Centre for Cement Research and Independent Testing
CEMENTS AND OTHER BINDERS

Services Offered

- Establishing Limestone Consumption Factor (LCF)
- Characterization & Evaluation of raw materials & Fuels
- Optimization of raw mix design
- Utilization of marginal / low grade limestone in the manufacture of cement and building materials
- Development of newer cements, composite formulations, alternate binding materials
- Improving clinker/cement quality
- Investigations on lump formation in cement silos/bags and remedial measures
- Effect of minor constituents on clinker/cement quality
- Optimization of SO$_3$ content in cement
- Studies on use of mineralizers in clinkerization

Achievements

- Meeting delivery schedules and targeted quality of delivered cement through minimizing/eliminating lump formation in silos/bags for 6 cement plants.
- Utilizing flyash, low grade limestone and additives in cement manufacturing through optimization of raw mix design for 44 cement plants.
- Optimisation of cement properties such as, setting time and early strength through optimization of clinker quality, PSD and SO$_3$ content.
- Carried out 143 LCF studies for cement plants resulting in:
  - Rationalization of limestone consumption
  - Estimating limestone royalty payable
  - Internal material audit in cement plants
Achievements

<table>
<thead>
<tr>
<th>Waste Materials</th>
<th>Benefits based on NCB Studies</th>
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<tbody>
<tr>
<td>Flyash from Thermal Power Plants</td>
<td>Increase in utilization up to 8% in PPC manufacture and 85% in brick manufacture</td>
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<tr>
<td>Lead-Zinc Slag (ISF Slag) from Hindustan Zinc Ltd.</td>
<td>Utilization up to 6% as raw mix component, and 5% as performance improver in OPC</td>
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<tr>
<td>Copper Slag from Sterlite Industries Ltd.</td>
<td>Utilization up to 2.5% as raw mix component, and 5% as performance improver in OPC</td>
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<tr>
<td>Steel Slag from Tata Steel Ltd.</td>
<td>Utilization up to 2% as raw mix component, and 5% as performance improver in OPC</td>
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<td>Spent Pot Lining from NALCO</td>
<td>Utilization up to 1.5% as raw mix component</td>
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<tr>
<td>Red Mud from NALCO</td>
<td>Utilization up to 4% as raw mix component</td>
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<tr>
<td>E-cat from Oil Refinery</td>
<td>Utilization up to 10% in manufacture of blended cement</td>
</tr>
<tr>
<td>Marble Dust from Marble Industries</td>
<td>Utilization up to 5 to 15% as raw mix component</td>
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<tr>
<td>Soda Ash Sludge from Soda Ash Industry</td>
<td>Utilization up to 6 to 25% as raw mix component</td>
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<tr>
<td>Lime Sludges from Different Industries</td>
<td>Utilization up to 25 to 70% as raw mix component</td>
</tr>
<tr>
<td>Jarosite from Hindustan Zinc Limited</td>
<td>Utilization up to 1.5% as raw mix component</td>
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Brick sample from cement kiln at 24 m indicated heavy discoloration due to infiltration of gases.

Corroded rotary kiln shell

Crushed light weight sintered aggregate

REFRACTORIES AND CERAMICS

- Diagnostic studies / investigations related to
  - Premature refractory failures in cement rotary kilns
  - Damage assessment during shipment of refractories
  - Quality evaluation of fresh refractories lot at cement / refractory plant
  - Loosening of brick rings in cement rotary kiln during operation
  - Coating and build-up formation/ring formation
  - Kiln shell corrosion

- Refractory management studies and optimization of refractory lining performance

- Development and technology transfer of refractory lining products

- High temperature investigations
  - Devitrification studies of slag, alumino silicates, etc.
  - Refractory-raw mix interaction studies

- Technical suitability of industrial wastes in refractory and ceramic industries

- Comprehensive thermal investigation of refractories using state-of-art equipments heating microscope, thermal analyzer, PCE, RUL, Spalling, PLC, etc.

Achievements

- Developed high performance refractory products for cement plants:
  - Alumina Zircon Refractory (AZR) Bricks for transition zone
  - Magnesia Spinelide Refractory Bricks for burning zone
  - High Strength Insulating Bricks for preheating zone
  - Coating Repellent Castables for build-up prone areas

- Light weight sintered aggregate based on 99.5% industrial wastes for construction industries.

- Use of NCB-AZR bricks in rotary kiln improved productivity by up to 10%.

- Trouble shooting services to 20 cement plants with following benefits:
  - Kiln uptime increase by up to 12%
  - Fuel consumption reduction by 2-3%
  - Lining performance synchronization for one year
  - Trouble free kiln operation

Services Offered

- Refractory kiln furniture utilizing spent catalyst from refinery
- Ceramic pottery-wares utilizing refinery waste
**FUNDAMENTAL AND BASIC RESEARCH**

**Areas of Research**
- Exploratory studies related to materials science
- Application of nano technology for enhancing the cement performance
- Development of novel cement systems and additives such as geopolymer, composite cement, portland limestone cement etc.

**INDEPENDENT TESTING**

**Services Offered**
- Complete physical, chemical, mineralogical and micro structural analyses of various types of cement, clinker, pozzolana, aggregate, concrete, admixtures, water, refractories, bricks, limestone and other raw materials, coal, lignite, etc as per national and international standards.

**Achievements**
- About 7000 samples are tested every year. The samples are mainly from BIS, Cement and Construction Industries and public sector organizations in India as well as from neighbouring countries.

**Facilities**
- ISO 9001-2008, NABL Accredited and BIS Certified Laboratories
- Laboratory Information Management System (LIMS)
  - Performs coding of samples, generation of test reports and data storage and retrieval
  - Facilitates smooth and efficient operations in Test House
- State-of-the-art testing equipment
**X-RAY DIFFRACTOMETER (XRD)**
- Diagnostic studies on unstable kiln coating, ring formation, build-ups and kiln shell corrosion.

**X-RAY FLUORESCENCE SPECTROMETER (XRF)**
- Chemical characterization of raw materials, additives, clinker, cement, pozzolanic materials, gypsum, etc.
- Facility for bead preparation.

**FOURIER TRANSFORM IR SPECTROMETER**
- Fully automatic, computerized and state-of-the-art equipment
- Determination of functional groups such as carbonate, sulphate, silicate, aluminate, etc.
- Characterization of cements, admixtures and fuel.

**CHNS ANALYZER**
- Ultimate analysis of various types of fuels for carbon, hydrogen, nitrogen and sulphur.

**ADIABATIC BOMB CALORIMETER**
- Computerized and fully automatic instrument.
- Determination of calorific value of coal and other fuels.

**PARTICLE SIZE ANALYZER**
- Fully automatic and rapid analysis of particle size distribution in cement and other powder samples.
DIFFERENTIAL THERMAL ANALYZER
- Thermal behavior of raw materials, kiln feed and fuels up to 1450°C.
- Decarbonization and clinkerization reactions.
- Hydration characteristics of cements.

INDUCTIVELY COUPLED PLASMA SPECTROMETER
- Estimation of toxic and non-toxic elements present in trace amounts in cements, industrial waste/by-products, water, effluents, etc.
- Rapid and simultaneous analysis of elements.

OPTICAL MICROSCOPE
- Mineralogical, microstructural, granulometric analysis of raw materials, aggregate and clinker etc.
- Evaluation of different types of coarse and fine aggregates for alkali-silica reaction.
- Petrographic investigation of silt of different origin.
- Model percentage and granulometric analysis of fly ashes and slags.
- Petro fabric analysis of rocks.

AUTOMATIC COMPRESSION TESTING MACHINES
- 2000, 1000, 350, 100 & 50 kN capacities.
- Compressive strength determination of cement mortar and concrete samples.

HEATING MICROSCOPE
- High temperature behaviour of raw materials, fuel ash, refractory, etc.
- Sintering studies.
- Initial Deformation Temperature (IDT), Spherical Temperature (ST), Hemisphere Temperature (HT) and Flow Temperature of Fuel Ash.

SCANNING ELECTRON MICROSCOPE WITH EDXA
- High magnification (upto200000x) and high resolution (3nm) microstructural, nanostructural investigations and elemental mapping of clinker, hydrated cement, aggregate and concrete etc.
- Point-to-Point chemical Analysis by EDXA.
OUR VALUED CUSTOMERS/BENEFICIARIES

- A. P. Government, Hyderabad
- Bureau of Indian Standards
- Central Pollution Control Board, New Delhi
- Central Pulp and Paper Research Institute, Saharanpur
- Delhi Metro
- Dhrangdha Chemical Works, Dhrangdha
- Gammon India
- Hindustan Zinc Limited, Udaipur
- Indian Oil Corporation, R & D Centre, Faridabad
- Jindal Steel Works, Torranagullu
- L&T
- Ministry of Environment and Forests, Govt. of India
- National Aluminium Company Ltd., Bhubaneswar
- National Environmental Engineering Research Institute, Nagpur
- National Mineral Development Corporation, Hyderabad
- Rajasthan State Pollution Control Board, Jaipur
- Rajasthan State Minerals Development Corporation, Jaipur
- Reliance Industries Ltd.
- State Directorates of Mines and Geology
- Sterlite Industries (India) Ltd., Tuticorin
- Tata Steel Limited, Jamshedpur
- Thermal Power Plants - Nasik, Panki, Obra, Badarpur, Faridabad, Kota, Dhanu
- United Nations Industrial Development Organisation

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