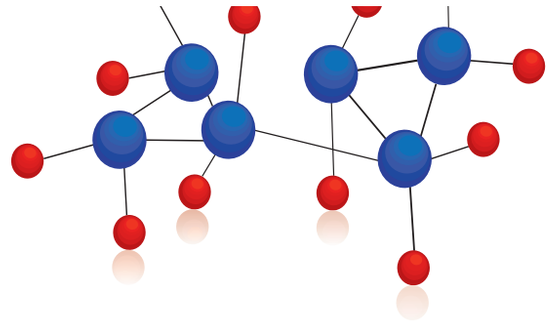
1.	Distillation unit	20 lit	Stainless steel	Steam Jacketed
2.	Centrifuse unit	20 lit	Ebonite	Basket type Max. Speed 1000rpm
3.	Centrifuse unit	5 lit	Stainless steel	Conical type Liquid-liquid separation
4.	Centrifuge unit	5Kg	Stainless steel	Vertical basket type
5.	Spray dryer unit(Lurgi)	10Kg	Stainless steel	Automiser speed 20000
6.	Spray dryer unit(BuChi)	1Kg	All glass	--
7	.Ball Mill	4Kg	Mild steel	High speed
8.	Roller Mill	--	Rubber	--
9.	Attrition Mill	5lit	Stainless steel	Water cooled, stirred
10.	Reactor/ Distillation unit	50 lit	Stainless steel	Stirred & Steam Jacketed
11.	Distillation unit	50 lit	Stainless steel	Stirred &Steam Jacketed

Units available in Pilot Plant II

	Specifications/ Unit Description	Capacity	MOC	Details
12.	Reactor/ Distillation unit	100 lit	MSGL	Agitator60-100rpm
13.	Reactor/ Distillation unit	50 lit	MSGL	Agitator60-100rpm
14.	Open pan Reactor unit	100 lit	MSGL	Agitator60-100rpm
15.	Open pan Reactor unit	50 lit	SS-316	Agitator60-100rpm
16.	Open pan Reactor unit	20 lit	MSGL	Agitator60-100rpm
17.	Rota cone dryer unit	100 lit	MS	Jacketed, steam heated
18	Short Path Distillation unit	1 lit	GLASS	POPE Sci Instruments
19.	Crytaliser	2 Lit	Glass	Syrris Make

Units available in Hydrogenation Plant (High Pressure Reactors)

1.	Reactor unit	500 ml	Stainless steel	Electrically heated Max. work Pr. 100kg/cm2 Variable speed stirrer
2.	Reactor unit	600 ml	Stainless steel	Electrically heated Max. work Pr. 180kg/cm2 Variable speed stirrer
3.	Reactor unit	1.0 lit	Stainless steel	Electrically heated Max. work Pr. 100kg/cm2 Variable speed stirrer
4.	Reactor unit	1.0 lit	HastelloyC-4	Electrically heated Max. work Pr. 100kg/cm2 Variable speed stirrer
5.	Reactor unit	1.0 lit	Nickle	Electrically heated Max. work Pr. 100kg/cm2 Variable speed stirrer
6.	Reactor unit	2.0 lit	Stainless steel	Electrically heated Max. work Pr. 100kg/cm2 Variable speed stirrer
7.	Reactor unit	10 lit	Hastelloy C-32	Electrically heated Max. work Pr. 100kg/cm2 Variable speed stirrer
8.	Reactor unit	10 lit	Stainless steel	Electrically heated Max. work Pr. 100kg/cm2 Variable speed stirrer
9.	Reactor unit	20 lit	Stainless steel	Electrically heated Max. work Pr. 15kg/cm2 Variable speed stirrer
10.	Reactor unit	50 lit	Stainless steel	Electrically heated Max. work Pr. 50kg/cm2 Variable speed stirrer
11.	Reactor unit	500 ml & 1.0 lit	Glass	Max. work Pr. 5kg/cm2 Variable speed stirrer
12.	Shakker unit	500 ml & 1.0 lit	MS	Max. work Pr. 40PSI Variable speed



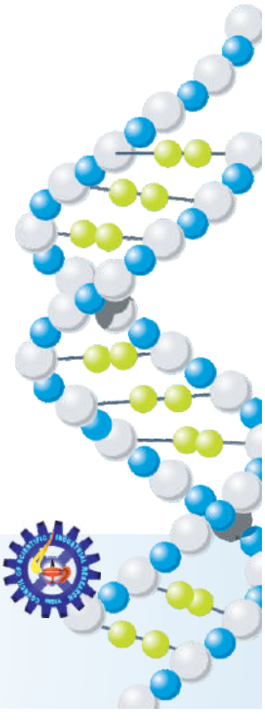
Coal & Gas Technology

Area of Expertise

- Development of suitable technologies for rational utilization of low-grade coals available in the country
- Carbonization of Coal & Biomass materials
- High Pressure Moving Bed Gasification of Coal to produce clean fuel gas for power generation from IGCC
- Scale-up & Techno-Economic Assessment of Gasification of Coal for IGCC Power Generation
- Economic Evaluation of Clean Coal Technological Options by Incremental Costing
- Fuel processing technologies for fuel cell applications.
- Gas Clean up & Separation of Gases
- Coal S&T(analytical) services
- Indigenous technology development for direct conversion of Indian Coals to Liquid Fuels
- Improvisation of Moving bed Pressure Gasification of coal by recycling tar & oil and carbon dioxide
- Alternative Fuels & Fuel Additives from biomass-derived liquids, (e.g. MTHF from Levulinic Acid.)
- Pressure Swing Adsorption for Gas Separations
- Carbon dioxide capture for sequestration by forming gas hydrates

Projects Completed

- Technology development for Low-Temperature Carbonization of non-caking coals in a 24 tpd pilot plant
- Technology development for high pressure briquetting of coke fines and slack coals
- Transfer of LTC and Briquetting technologies to M/s Singareni Collieries Co. Ltd., Kothagudem for their 900 tpd commercial venture 'COAL CHEMICALS COMPLEX', at Ramakrishnapuram, AP (1978).
- Establishment of 24 tpd moving bed pressure gasification pilot plant: UNDP-Assisted Thrust Area Project (1980-85).



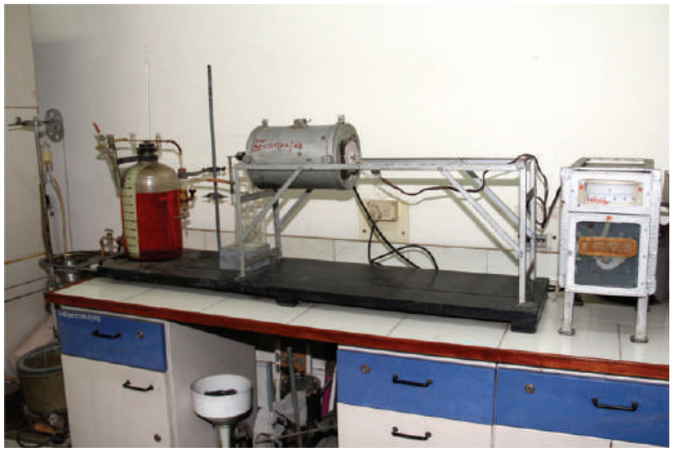
- Moving bed pressure gasification of different low-grade Indian coals(1986)
- Data generation on Gasification characteristics of High-Ash North Karanpura Coal from Bihar for Techno-Economic Assessment of IGCC for Clean Power Generation.(1990)
- Preparation of Techno-Economic Feasibility Report for a 600MW Conceptual IGCC power plant using high-ash North Karanpura coal(1992)
- Monitoring, Standardization & Quality control of coal.
- Preparation of project proposals for submission to GEF funding on behalf of TERI (2002).
- Preparation of detailed project brief for submission of GEF on 'Demonstration of moving bed gasification of coal for industrial heating application in the cluster of pottery kilns at Khurja, near Meerut in U.P.(2002)
- Production of Clean Fuel Gas from Coal-derived gases using Reactive, Regenerable Sorbents for Sulphur Removal and Candle Filters for Fine Particulates Control (2005)
- Medium-temperature, Multi-contaminant Cleanup of Simulated Coal Gas mixtures using Reactive, Regenerable Sorbents for removal of Sulphur, Ammonia & Alkali metal vapor (2011)
- Evaluation of the British Gas-Lurgi (BG-L) coal gasification process for its suitability to low-grade Indian coals (2010)

Technologies Available

- Moving bed pressure gasification of low-grade Indian coals
- Hot Gas Clean Up for Dust removal & Desulphurization of Coal-derived Fuel Gases at 850oC and 20kg/cm2.
- Denitrification, Desulfurization and Dealkalization of Coal-derived Fuel Gas at 500oC and 20kg/cm2.

Facilities

Gray-King Carbonization Assay



Make :
M/s Transitrol, Mumbai

Operational Aspects :
Operated at high temperatures in the range (500-900°C)

Additional features :
Coupled with energy regulator capable of allowing temperature rise @5°C/min

Application :
Product spectrum (yields of coke, tar, liquor and gas) from carbonization of solid fuels under specified conditions

Division/Location :
Analytical Lab, Coal & Gas Technology

Carbon-Hydrogen Analyzer

Make :
M/s Therelek, UK

Operational Aspects :
Modified Fentons method developed at CFRI, Dhanbad. Total
combustion of sample in a stream of oxygen and absorbing of different
products by suitable absorbers

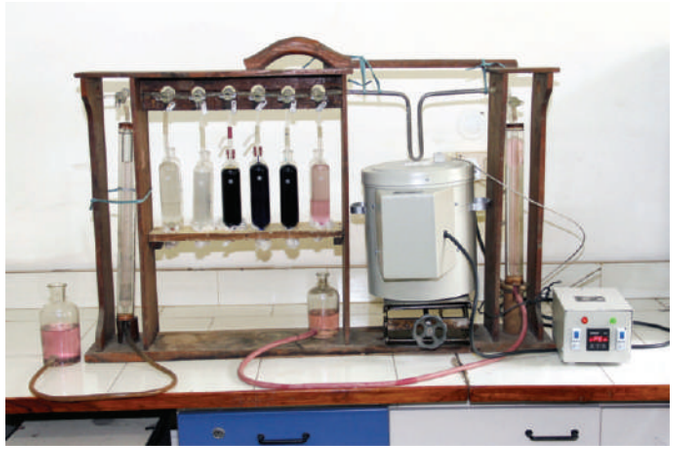
Accuracy : 0.2%

Additional features :
High temperature furnace

Application :
To determine the Carbon & Hydrogen in solid and liquid fuels.

Division/Location :
Analytical Lab, Coal & Gas Technology

ORSAT Gas Analyzer



Make /Model :
M/s Meghna Industries, Mumbai

Operational Aspects :
Preferential absorption of individual gases present in the fuel gas Mixtures in different absorbents

Accuracy : ±0.2%

Special provisions :
Coupled with high temperature furnace

Application :
To determine the chemical composition of the gas sample.

Division/Location :
Analytical Lab, Coal & Gas Technology

Ash Fusibility Apparatus

Make :
E. Leitz Wetzlar, Germany

Type :
REDYX Nr 34550

Special provision :
Equipped with heating microscope and photographic recording

Mode of operation :
Electrically heated under oxidizing/reducing atmosphere

Application :
Determining the melting behaviour of fuel ashes, slags, glazes, enamels, glass and ceramic substances

Division/Location :
Analytical Lab, Coal & Gas Technology

Hard Grove Grindability Apparatus

Make :
M/s H.W.Wallace & Co. Ltd, UK

Operation aspects :
Test-sample of coal is ground under specified conditions in a standard laboratory mill. The size-consist of the product obtained on applying a definite amount of energy is used to rate the relative grindability of the sample in comparison with a standard soft coal having the index of 100. Harder the coal, lower is the index.

Additional features :
Equipped with a revolution counter and an automatic device for stopping after stipulated revolutions.

Application :
To determine Hard Grove Grindability Index of Coal (HGI) which, is a measure of hardness of coal solids.

Division/Location :
Analytical Lab, Coal & Gas Technology

Automatic Adiabatic Bomb Calorimeter

Make :
M/s Gallenkamp-England

Model :
CB-110

Special Provision :
Equipped with Telescopic vision

Operation Aspects :
High pressure Bomb capable of burning completely solid and liquid fuels under oxygen pressure with adequate safety factor

Application :
To determine the Gross Calorific Values of solid and liquid fuel samples.

Division/Location :
Analytical Lab, Coal & Gas Technology

Gas Chromatograph

Make :
M/s Agilent Technologies, USA

Type :
Process Analysis Instrument

Model : Agilent 4890 D

Operational aspects :
Dual Detector facility TCD/FID

Purpose :
Analysis of Gaseous and liquid samples

Division/Location :
Analytical Lab, Coal & Gas Technology

IR Gas Analyzer

Make :
M/s. Thermo Fisher Scientific, USA

Type :
Online Process Instrument

Model : 48-i

Mode of Operation :
Atmospheric & Continuous

Purpose and Accuracy:
Detection of CO up to 1 ppm

Division/Location :
Analytical Lab, Coal & Gas Technology

High Pressure Autoclave

Make :
M/s Amar Equipments Pvt Ltd, Mumbai

Type :
Vertically Mounted Batch Reactor

Volumetric Capacity :
500 ml

Operating Conditions:
Up to 600°C & 100 kg/cm^2

Application :
For conducting reactions under pressure

Division/Location :
Gas Separations Plant, Coal & Gas Technology

Gas Mix Synthesis Apparatus

Model/Type :
Fabricated at M/sTransTech Projects, Pune

Special Provisions :
A low pressure Gas-mix receiver fed through a static mixer the individual gas components from pure gas cylinders in desired proportions; a gas booster that could compress the mixture to pressures up to 65 kg/cm^2 and a buffer vessel to store the HP simulated mixture

Application :
Physical Simulation of different gas mixtures that need cleanup at HT/HP conditions

Location/Division :
Gas Separations Plant, Coal & Gas Technology

Gas Heater

Model/Type:
Fabricated at M/s Montech Instruments, Chandigarh

Special Provisions :
Inconel gas conduit coil embedded in ceramic mould is energized to maintain a skin temperature of about 1200°C in order the gas stream at 20kg/cm^2 reached 850°C;

Application :
Preheating the simulated sour gas mixtures to above 500°C to enable adsorption at 850°C.

Location/Division :
Gas Separations Plant,
Coal & Gas Technology

Hot Gas Desulphurizer

Model/Type :
Fabricated at M/s Montech Instruments, Chandigarh

Special Provisions :
Split-furnace heaters around the reactor sections and adsorptive desulfurization in dual-bed adsorbers to enable recovery of the sulfur removed during counter-current regeneration of the beds

Application :
Desulphurization of simulated sour gas mixtures at HT/HP conditions (850°C & 20 kg/cm^2)

Location/Division :
Gas Separations Plant,
Coal & Gas Technology

Hot Gas Candle Filter

Model/Type :
Fabricated at M/s Uniexcel, Mumbai

Special Provisions :
Silicon Carbide candles for Filtration and HP back-pulse nitrogen reservoir for purging the filter candles

Application :
Removal of fine particulates from simulated dusty gas mixtures at HT/HP conditions (850^{0}C & 20 kg/cm^2)

Location/Division :
Gas Separations Plant,
Coal & Gas Technology

Dusty Gas Simulator

Model/Type :
Fabricated at M/s Montech Instruments, Chandigarh

Special Provisions :
Split-furnace heaters around the reactor sections and adsorptive desulfurization in dual-bed adsorbers to enable recovery of the sulfur removed during counter-current regeneration of the beds

Application :
Desulphurization of simulated sour gas mixtures at HT/HP conditions (850°C & 20 kg/cm^2)

Location/Division :
Gas Separations Plant,
Coal & Gas Technology

Dealkalizer

Model/Type :
Fabricated at
M/s Montech instruments, Chandigarh

Special Provisions :
Equipped with an ingenious in-situ Surface Ionization Detector for detecting alkali metal vapor in syngas mixtures

Application :
Addition of alkali metal vapor to simulated syngas mixtures by salt sublimation for its subsequent removal by adsorption at HT/HP conditions (400°C & 20 kg/cm^2) and in-situ detection of alkali vapor content before and after cleanup

Location/Division :
Gas Separations Plant, Coal & Gas Technology

Gas Chromatograph

Model/Type :
GC – 1000 of M/sChemito make, equipped with TCD, FID & FPD

Special Provision :
On-line gas sample-conditioning system

Application :
Estimation of gas mixture composition before and after cleanup

Location/Division :
Gas Separations Plant, Coal & Gas Technology

Instrumentation (Pilot Plant Facilities)

Area of Expertise

- Rendering assistance for upscaling of CSIR-IICT laboratory scale and other agencies processes.
- Providing designs, commissioning of special purpose equipment and pilot plant facilities.
- Providing consultancy services to outside agencies.
- Establishment of Bench Scale experimental units procured for specific R & D purpose provided with solutions in the design of process measurement and automation systems.
- Providing Process Automation System Engineering Solutions.
- Preparation of Process & Instrumentation Diagram based on the Process Flow Diagram, directly interacting with the respective Process Groups.
- Preparation of Instrumentation Detailed Engineering based on the Instrumentation provided on the P & Ids.

Design Engineering

Area of Expertise

- Mechanical design and engineering of process plants at pilot and commercial scales.
- Process plant safety, risk and hazard analysis
- CAED software development and design automation for plant engineering
- Process equipment and Heat exchanger design
- Detailed equipment drawings and specification sheets
- Piping engineering and design, pipe routing drawings, piping GA plans, piping isometrics, piping BOQ and material specifications
- Equipment design appraisal using Finite element analysis
- Equipment arrangement plans and elevations
- 3D plant modeling
- Project planning and monitoring
- Safety audit, hazard analysis, fire hydrant design

- Dynamics of expansion bellows
- Analysis of vibrations and stability of fluid conveying pipes
- Material processing by severe plastic deformation
- Acoustic analysis of process equipment

Detailed / Basic design reports are available

- Low Temperature Carbonization
- Monocrotophos
- Chlorpyriphos
- Butachlor
- Undecenoic Acid (UDA) (except Section 300)
- HFC-134a
- TrimethylPhosphite
- Glyoxal
- Sodium azide
- Castor oil derivatives
- Cyanuric chloride
- Castor oil Derivatives
- TBBAz

Facilities

Single Tube Reactor Setup

High Temperature single tube Catalytic fixed-bed reactors are the most important type of reactor for the synthesis of basic chemicals and intermediates. In these reators, the reaction takes place in the form of a heterogeneously catalyzed gas reaction on the surface of catalysts. In addition to the synthesis of valuable chemicals, fixed-bed reactors have been increasingly used in recent years to treat harmful and toxic substances.

Operational Aspects:

- 3/4" NB Dia X 500 mm length, 80 SH pipe, Hast-C.
- Pressure 30 bar
- Temperature 500oC.
- Mass flow controller for Nitrogen flow and Co^2
- Liquid input through metering pump.
- Provision for gas cooling and gas liquid separator.

Location :
Reaction Engineering Pilot Plant

High Temperature Skid Mounted Reactor Setup

High Temperature single tube Catalytic fixed-bed reactors are the most important type of reactor for the synthesis of basic chemicals and intermediates. In these reators, the reaction takes place in the form of a heterogeneously catalyzed gas reaction on the surface of catalysts. In addition to the synthesis of valuable chemicals, fixed-bed reactors have been increasingly used in recent years to treat harmful and toxic substances.

Operational Aspects:

- ¾" NB Dia X 1000 mm length, 80 SH pipe, inconel 800 HT.
- Pressure 10 bar
- Temperature 1000^{0}C.
- Mass flow controller for gas input, liquid input through pump.
- Weigh balance with Accuracy of 0.1 kg capacity 35 kg.
- Provision for gas cooling and gas liquid separator.

Location :
Reaction Engineering Pilot Plant

Bubble Column Reactor

Bubble Column Reactor is used for gas-liquid reactions, consisting SS 316 & Perspex vertical cylindrical columns for undertaking Pressure & atmospheric Reactions. The introduction of gas takes place at the bottom of the column and causes a turbulent steam to enable an optimum gas exchange. The mixing is done by the gas sparing and it requires less energy than mechanical stirring. The liquid can be in parallel flow or counter-current. Bubble column reactors are characterized by a high liquid content and a moderate phase boundary surface. The bubble column is particularly useful in reactions where the gas-liquid reaction is slow in relation to the absorption rate. Bubble column reactors are used in various types of chemical reactions.

Reactor R-101
- MOC: Ss316 L
- Column I.D: 106 mm
- Column Height 1500 mm
- Operating Pressure – 12kg/cm2
- Operating Temperature 100oC

Reactor R-102
- MOC: Perspex
- Column I.D: 106 mm
- Column Height 1500 mm
- Operating Pressure – Atm.
- Operating Temperature Ambient

The System is equipped with:
- Mass Flow controller for Air
- Liquid Flow Mass flow controller: 6 – 30 Lit/hr
- Rotameter: 36 – 360 Ltr/hr
- System is controlled by PLC, SCADA system.

Location : Reaction Engineering Pilot Plant

High Performance Liquid Chromatograph

Model :
Shimadzu LC-2010A

Operational Aspects :
HPLC – Analytical (Flow rate 0.01-5.00ml/min)
Auto injector tem controlled (-4-60 deg C)

Special Provisions :
Photodiode array detector (190-800nm)
UV-Visible detector
Reftractive Index Detector

Accuracy : +0.01%

Applications :
Traditional medicines and herbal medicines

Department/Location :
Reaction Engineering Laboratory

Facilities

Computer Aided Drafting

Model :
AutoCad Mechanical 2013 on Windows Platform with Pentium based workstations.
Operational Aspects :
Multiuser facility with A4 to A0 size monochrome printing/plotting
Special provisions : 3-dimensional modelling, 2-dimensional detailed engineering drawing, Customized menu driven operations. Different software packages useful in process plant design & detailing are available.
Applications :
Can be used to make accurate and crisp two and three-dimensional detailed engineering drawings like process flow sheets, P&I diagrams, process plant layouts, piping detailed drawings and isometrics, detailed equipment mechanical drawings and so on.
Department/Location :
Design & Engineering Division/II Floor, Main Building

Computer Aided Design

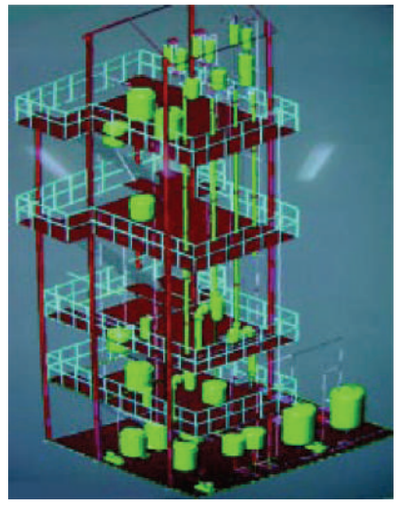
Model:
Standard & Proprietary packages as well as software developed in-house for the mechanical design and detailing of pressure vessels, heat exchangers, FRP Pressure vessels, tube layout for heat exchangers and pressure drop calculations in pipelines. Available on Windows Platform with Pentium based Workstations.

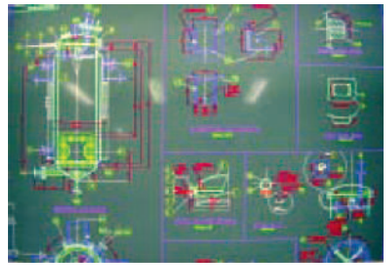
Operational Aspects :
Autocad Inventor 2013 , Solidworks Premium and 3D Studio Max Software on Windows Platform with high end xeon based Graphics Workstation ; Multiuser facility with A4 to A0 size monochrome printing.

Special provisions :
Designs are as per the requirements of various national and international codes like ASME, BS, BIS and TEMA standards. Customized to suit quick and reliable design.

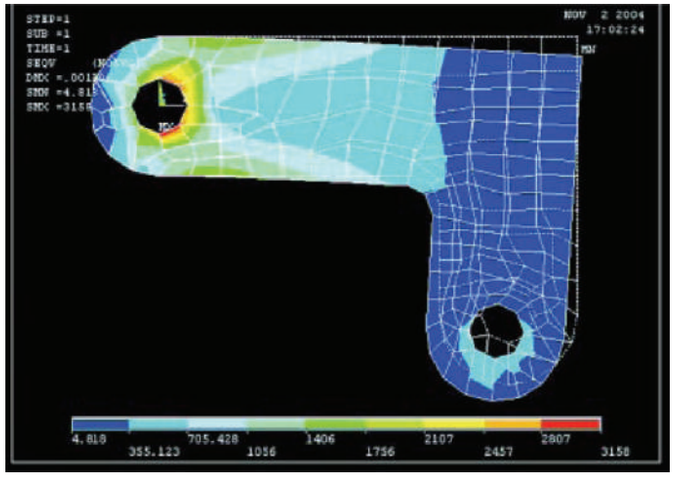
Applications :
Can be used to design various process equipment made of different materials of construction including fiber reinforced plastics. Accurate drawings of tube layout for heat exchangers can be produced. Can also be used to develop customized design software utilizing the expertise available.

Department/Location :
Design & Engineering Division/II Floor, Main Building.





Design Appraisal Facility



Model : Finite Element Analysis Packages like ANSYS Multiphysics . Available on Windows Platform with Pentium based workstations

Operational Aspects : Multiuser facility with A4 to A0 size colour/monochrome printing

Special provisions : Powerful modeling and analysis tools, capable of analyzing static, dynamic, stability, axisymmetric, contact problems.

Applications : Can be used to design and analyse various process equipment and other structural components made of different materials of construction including fiber reinforced plastics.

Department/Location :
Design & Engineering Division/II Floor, Main Building

Scanning and Drawing Conversion

Model : A0 size monochrome scanner and several A4 size colour scanners with raster to vector conversion software and AutoCad 2013. Available on Windows Platform with Pentium based workstations.

Operational Aspects : Multiuser facility with A4 to A0 size colour/monochrome printing and A0 size photocopying.

Special provisions : -

Applications : Can be used to scan drawings on paper/tracings and convert them to a digital format. Also used to convert scanned images to vector format to enable editing in standard software like AutoCad 2002. Large format photocopying (A0) facility is also available after digitizing,vectorizing and printing.

Department/Location : Design & Engineering Division/II Floor, Main Building

Facilities

Project Engineering Expertise & Services at IICT

The Engineering Services Division (ESD) of the Institute has excellent range of generic machine tools and engineering skills to cater to the needs of in-house R&D activities, development of experimental prototypes and design & project engineering expertise for the development of special infrastructural facilities.

Prototype expeller in the shop floor

ESD designed modernised laboratory

The machinery include the following:

- Lathe machine (size : 12 ½" x12 to 10 ½" x14")
- Radial drilling (2" dia.)
- Milling machine (Universal & vertical)
- Slotting machine (S-L/3-60)
- Shaping machine (24")
- Shearing machine (25mm)
- Sheet bending& cutting machine (upto 3mm)
- hammering machine
- automatic double column horizontal band saw machine (300mm X 300mm)
- hydraulic press (63 tons)
- metal joining facilities like welding transformers & rectifiers
- State of the art Glass blowing equipment & facilities

Design & project engineering expertise for the development of special infrastructural facilities include:

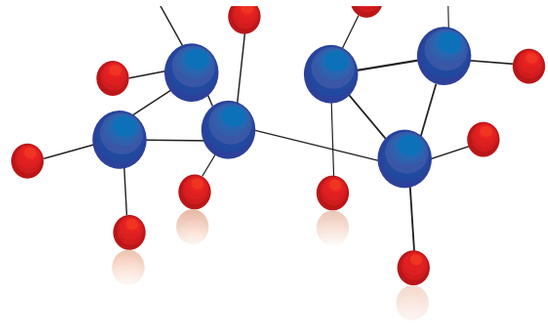
- The development of modern chemical laboratories complete with fume hoods, spot extractors, work benches with utilities fittings for gas (nitrogen), water, vacuum, storage cabinets, fume hoods confirming to ASHRAE, SEFA and OSHA standards with the objective of maximum utilisation of space.
- Design & development of low cost screw expellers for expulsion of oil from Jatropa, Karanja seeds and other high oil bearing seed materials.

Project Engineering Expertise & Services at IICT

DG Sets

Synchronous Panel

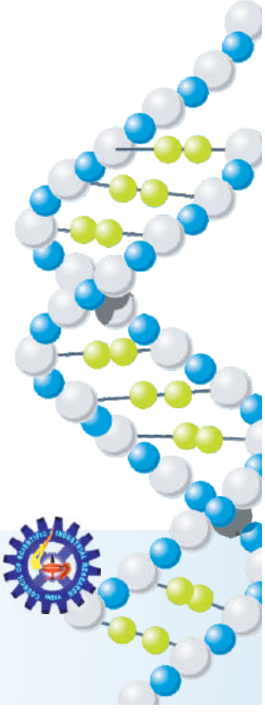
- Drawing of specification, planning and procurement of Variable refrigerant flow (air-conditioning) systems for part load applications.
- Drawing of specification planning and procurement of stand-by power generation units and solar power generation.
- Design and fabrication of custom made glass reactors, distillation columns, and other R&D glass apparatus.



Information and Computational facility

Area of Expertise

- Computer-aided studies
- Software development
- Inter-disciplinary collaboration with other IICT departments
- Information Network Systems (INS)
- Education & Training (HRD)
- Human Resource Development
- Evolutionary computing and Global Optimization Metaheuristics
- Reliability, Optimization and Analysis, Fault Tree analysis, Quantitative assessment and Risk Contouring.
- Multivariate statistical Modeling
- Data Mining



Facilities

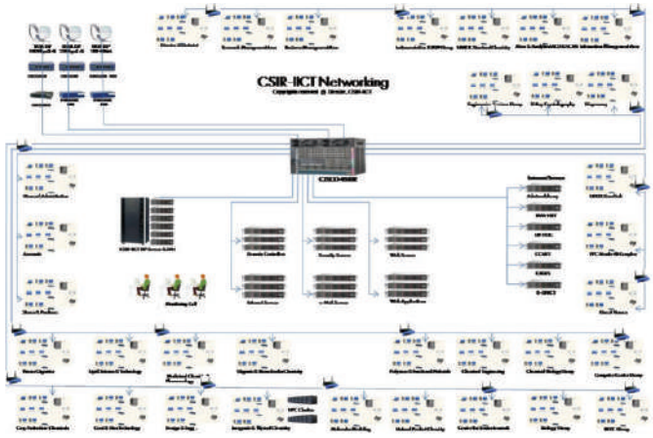
Information Management (Library)

The Library is a large information repository with resources both in electronic and print formats and offers a wide variety of information services.

- Subscribes to a large numbered scientific journals in Chemical & Life Sciences with an annual budget of about Rs. 400 lakhs.
- Chemical Abstracts in print from 1907 and on CD from 1996 onwards.
- Electronic access to about 3500 scientific journals through intranet of Laboratory.
- E access to Web of Science – a large Indexing and Abstracting database covering 14000 journals from 4000 publishers.
- SciFinder facility for specific literature search.
- Collection of books and bound volumes more than a million in number.
- Specialized Electronic Database
- In house bindery facility.
- User rooms with Internet & CD database browsing.
- Circulation, Reference, News Paper clippings, Inter library loan and Translation Services for Foreign language articles to its internal users.
- Bibliometric studies and management of research output through IICT Research Publications.

Facilities

COMPUTER CENTRE at CSIR-IICT is one of the oldest in CSIR functioning since 1966. It has centralized resource facilities for entire campus. The main aim of computer centre is to provide IT enabled Internet and Intranet services to all scientists, research scholars, technical and administrative staff of CSIR-IICT. Following are the facilities and activities provided by computer centre.



Networking Facilities

Campus wide network of CSIR-IICT comprises of fibre optic backbone highway connectivity between several multi-storeyed buildings within the campus and Ethernet connectivity within the buildings that facilitate high-end data transfer. It is a heterogeneous network system operating under Windows and Linux operating systems. About 800 desktops/ laptops are connected to the network. For the sake of convenience and manageability, the entire campus is divided into 40 VLANs.

Network Infrastructure Facilities

- Cisco routers – 2 nos
- Cisco CSM firewall – 1 no
- Cyberoam UTM – 2 nos
- CISCO core switch – 1 no
- 16 port Layer-3 distribution switches – 15 nos
- 24 port Layer-2 edge switches – 75 nos

Network based IT Services

A. Internet Services

Internet bandwidth is provided through internet leased lines from TATA with 180 mbps bandwidth and from BSNL with 23 mbps bandwidth. The National Knowledge Network (NKN) is a state-of-the-art multi-gigabit pan-India network for providing a unified high speed network backbone for all knowledge related institutions in the country. The objectives of NKN are to enable scientists, researchers and students from different backgrounds and diverse geographies to work closely in emerging areas. All CSIR labs are the core members of NKN and CSIR-IICT is connected to it. National Informatics Centre (NIC) is the implementing agency of NKN and 100 mbps bandwidth expandable to 1 Gbps was provided by it to CSIR-IICT. Scientists, research scholars and other user departments of CSIR-IICT avail these services in carrying out their research activities.

B. Intranet Services

Server Operating Systems
- Windows 2008
- Centos 5.0 Linux

Services on Windows platform
- Domain controller
- LDAP
- Local DNS
- DHCP
- WINS
- WSUS
- Antivirus/ Antispam/ Antimalware
- Web services
- Intranet mai

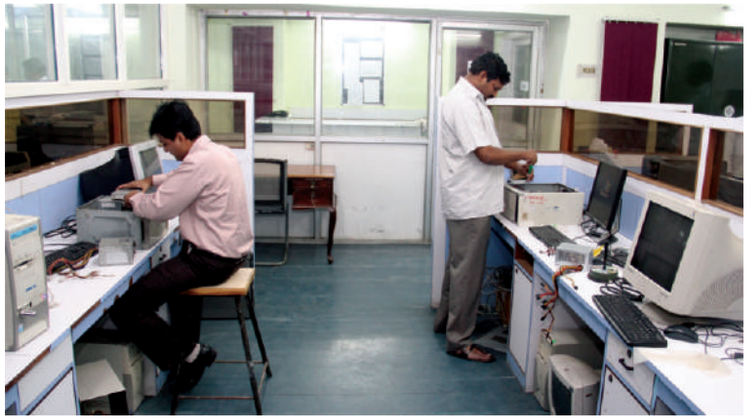
Services on Linux platform
- Public DNS
- Squid Proxy server
- Sendmail email server on Linux
- Web server

RDBMS services
- Oracle server on windows
- MS-SQL server on windows 2008

C. Software Development

Computer centre in association with concerned departments develops applications software in their respective areas of requirement. Following are the software developed:

- Project Information System – Distribution of monies of various Consultancy and Sponsored projects
- CCNET – an intranet website for frequently used software tools and applications
- Visitors' information System – for Security department of IICT.
- Medicines inventory management System - for IICT Dispensary
- Pathological Tests Reporting System – for IICT Dispensary.
- Seminars portal – to design and host websites for publicity of Seminars/ Conferences/ Workshops that are being organised at CSIR-IICT



D. Education & Training

Computer Centre periodically organises training programmes for staff in familiarizing with application software and office automation works.

E. Network based Services and Facility Management

Computer center provide services in desktop and network related trouble shooting works for its staff. These services relate to installation, update and configuration in OS, software, hardware, network, systems security etc.

Synergistic Collaboration: CSIR-IICT and Industry

CSIR-IICT has a rich pool of scientists with a broad range of research interests and expertise enabling multidisciplinary teams to work on various research & industrial products and processes. The ongoing research activities are wide-ranging, reflecting the diversity of modern chemical sciences and engineering. The research thrust is to develop and deliver processes for both small and large industries.

A new initiative has been launched to bring industry closer to our research efforts. The **CSIR-IICT: Industry R&D Consortium** aims to carry out research to develop new processes/products and improve existing industrial processes. The main objective of this consortium is to pursue challenging research projects that benefit industry and society.

CSIR-IICT Industry R&D Consortium

R&D Partnership

- Participate in ongoing research & industrial programmes of the Institute
- Fine tune corporate R&D strategies.
- Formulate the scope of research programmes of the Institute
- Early access to research results
- Utilize the consultancy services of the Institute
- Suggest new R&D problems/ products/ processes

R&D Interactions

- Participate in seminars and interactive Meets
- Discuss and review research findings of the Institute.
- Interact with other partners and scientists in a non-competitive environment.
- Exchange programmes
- Customized training programmes

CSIR-IICT invites the industry partners to join the **CSIR-IICT: Industry R&D Consortium.**

For further details contact

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सी एस आई आर - भारतीय रासायनिक प्रौद्योगिकी संस्थान
(वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद)
तारनाका, हैदराबाद (आ.प्र.) भारत

CSIR-Indian Institute of Chemical Technology, Hyderabad (CSIR-IICT) is a premier R&D institute under the aegis of Council of Scientific and Industrial Research, Ministry of Science and Technology, New Delhi. It has made significant contributions in the last seven decades in Chemical Science and Technology.

Major areas of Research at CSIR-IICT are: Natural products Chemistry, Agrochemicals including Pheromone Chemicals, Drugs & Intermediates, Organic Coatings and Polymers, Catalysis, Material Science, Lipid Science & Technology, Chemical Biology, Analytical Chemistry, Environmental Sciences, Coal, Gas & Energy, Chemical Genomics & Biotechnology and Chemical Process Engineering.

CSIR-IICT has state of the art facilities like National Mol Bank, HTS for Chemical Library Generation & Screening, LCMS, NMR, XRD, SEM, TEM, AFM, ESCA, Laser Raman, Ultrafast Laser Spectroscopy, Fluorescence Correlation Spectroscopy, Automated Robotic Synthesizers.

CSIR-IICT has a rich pool of scientists/ research supervisors numbering about 200 and over 600 PhD students. CSIR-IICT has active collaborations with several countries including France, Germany, UK, Switzerland, Italy, USA, Australia, Japan and Korea.

IICT provides technologies for:
(Lab/bench/pilot plant scale)

- Agrochemicals/Pheromone Chemicals
- Drugs & Pharmaceuticals
- Lipid Science & Technology
- Surface Coatings/Adhesives/Polymers
- Industrial Organic/Inorganic Chemicals/ Intermediates/Specialty Chemicals
- Catalysis
- Fluoro Organic Chemicals
- Functional and Nanomaterials
- Coal, Biomass Gasification and Bio-diesel
- Biotechnology Based Products

IICT provides knowledge based services for:

- Physicochemical and thermal characterization of heterogeneous and homogeneous catalysts
- Custom synthesis
- Molecular modelling for drug design
- Combinatorial libraries for analoguing
- Drug master files
- Chemical finger printing
- Invitro & invivo entomological/toxicological/ pharmacological screening of bioactive molecules.
- Basic/Detail engineering packages for pilot plant & commercial plant
- Pilot plant facilities for upscaling of processes
- Process simulation, optimisation & control
- Process safety
- Catalytic reaction engineering

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