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BENEFICIATION OF LOW GRADE LIGNITE OF BARMER RAJASTHAN (INDIA)

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ABSTRACT

The Lignite mining waste at Giral mining site in Barmer district of Rajasthan referred as clay-lignite interburden has been identified as a potential source of energy. The interburden consists of finely dissipated lignite in clay. The upgradation of this waste has been carried out through development of cost effective sustainable technology. The carbonaceous clay with calorific value of the order of 2500 kcal/kg have been obtained.

Key words: Lignite, Beneficiation, Low grade, Barmer.

INTRODUCTION

The state of Rajasthan in Indian Union is endowed with the large reserves of lignite in the districts Barmer, Nagaur, Bikaner and Jaisalmer. Lignite is being mined at Giral mines of Barmer. The mining waste at Giral mines is termed as clay-lignite interburden consisting of lignite bends of varying thickness up to 0.50 m, which are finely dissipated in clay layers in between two lignite seam,s has been identified to be energy rich.

Lignite values present as over burden and inter burden

The ‘intercalation of lignite and carbonaceous clay, was bound to possess C. V. between 1001 and 2000 kcal/kg. It has no commercial value and is treated as waste. This particular part has been referred as Clay Lignite Inter Burden Waste **(CLIW)** in present investigation.

The representative samples from boreholes and pits were analyzed for proximate analysis and the results are reported in Table 1 and accordingly, an area was selected from

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where we can withdraw a bulk sample of CLIW having C. V. between 1800 and 2000 kcal/kg, for our beneficiation study.

Table 1: Proximate analysis of representative seam lignite samples collected from Giral mines

S. No.	Specifications of the samples	% Moisture	% Volatile matter	% Fixed carbon	% Ash	C.V.*
1	S-1, MS-North and East side, Jalela Mimes	35	20.29	13.27	31.44	2103
2	S-2, Jallela Mines, Middle part of North and South	35	19.32	6.84	38.84	1527
3	S-3, LS-1, 8A, Giral pit	35	22.60	12.39	30.01	2146
4	S-4, Main seam, Eastern side, Jalela Pit	35	25.73	13.67	25.60	2407
5	S-5, Top and bottom part of main seam, North- west part, depth 28-30 meters, Giral pit	35	22.50	33.43	09.07	1869
6	S-6, A-6, Giral pit	35	21.98	11.11	31.91	2010
7	S-7, A-7, Giral pit	35	22.01	11.46	31.53	2040
8	S-8, R-85 Borehole, Depth 32 meter, Giral Pit-2	35	19.80	4.39	40.81	1350
9	S-9, R-85 Borehole, Depth 45.5 meter, Giral Pit-2	35	9.35	2.59	53.06	680
10	S-10, LS-1, North end, Jalela	35	22.45	8.87	33.68	1850

*C.V. - Calorific value in kcal/kg

Sample from site 5, due to high inorganic matter as revealed in high ash content 33.43% and marginally lower C. V. 1869 kcal/kg was selected for upgradation.

EXPERIMENTAL

Sample preparation and analysis

The inherent moisture of the sample collected was 32%. The raw ore collected was then spread on the floor evenly and is allowed to dry under a ceiling fan for four days. As the lumps start loosing moisture, some cracks begin to appear on the surface of the lumps; slowly these cracks widen and lumps starts to crumble down by itself. At this stage, the bigger lumps were broken into smaller lumps of 40 mm in size with the help of a light hammer to speed up the process of dehydration. Whole of the material is mixed and again spread for another six days. After complete air drying, the material was subjected to dry sieving in the range of 1 mm to 30 mm. After air drying the final moisture of the sample was approximately 5%. A representative sample was prepared by coning and quartering and analyzed for proximate and chemical analysis.

Table 2: Proximate analysis of ROM collected in bulk

Sample	% Moisture	% Volatile matter	% Ash	% Fixed carbon	Calorific value (kcal/kg)
CLIW*	35.00	21.12	32.64	11.24	1978

*CLIW – Clay Lignite Inter Burden Waste

Table 3: Chemical analysis of CLIW collected in bulk.

Sample	% SiO_2	% Fe_2O_3	% Al_2O_3	% CaO	% MgO	% LOI*
CLIW*	16.18	2.63	9.86	0.50	0.20	68.70

*LOI – Loss on ignition.

*CLIW – Clay Lignite Inter Burden Waste

Wet sieving

This experiment was designed on the observation that air dried carbonaceous clay (minerals rich matter) disintegrates quickly in water, when it is kept submerged in water for some time. The particles of carbonaceous clay absorb water, swell and start disintegrating when come in contact of water and transformed into mud, living apart the pieces of energy rich matter (lignite). For the convenience, bigger size lumps were broken into smaller size, up to 30 mm size, so that the surface area of the lumps for the interaction with water will increase and the time for the interaction will reduce.

250 g of air dried sample was dispersed in two liters of water for one hour with occasional stirring. After an hour, the whole mass is subjected to wet sieving in the range of 1 mm to -300 mesh and the respective residues were dried in an oven at 105^0C. After drying, all fractions were weighed separately and analyzed for proximate analysis. The (-) 300-mesh portion is allowed to settle for twenty four hours; then water is decanted and the solid mass was dried in oven at 105^0C, weighed and proximate analysis was carried out.

Table 4: Wet sieving of air-dried sieve fraction

Size distribution and results of proximate analysis of various size fractions after wet sieving. Sample –10 mm to + 5 mm fraction of S-5, original C. V. 2089 kcal/kg

S. No.	Sieve size (mm)	Wt. % retained	% Volatile matter	% Fixed carbon	% Ash	C.V.	Cumulative C. V.
1.	+ 1 mm	58.0	28.67	16.10	20.23	2754	2754
2.	+ 60 mesh	18.0	18.75	7.52	38.73	1554	2474
3.	+ 100 mesh	4.0	16.10	5.30	43.60	1240	2412
4.	+ 200 mesh	3.2	15.80	5.05	44.15	1204	2365
5.	+ 300 mesh	0.8	15.64	5.06	44.30	1197	2354
6.	- 300 mesh	16.0	14.01	4.19	46.80	1044	2145
		100.0					

*C.V. - Calorific value in kcal/kg at 35% moisture

RESULTS AND DISCUSSION

The results of analysis clearly revealed that the size fraction (+) 1 mm is richest in energy contents (volatile matter, fixed carbon and calorific value). The next fraction i.e. (+) 60 mesh is comparatively poor in energy contents than (+) 1 mm fraction. After that, energy contents decreases gradually. The fraction (–) 300-mesh is being the poorest in energy contents, whereas on the other hand, it has the highest mineral contents or ash.

Therefore, it can be concluded that the method of wet sieving could be useful in separating the lignite fraction (+ 1 mm), which is rich in energy from mineral rich matter.

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