

ENVIRONMENTAL MANAGEMENT

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Capability

Environmental problems are inseparably associated with coal conversion and processing. CIMFR-Digwadih Campus is copiously involved in carrying out R & D work in the area of environmental management related to coal-based industries. This includes the monitoring of quality of air (aerosols, biotic/abiotic particulates), water, soil and suggesting/developing appropriate methods for their minimizing/abatement; development of environmental standards, soil quality index; making environmental impact assessments and management plans; mitigation of GHGs; management of solid waste from coal-based industries, principally the fly/bottom/pond ash from TPPs and mine refuse/spoil generated during mining operations, besides addressing the associated environmental problems. In the context of sustainable management of solid waste from TPPs, systematic R & D work has been successfully carried out, over the past one and half decades or so. This comprises detailed physico-chemical characterization and determination of potentially toxic trace/heavy metals and radionuclides in coal ash and its bulk use in brick making and agriculture/forestry sector (as liming agent, soil modifier and amendment, source of essential plant nutrients, and also for the reclamation of waste/degraded lands/low lying area/mine spoil/abandoned ash ponds). Besides, R & D work includes the diversified area for developing the suitable technology for recovery of some of the value-added products. The institute also organizes national/international symposia/seminars and training courses on various R & D activities from time to time.

As such CIMFR-Digwadih Campus has developed wide ranging expertise and created excellent infrastructure facilities- in terms of both technical manpower and equipment, for solving the problems of environmental concerns of various coal-based industries. It has well equipped laboratories, backed by richly experienced and qualified scientists in different disciplines such as Agriculture Chemistry, Soil Science, Microbiology, Biotechnology, Botany, Environmental Science, Analytical Chemistry (for chemical, biological and instrumental analyses), Radiation chemistry, Chemistry, etc. all under one roof of the Environmental Management Division for carrying out such work in the area of management of environment.

Facilities

The facilities available in the Division cover the following purpose:

- Characterization of fly ash/soil/crop produce/ash leachate
- Durability characteristics of fly ash/clay bricks/blocks
- Analysis of ambient air/stack gases/water/noise
- Measurement of photosynthetic rate/stomatal conductance/transpiration rate/leaf area/canopy characteristics
- Qualitative and quantitative characterization of air borne bioparticulates (pollen, fungal spores, algae, insects, etc.)

Facility-wise, the equipments available at CIMFR-Digwadih campus for undertaking different R & D work on utilization and characterization of fly/bottom/pond ash, soil, crop

produce, ash pond effluents, ground/surface water for various physico-chemical parameters including the analysis of toxic/heavy metals, nutritional parameters, radioactivity and also for monitoring the various air/water pollutants and their abatement strategies are as follows:

Soil Analysis

- Ceramic Pressure Plate Extractor for determination of moisture in soil at different bar
- Tensiometer
- Semi automatic Nitrogen distillation system

Water Analysis

- Toxicity Characteristics Leaching Procedure (TCLP) System
- BOD Incubator

Air Monitoring

- Leica Bright-Field Microscope (Japan) with photography arrangement
- Nikon Scanning Microscope
- High Volume Sampler
- Respirable Dust Sampler
- Stack Monitoring Kit
- Orsat Apparatus
- Graham Lawrence Apparatus
- Flue Gas Analyser (IMR, USA)
- Burkard Air Sampler (Burkard, U.K.)

Common Equipment (for air, water, soil & plant analysis)

- Alpha Counting System (Canberra, USA)
- Millenium Ion Liquid Chromatograph (Waters, USA) for the analysis of cations, anions, trace/heavy metals, amino acids, proteins, PAHs, PCBs, pesticides etc.
- Ion Analyzer (Orion)
- Permeameter

- Hydraulic Conductivity Test Kit (Eijkelkamp, Denmark)
- Millipore Filtration Unit
- Millipore RO+ and Milli-Q for HPLC grade water
- Microwave Digestion Unit (Prolabo, France)
- Refrigerated Centrifuge for Microbiological work
- Portable Photosynthesis System (CI-210, USA)
- Portable Leaf Area Meter (CI-201, USA)
- Portable Sunscan Plant Canopy Analyser (Delta T Devices, Cambridge, U.K.)
- Vibrating Table
- Visible Spectrophotometer (Spectronic 20 D)
- Ethoprovision System for Insect Trapping

Upcoming facilities

- ICP-Atomic emission Spectrometer
- GC-MS
- Total Organic Carbon Analyser
- UV-Vis Spectrophotometer
- Gel Electrophoresis System
- Flame Photometer
- CO₂ Analyser
- Stereoscopic Microscope
- Portable Weather Monitoring Station
- Tilak Air Sampler
- Anderson Air Sampler

Customers and Beneficiaries

The different entrepreneurs and beneficiaries of the technologies developed are

1. West Bengal Power Development Corporation (Bakreshwar TPP)

2. National Thermal Power Corporation (Farakka, Ramagundam)
3. Neyveli Lignite Corporation, Tamil Nadu
4. Maharashtra State Electricity Board (Chandrapur STPS, Bhusaval TPS, Koradi TPS, Khaparkheda TPS)
5. Uttar Pradesh Rajya Vidyut Utpadan Nigam Ltd. (Obra TPS, Anapara STPS, Harduaganj TPS)
6. Bharat Coking Coal Ltd, Dhanbad
7. Mahanadi Coalfield Ltd., Sambalpur, Orissa
8. Tata Steel, Jamadoba, Dhanbad
9. Ministry of Agriculture
10. Ministry of Environment & Forests
11. Ministry of Energy, Dept. of Coal, GOI
12. Central & State Pollution Control Boards
13. Local Farmers in the vicinity of different TPPs

Technologies Developed

The expertise/processes/technologies developed at the Institute on the coal ash utilization encompass such diversified areas as:

Fly Ash Soil Amendment Technology (FASAT)

CIMFR-Digwadih Campus has developed fly-ash soil amendment technology (FASAT), which has been extensively demonstrated through field trials under different agro-climatic conditions and soil types in different parts of the country for cultivation of various cereals, oil yielding, root, leguminous and vegetable crops in actual agricultural fields/waste land/mine spoil and for growing different forestry species.

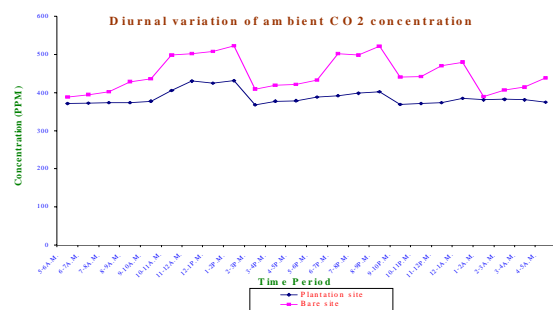


- **Waste Land Reclamation**

- **Reclamation of Mine Spoil/OB Dumps/low lying area**
- **Bio-restoration of abandoned Ash Pond**
- **Urea Fly-Ash Pellets**

Mitigation of GHG through Afforestation and in situ infusion of Fly Ash

Technology for Mitigation of GHG (CO₂) through plantation of different photosynthetic-efficient plant species has been successfully developed. Also a process for in situ infusion of fly ash with CO₂ in TPPs leading to substantial mitigation of GHG in TPPs has been developed.



Bio-solubilisation of Lignite to Humic Acid

Process for bio-solubilisation of lignite to humic acid using fungal and bacterial strains has been successfully developed, which is quite comparable with the standard humic acid and found rather superior in nutritional status especially for agro-forestry application in an eco-friendly manner particularly in respect of trace/heavy metals and PAH (Under process).

Fly ash bricks/blocks

The process for the manufacturing of high strength fly ash bricks using a high percentage of fly ash along with other ingredients like lime, sand, etc. by steam curing process has already been patented and commercialized at Jaggadhatri Brick Works, Barrackpore, Pulver ash Projects, W.B. (IP No. 128684, 1970)

Value added products from fly ash

The process for the extraction of different value added materials including hard scouring powder

on a commercial scale has been developed.(US Patent No.10/107, 613 US dt.28.03.2002; PCT Patent No.PCT/IB02/011 : WO 26-03-2002)

Other Activities:

- Assessment of Aerosols/Abiotic and Biotic particulates, their periodical variations in and around coal fields and other coal-based industries; correlation between such particulates and prevailing seasonality; find out associated allergenic disorders; preparation of pollen and fungal spore calendar.
- Insects as Biosensor, Identification of insects and evaluation of their risk to human and ecological health with reference to coal mining and processing industry; suggesting of remediation, developing an index of biological integrity.
- Rapid and Comprehensive Environmental Impact Assessment studies have been made at the industrial sites of TALOJA & TARAPUR of MIDC, Mumbai for selection of integrated hazardous waste management sites.

Specialised services:

- # Leaching characteristics of solid wastes
- # Consultancy Services for Safe Disposal and Gainful Utilization of Coal Ash
- # Monitoring of different pollutants of air (aerosols, abiotic and biotic particulates) and water, preparation of pollutant calendars and suggesting the abatement strategies
- # Environmental Impact Assessment and management Projects
- # Soil Quality and Human Health
- # Development of Nanopesticides
- # Soil-C sequestration through Bio-Char
- # Testing Facilities

Symposium/Refresher Course/ Training:

CFRI has been conducting various programmes, i.e. organizing of Seminar, Refresher Course,

Training and Extension programme for popularization of bulk use of fly ash through demonstration trials in the fields of farmer of the local villages in the vicinity of different TPPs, apart from organization of Kisan gosthis and Kisan mela from time to time.



Discussion on beneficial uses of Fly ash with farmers



Technical enquiry

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Provides excellent expertise
in Improving Your Waste Land
Through Fly Ash Utilization

Fly Ash Soil Amendment Technology (FASAT)

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- **Improvement in physico-chemical properties of the soils**
- **Substantial increase in crop yield (20-60%)**
- **Early maturity of crops**
- **Higher nutritional value of the crops**
- **Less pest incidence**
- **No carry over of the trace/heavy metals/radioactivity beyond permissible limits and without any other adverse effect**
- **Encouraging growth performance of various plant species including the timber, oil yielding, fruit bearing and ornamental and medicinal plants.**

This technology covers the following areas:

Waste Land Reclamation

Waste/degraded land/low lying areas near in the vicinity of different TPPs viz. Farakka STPP, Bhusawal TPS, Chandrapur STPP, Harduaganj/ Obra/ Anpara TPPs of UPRVUNL, NLC and in the State of Jharkhand have been reclaimed

and made suitable for crop farming /social forestry /medicinal plants through bulk use of fly-ash. Fly-Ash has been established to act as excellent soil conditioner/ modifier.



Wasteland Management (Cultivation of Medicinal Plants)
**Waste land management
(Cultivation of Medicinal plants)**



**Reclamation of Low Lying
Area filled with FBC ash at
Jamadoba, Dhanbad**



**Paddy cultivation in Mine
Spoil at NLC Neyveli (TN)**

Reclamation of Mine Spoil/OB Dumps

Mine spoil/refuge in the vicinity of different mines such as BCCL, NLC, MCL have been successfully reclaimed using the FASAT and other amendments depending on the fertility of the mine spoil/refuge and various crops and plant species including timber, oil yielding, fruit bearing and ornamental, and medicinal plants have been grown with encouraging growth performance and established the suitability of the technology for crop farming/social forestry through bulk use of fly-ash.



Bio-restoration of abandoned Ash Pond/low lying area

Technology for restoration of biological system in abandoned ash pond and make it productive and suitable for agro-forestry purpose via biotechnological methods in eco-friendly manner has been successfully developed.



Approximate Cost of FASAT package: Rs 25,000.00 per acre, including transportation of pond-ash up to 25 km @ 50 t/ha

(The figure is indicative only and will vary depending upon soil types and agro-climatic conditions and distance of ash transportation).

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