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UP GRADATION OF LIGNITE COAL BY WET SIEVE TECHNIQUE FROM MATASUKH MINES OF NAGAUR, RAJASTHAN, INDIA

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ABSTRACT

Energy consumption per capita in modern society, The drastic development in industrial sector, commercial sector due to atomization the energy supply was started by lignite coal along with other energy source in which wet sieve technique is a physical method to up gradation by using size of coal particle with water. The lignite sample contained fix carbon=7.62%, ash= 39.90%, and volatile matter=22.48 % and marginally lowers calorific value =1748.84 kcal/kg. The retained weight= 44.5% of +100 mesh and passing weight =55.5 % for -100 mesh were obtained of fine size rang 100 mesh(0.149mm) to 1mm in wet sieve technique. The material was transformed into a value added product of CV=2332.3 kcal/kg of fine size of lignite coal particle. The wet sieve technique gave CV+583.46 kcal/kg value added lignite coal.

KEYWORDS: Retained weight, Dielectric property.

INTRODUCTION

In order to overcome the dry sieve technique a new sieve technique was proposed to up gradation of lignite coal by using water is referred to as wet sieve technique. In this technique the tape water is used as solvent due to high dielectric property. The tape water was used as normal washing medium [1] in metallurgy and coal industries .By water impurity easily is removed from the lignite coal sample. The salt and ash forming agents are also removed to lignite coal. In naturally occurred the lignite coal of Matasukh mines had already presence with salty water and the extraction of such large amounts of lignite required dewatering [2] of the lignite mines before it was exploited. The lignite coal is heterogeneous organic and inorganic matrix complex having random distribution. The lignite coal of Matasukh mines is of complex macro molecular network structure and consist of organic and inorganic part which is joined by cross linked hydrogen bond and Vander Waal's bonds however these type of bonds were weak nature but are sufficient to bind coal in dry phase. In this mechanism the water soluble impurity is removed with water by dissolving itself and remaining carbon matrix gave up gradation value added lignite after sieving as. The clay is of hydrophilic nature so it absorbs water. This type of clay can be precipitated and removed to up-gradation of lignite coal by absorbing water whereas hydrophobic nature of carbon repel the water eventually the breakdown of sample take place by water absorbing. In present sample the 50% silica was reported in carbon matrix of lignite coal. According to the study of sintering behavior of clays it was observed that above 600°C the first shrinkage phase started due to the collapse of kaolinite or halloysite structure caused by de hydroxylation [3].

$$Al_2O_3(SiO_2)_2 \cdot 2H_2O \rightarrow Al_2O_3(SiO_2)_2 + 2H_2O$$

The organic compound like humic acid was present in lignite coal also formed the sodium salt and dissolve in water as sodium salt [4] in the presence of alkali medium.

$$HUMIC\text{-}OH_{(non\ soluble)} + NaOH \rightarrow HUMIC\text{-}ONa_{(water\ soluble)} + H_2O$$

Here sodium humate is water soluble and dissolve in water having plasticizing properties which is responsible to bind the coal particle each other. The density and porous structure [5] effected the wet sieve beneficiation of lignite coal to

overcome separation of coal particle. Low density and porous structure are in favor of up gradation of lignite coal. The ash particles got settled from the slurry and clear effluent [6] and water was discharged from the ash pond. The mean pore size of the bed > Mean size of the particle concept was applicable the formation of coal particle in sieving. There were organic contents in lignite coal having aliphatic and aromatics derivative took part in to auto air oxygenation [7] and turned into dark brown and black solution which do not bio degradable. This carbon could be detected and isolated by tailing [8] method from solution. This coal solution was highly toxic and phenol compound from a lignite pyrolysis factory was caused an extensive environmental pollution [9] and this carbon could be regained by technologically by an ecologically and economically acceptable strategy.

A binder or called additive could be a liquid or solid that formed a bridge, film, matrix, or causesed a chemical reaction to make strong inter particle bonding [10]. The bio west binder may be used to up gradation of tailing lignite coal. The surface characterization of lignite coal played main role in coal modification processes as wettability [11] and coal water slurry mixture. The total surface of lignite is increased by the formation of fine size 200 mesh 50 mm. The tape water take part into swelling like the other solvent and this was measured as swelling index .The solvent swelling had catalytic effect [12] on pyrolysis kinetics of lignite coal.The presence of alkali metal ions like Na^+, K^+ and alkaline earth Ca^{+2}) had been investigated in lignite coal of Matasukh mines and observed it's catalysts [13] effect for coal gasification .The Na^+ was the principal alkali ion in lignite and bonded to the oxygen anions in the carboxyl groups of oxidative structure of lignite coal while the K^+ ion was in low amount than Na^+. The Na^+ was present as NaCl in salty solution in moisture and adsorbed in coal pores and capillaries. The calcium ion was exchanged with the hydrogen of the carboxyl group of lignite coal with decreasing catalytic activity in burning mechanism.

EXPERIMENTAL SAMPLES AND WET SIEVE METHOD

The experimental lignite coal sample was collected from Matasukh mines of Nagaur, central Rajasthan, India. The basic sample was selected of marginal CV having 1748.84 kcal/kg and its principal parameters with CV had been tabulated in Table =1.The lignite coal sample was of high moisture and impurity with soft in nature.

Materials and sample

The lignite coal sample was dried and sieved by the nesting of sieve 50mm to 298 mesh and divided in 8 fraction group. The all eight fraction size +50mm to 200 meshes were dried in open air and reduced by coning and quartering method. The every fraction was sieved by 100mesh to get fine size coal particle which was subjected to use in wet Sieve technique.

At first the %slurry was performed by adding tape water in 10 gm lignite coal and made up 100 ml coal solution and this 10% slurry having wet sieve lignite coal was separated by+100 mesh at sieve top represented as w_1 gm whereas the passing particle is represented by -100 mesh represented as w_2 gm. The % retained weight R was calculated as bellow formula.

$$\% R = (W_1/W)*100 \quad (1)$$

Here R=retained weight in percentage.
W_1=retained weight in gm.
W_2=passing through sieve in gram.
$W=W_1+W_2$ total weight in gm.
The passing percentages can be calculated as

$$\% P=100-R\%. \quad (2)$$

Here %P= passing percentage of weight, %R=retained weight in percentage passing.
Thus the separated w_1 and w_2 each mesh was ready to proximate and ultimate analysis of the sample by drying and tabulated in Table 2.

Method and experiments.

In this sieve technique the mechanism was carried out by using tape water to up gradation of lignite coal so this possessed wet Sieve technique. In this mechanism air dried lignite coal sample which was subjected to wet Sieve was selected by coning and quartering method and 10% slurry made up by 10 gm coal submerged into tape water made up 100 ml at10 minute occasional stirring. In this mechanism lignite come to contact the tape water and absorbed it so the carbonaceous clay which was present with coal absorbed tape water and started to swell and changed into mud

whereas the energy rich matter was non soluble. The energy rich matter was broken in to small size by increasing the total surface area. After 10 minute the whole mass which was subjected to wet sieving was filtered by +100 mesh and replaced in oven at 105^0 C after complete drying this was weighed and used to determine for proximate and ultimate analysis where as -100 mesh was settled down for 24 hours. Now the water was decanted and dried in oven at 105^0 c. remaining sold mass was weighed and used to determine for proximate and ultimate analysis for wet sieving .The principal parameters and CV were tabulated in Table3.

RESULTS AND DISCUSSION

3.1.The retained weight of +100 mesh was obtained 44.5% in wet sieve technique which show that the carbonic substances is free in the presence of water because the impurities are soluble in water due to high die electric constant whereas the coal particles are repealed in wet sieve technique therefore the % retained weight is the highest for 100mesh (0.149mm) to 1mm fine size. The representation of retained and passing weight in wet sieve technique for +100 mesh and -100 mesh size have been shown in Fig 1.

3.2. The principal parameters are detected by proximate analysis for wet sieve technique. The principal parameters are FC=12.4%, %VM =24.31%, %AS=33.29% at 35% moisture. The wet sieve give beneficiation by reducing AS=1.61% and increasing VM=1.83% and FC=4.78% for+100 mesh fraction whereas reducing %AS=5.52% and mild increasing %AS =0.74% for -100 mesh.

Sintering is defined as the welding together of ash particles into a single solid material which take place below the melting point of the material. The ash of lignite coal shows low sintering than other fuel. The wet sieve beneficiation was represented in Fig 2.

3.3. The fine size fraction of +100 mesh of lignite coal give maximum CV value added product under wet sieve operation. The 100 mesh fraction give CV 2332.3 kcal/kg which is CV+583.46 kcal/kg value added product whereas the-100 mesh fraction shown CV=1761.22kcal/kg having only increased 15.38 kcal/kg for the size rang 100 mesh to 1mm. The representation of CV kcal/kg in wet sieve technique for +100 mesh size and -100 mesh 0.298 to 50mm are represented in Fig3.

CONCLUSION

4.1The retained weight of +100 mesh is obtained 44.5% and 55.5 %passing weight for -100 mesh of fine size in wet sieve technique. In the wet sieve technique therefore the % retained weight is the highest for +100mesh of size rang 100 mesh (0.149mm) to 1mm fine size.

4.2. The principal parameters of 5mm to 0.298mm has been measured in wet sieve technique for+100 mesh and -100 mesh. The beneficiation take place by reducing %AS=1.61% for+100 mesh and %AS=5.52 in -100 mesh of the range of 100 mesh to 1mm in wet sieve technique.

4.3The up gradation of lignite coal in wet sieve technique is taken place successfully in the size range 100 mesh to 1mm for fine size. The 100 mesh fraction give CV 2332.3 kcal/kg which was CV+583.46 kcal/kg value added product whereas the-100 mesh fraction shown CV=1761.22kcal/kg having only increased 15.38 kcal/kg for the size rang 100 mesh to 1mm. The results are represented in Fig4.

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Table =1.Basic CV kcal/kg Moisture=35%.
Dry sieve size=60 mesh.

S. No.	Approximate parameters analysis	Value in %
01	FC	7.62
02	VM	22.48
03	AS	34.99
04	CV kcal/kg	1748.84

VM=Volatile matter
AS=Ash
FC=Fix Carbon
CV=Calorific Value

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Table 2 Each sample Wt=10 gm, Slurry=10%, P^H=Basic, Settle time=10 minute, Sieve size =100 mesh.

S. No.	size in mm	RW gm of+100 mesh	PW gm of-100 mesh	RW % of+100 mesh	PW %of-100 mesh
01	+50mm	3.42	6.58	34.2	65.8
02	20 mm to 50mm	3.92	6.08	39.2	60.8
03	10 mm to 20mm	4.06	5.94	40.6	59.4
04	4.75mm to 10mm	4.32	5.68	43.2	56.8
05	1mm to 4.75mm	4.42	5.58	44.2	55.8
06	**100mesh (0.149mm)to 1mm**	**4.45**	**5.55**	**44.5**	**55.5**
07	100 mesh(0.149mm) to 200mesh(0.298mm)	4.33	5.67	43.3	56.7
08	-200mesh(0.298mm)	4.28	5.72	42.8	57.2

RW=Retained weight, PW=Passing weight

Table 3Wet sieve technique Fix parameters: Slurry=10%, P^H=Basic, Settle time=10 minute, Sieve size =100 mesh, each sample Wt=10 gm.Variable parameters:FC=fix carbon, VM=volatile matter, AS=ashCV=colorific value, +100 mesh= retained in 100 mesh sieve-100 mesh= passing through 100 mesh sieve

		+100 mesh				-100 mesh			
S. N.	Size in mm	%FC	%VM	%AS	CV kcal/kg	%FC	%VM	%AS	CV kcal/kg
1.	+50mm	8.32	19.06	37.62	1635.24	7.17	18.13	39.70	1494.44
2	20 to 50mm	13.66	16.51	34.85	1945.62	10.10	15.97	38.93	1626
3	10 to 20mm	12.86	19.81	46.30	2045.02	9.68	16.16	39.16	1601.76
4	4.75 to 10mm	10.19	20.93	33.88	1882.08	11.55	13.40	40.65	1671
5	1mm to 4.75mm	11.03	22.06	31.73	2051.58	9.35	20.62	35.3	1797.7
6	**100mesh to 1mm**	**12.4**	**24.31**	**33.29**	**2332.3**	**8.36**	**20.53**	**40.51**	**1761.22**
7	100 to 200mesh	10.74	25	34.27	2129.86	9.97	23.12	31.82	1978.04
8	-200mesh	5.22	20.65	39.13	1460	4.82	13.19	51.99	1054

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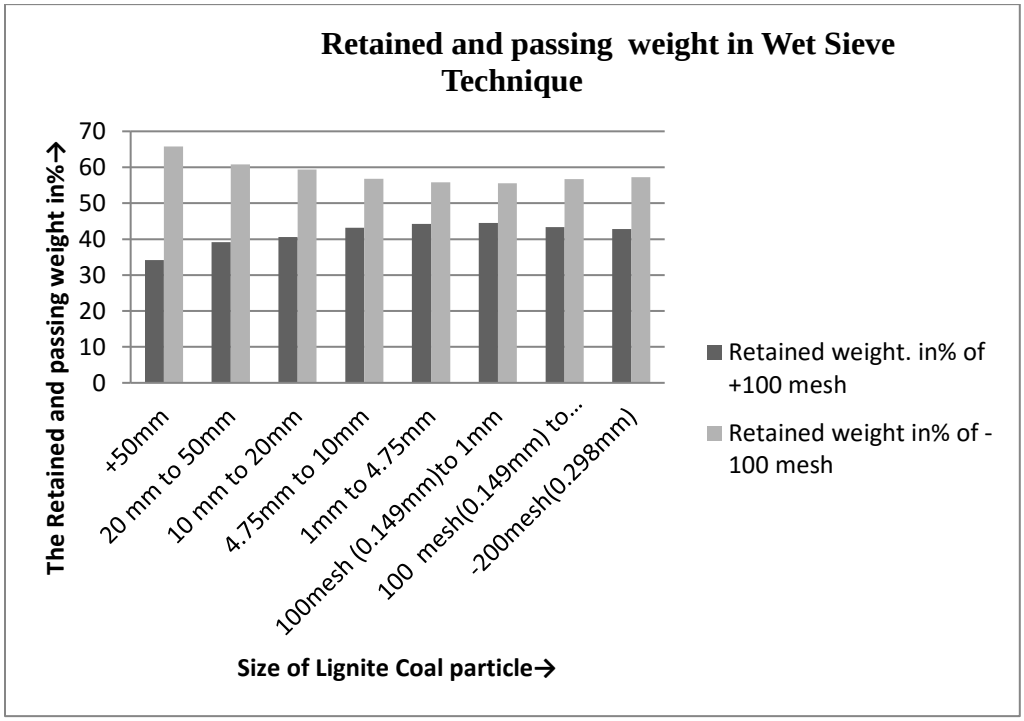

Fig. 1 The representation of retained and passing weight in wet sieve technique for +100 mesh and -100 mesh size

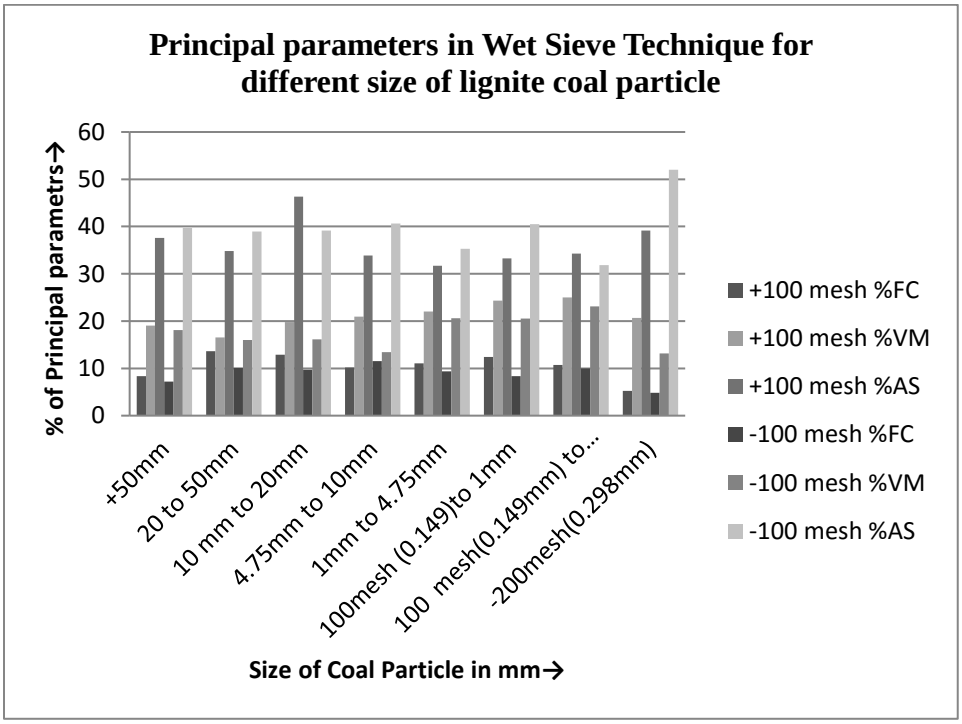

Fig. 2 The representation of principal parameters in wet sieve technique for +100 mesh and -100 mesh fine size.

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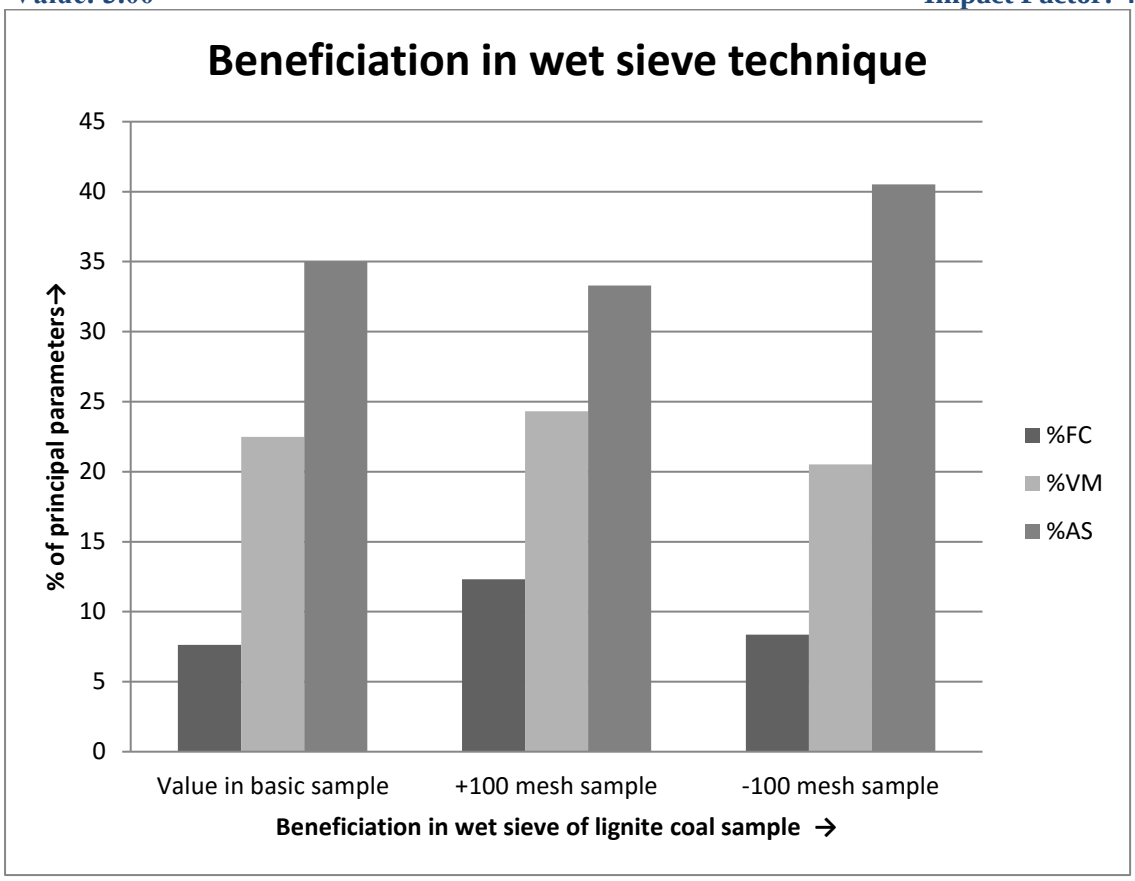

Fig. 3 The representation of beneficiation in wet sieve Technique for +100 mesh size and -100 meshes rang in 0.298mm to 55 mm.

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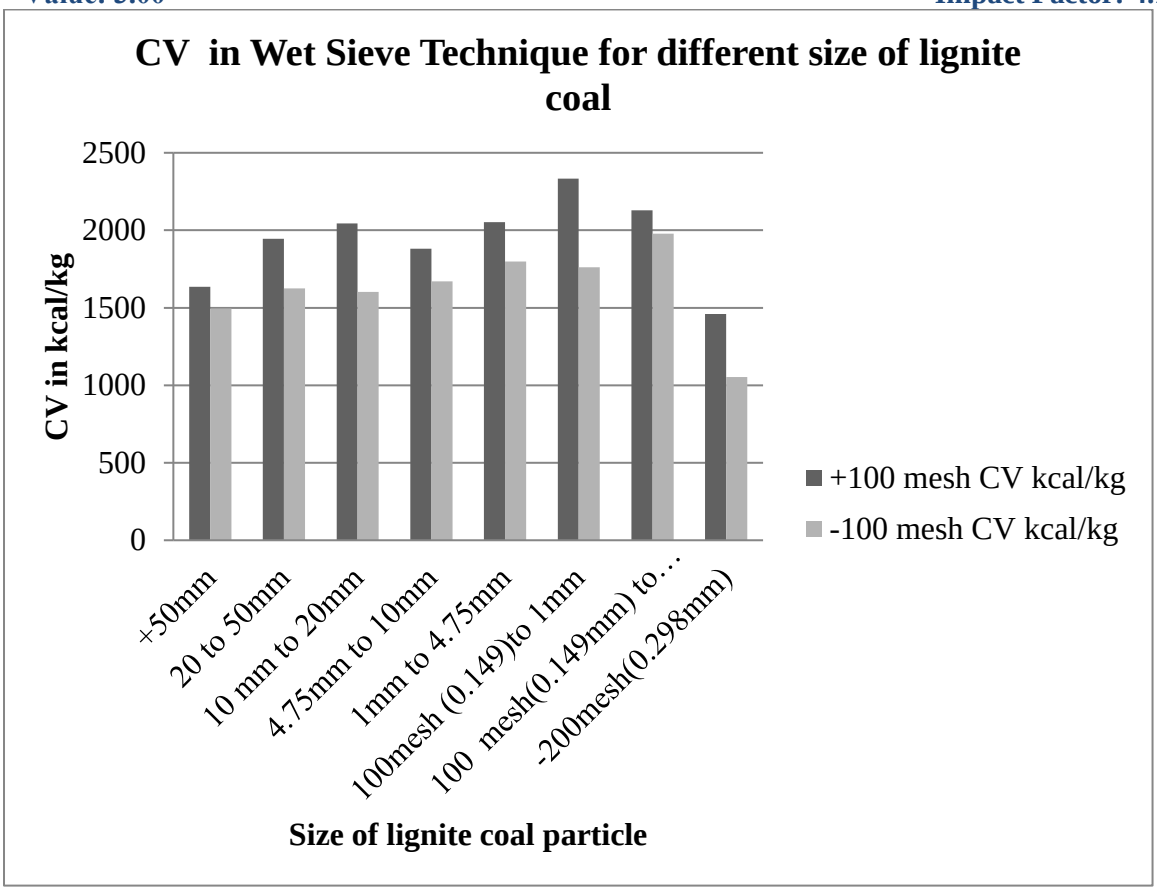

Fig. 4 The representation of CV kcal/kg in wet sieve Technique for +100 mesh size and -100 mesh fine size 0.298 mm to 50 mm