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An important role of coal and its calorific value on the performance of thermal power station: A case study

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Abstract
An investigation was undertaken to study the Physical and Chemical properties of coal in Korba district. Due to the Presence of lot of Coal mines, number of coal based thermal power stations are established in Korba district. So study has been carried out for assessment of coal quality, whether it is suitable for thermal power stations, by collectying sample from Gevra Coal mines. This paper presents Grade of the coal available in Korba district. Three different Coal samples were collected from different areas of Gevra Coal mines and analyzed for Proximate, Ultimate and Calorific value as per Standard methods. The useful heat values (UHV) of three coal samples are 2482K.Cal/Kg, 2917K.Cal/Kg, and 2786K.Cal/Kg. From overall analysis, and according to UHV of coal samples we can conclude that the grade of Gevra Coal is" F"and is very much useful for Coal based thermal power stations.

Keywords: Coalmines, Chemicalproperties, thermalpower,Calorific value.

INTRODUCTION

Coal may be defined as that part of the of the earth's crust which has been as a result of the accumulate of decayed plant remains millions of year. Coal is a fossil fuel formed from plant remains that were trapped in mud and therefore not oxidized. It is technically a sedimentary rock with a chemical structure similar to that of a polymer. Its structure varies based on the age of the coal and therefore the amount of pressure applied to it over time. The main types of coal are listed below from youngest:

Peat (technically a precursor to coal), Lignite, Sub-bituminous coal, Bituminous coal, Anthracite (pictured below), Graphite.

In the contemporary industrial world, coal is still a popular source of fuel due to its abundance and low cost. Coal plants provide most of the electricity in the United States and many other countries. The basic principle of the steam engine is still used. The principle difference is that the turbines are used to power electrical generators rather than gears and wheels. Additionally, coal is now industrially pulverized before being burned. Most coal plants in the United States are in continuous use and require daily shipments of 10,000 tons of coal per day (or more) to continue to operate.

Gradation Of Coal

For the purpose of pithead prices the department of coal at ministry of energy, regarded the coal on the basis of UHV according to the table given below:

S.No.	Grade	UHV(K.Cal/Kg
1	A	>6200
2	B	5600 to 6200
3	C	4940 to 5600
4	D	4200 to 4940
5	E	3360 to 4200
6	F	2400 to 3360
7	G	1300 to 2400

Study Area

Korba coalfield is located in Korba district of Chhattisgarh Korba and covers an area of about 530 sq. km. as per GSI a total of 10115.21 Mt. coal reserves available in Korba coal field.The deposits are restricted into two distinct zones.

Thick seam/quarriable power grade zone comprising of grade E, F & G having reserves of approx. 9068 Mt.

Thin seam/underground superior grade zone comprising of grade B to D having reserves of approx. 1007 Mt.

The area selected is GEVRA AREA Coalfield., which is situated partly in Shahdol district of Madhyapradesh and partly of Sarguja district of Chhattisgarh, is quite different from the other coalfields of Son-Mahanadi Vallley as large part of it contains a numbers of interbanded Seams. In fact, an en-echolon fault trending EWE-WSW with down through towards north divides the coalfield in two halves.

The GEVRA AREA coalfield is part of the large sediment-filled Gondwana trough located in the drainage basin of the Son river. The coalfield has a regional E-W elongation in conformity with alignment of the basin belt. The beds have a general WNW-ESE to E-W trend and dip at very low angles towards NNE or N. The predominant rock

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type is pink porphyritic gneiss. The Talchir sediments are found to the south of the coalfield. The lithological assemblage of the Talchir formation includes tillite, green and chocolate shales, rhythmites and sandstones of varying grain sizes. The Barakar formation which shows characteristic vertical variation in the arrangement of the lithofacies, conformably overlies the Talchir formation. In the northern part of the GEVRA AREA coalfield, a sequence of very coarse grained, pebbly sandstones and fer-ruginous sandstones constitute the prominent ridges.

Sampling and Analysis

Sample preparation of laboratory sample methods are prescribed for following three size groups of coal.

Run-of-mine coal: 23 cm to 0cm
Large coal: 15cm to 5 cm
Small coal : 5 cm to0 cm

Preparation of sample

Run-of-mine coal-run of mine coal is comprising of all sizes comes out of the mine without any crushing or screening.

The fraction of the run of mine coal as is retained on a screen when subjected to screening or is picked out by a fork shovel during loading is called steam coal.

The fraction that remains after steam coal has been removed from the run of mine coal is called slack coal.

The collected coal sample shall be crushed to 5 cm size, preferably by mechanical means, mixed thoroughly and quartered. Two opposite quarters shall be retained and the rest rejected. The retained material shall be further thoroughly mixed together, and by another coning and quartering, half the portion will be retained and remained and remainder rejected. Thus, ultimately, one quarter of the original sample is retained and the rest rejected.

The material so obtained shall be crushed to 12.5 mm by a jaw crusher and then to3.35mm by a PALMAC type reduction mill or a roller crusher. The crushed material shall be reduced by coning and quartering or by riffling till 2 kg of sample is obtained.

Laboratory sample

The samples as reduced under for following method were finally ground to pass through a212-micron IS Sieve, from the ground material, 1.5kg quantity was taken which constitute the laboratory sample. The samples were kept in glass or polyethylene containers and sealed and marked properly.

Analysis

The collected samples were analyzed for Proximate(Moisture, Ash, Volatile matter, and Fixed Carbon), Ultimate (Carbon, Hydrogen, Nitrogen and Sulphur) and Calorific value by following standard methods.

RESULTS AND DISCUSSION

After Analysis the following results were ob

PROXIMATE ANALYSIS					
Sample No.	Moisture(%)	Ash(%)	Volatile matter(%)	UHV(K.Cal/Kg)	Fixed Carbon%
01	6.3	40.3	23.0	2482	30.5
02	9.0	34.3	22.8	2917	35
03	7.8	36.5	23.8	2786	32
ULTIMATE ANALYSIS					
Sample No.	CV (K.Cal/Kg)	Hydrogen (%)	Carbon (%)	Nitrogen (%)	Sulphur (%)
01	4931	3.06	42.6	1.08	0.49
02	5323	3.28	43.9	0.86	0.65
03	4244	2.67	37.9	0.75	0.44

CONCLUSION

The UHV of the above samples is in between 2401to 3360. So we can conclude that thegevra coal is of" F grade".

As F grade coal is used in power stations it is called as power coal, because most of the Boilers of the power stations in Korba district are designed as such and its cost is also very less.

If we use higher grade coal excess heat will be produced. The Ash produced will form klinker as a result the boiler will be chocked.

If we use high grade coal in power stations, Sudden increase in temperature may occur and control over them is impossible.

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