Recovery of Cleans from Coal Fines

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CFRI- At a Glance

- **An internationally reputed Coal R & D Institute**
- **Accredited with ISO 9001 : 2000 certification : The First National Laboratory under CSIR to achieve the honour.**
- **Has proven expertise in the following areas :**
  - **Resources Quality Assessment**
  - **Coal Preparation**
  - **Coal Carbonisation**
  - **Coal Combustion**
  - **Coal Gasification**
  - **Environmental management**
  - **Fly Ash Utilisation**
  - **Synthetic Fuels and Chemicals**
  - **Basic Research on Coal**

➢ CFRI's Contribution on Coal Preparation

- Washability investigation on more than 1500 coal samples
- Development of flow sheet for beneficiation of coal
- Planning of Existing Coal Washeries
- Feasibility studies and technical assistance in Tender Evaluation
- Performance evaluation and Guarantee test for all Washeries
- Investigation on Beneficiation of Power Coals of India

➢ CFRI's Contribution on Coal preparation

- Multi-stage washing of Low Volatile Coking Coal of Jharia Coal Field
- Pollution controlled closed circuit Mini Flotation Plant
- Development of Oleo Flotation Technology
- Development of Oil Agglomeration Technology
- Concept of Characteristic Ash for Global Optimization

➢ Coal Preparation Facilities at CFRI

1) Large coal washing pilot plant, 40 tph capacity comprising of
   a) Jig : Capacity 20 tph
   b) Heavy Medium Drum Separator : Capacity 20 tph

Fully equipped with transfer units, screens, crushers, PL controlled instruments to operate the plant in 8 different circuits

2) ***Modern Fine Coal Treatment Pilot Plant with on line instruments and PL control comprising of the following facilities/circuits :***

i) Experimental batch Rotary Breaker, 3.5 dia

ii) Primary Crushers x 100/50 mm (inclosed circuit) operating on different principals
a) Shear b) Impact c) Compression

iii) Closed Circuit Secondary Crushing House

iv) Size classification circuit with provision of controlled spray water

v) 200 mm HM cyclone Unit

vi) Spiral circuit

vii) A battery of Flotation Cells with de-watering devices

The above facility is also utilized to carryout tests on Oleo flotation process

viii) Oil agglomeration unit

R & D Studies at CFRI on upgradation of Coal fines

CFRI has been working on the treatment of coal fines/finely ground high ash coals/Middlings for a long time.

The Institute has developed the following processes to meet the requirement of the coal based industries mainly the Steel Industries

- Improved Froth flotation Process
- Oleo flotation Process
- Oil Agglomeration Process

Improved Froth flotation Process

1. CFRI has developed an Improved Floation Process for the beneficiation of high ash coal slurry.

2. The process can recover finest cleans (less than 15% ash) from Indian coal slurry.

3. This is a cost effective process for beneficiating high ash coking coal fines

4. Three Flotation Plants having 10-15 tph capacity plants have been installed by Private firms on CFRI Process

Novelty of the Process

- Superior design of Flotation cell with self suction of input slurry from conditioner.
- Provision of secondary feeding for re-treatment of froth/tailings.
- Pulp level control in each flotation cell.
- Special emulsifier (low powered), designed and fabricated at CFRI.
- Belt discharge type vacuum filter.
- Gravity filtration tank for drying of tailings for use in briquette making, brick burning, etc.
- Completely closed water circuit process.
- No air or water pollution.

Oleo Flotation Process

- Oleo Flotation Process has been developed at CFRI for the beneficiation of Natural slurry and dewatering of concentrate with cyclone cleans in centrifuge.
- The thick slurry is conditioned with two reagents comprising diesel oil and fraction of tar oil.
- The conditioned pulp after dilution is treated in flotation cells with controlled aeration to separate concentrate as oil flocs.
- After partial removal of water, the concentrate is mixed with over size cyclone cleans.

- The combined clean coals are dewatered in centrifuge.
- The final product is having moisture content of 6-8%.
- The process provides for cleaning and dewatering of coal fines to the acceptable limit in terms of ash and moisture content.
- Oleo flotation pilot plant of 20 tph capacity with around 40 tph dewatering arrangements of combined cleans has been set up in the Sudamdih washery of BCCL.
- It is CFRI patented process.

Oil Agglomeration Process

- CFRI developed an emerging process called "Oil-Agglomeration" for the effective beneficiation of coal fines, finely ground high ash coals and washery middlings. The process has three distinct merits
- High yield of cleans with very low loss of carbonaceous matter through tailings.
- Easy dewatering characteristics of cleans and
- Improvements in the coking propensities of the cleans.
- Coal fines or finely ground high ash coal / middlings in thicken slurry under controlled pH are agitated in a suitable designed conditioning vessel with mineral oil

- The coal particles get preferencially coated with thin layer of oil.
- These selectively coal particles along with non-combustiles and water are agitated in an agglomeration cell in presence of agglomerating oil.
- Clean coal particles form dense, compact and spherical agglomerates and mineral matter remain dispersed in water;
- These materials (agglomerates and tailings) are passed over a bent sieve followed by a vibrating screen.

- The agglomerates being bigger in size are separated and collected and the water carrying the mineral matter passes through the aperture of the screen.
- The process provides an attractive method of beneficiation and dewatering.
- The process has been successfully demonstrated in a 2 tph plant at Lodna, BCCL.
- A 10 tph demonstration module was installed and commissioned at Patherdih washery, BCCL.

It is a CFRI patented process.

Present R & D Studies on Coal fines

Processes based on Surface Properties

1. Froth Flotation
2. Flotation by Jameson Cell
3. Column Flotation
4. Oleo Flotation
5. Oil Agglomeration

Physical Processes

6. Spiral
7. Water Only Cyclone
8. Multi-gravity Separator
9. Falcon Separator
10. Kelsay Jig

Thank you