Volatile displacement of Meghalaya coals – A pointer to explore low sulphur coals

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Volatile displacement, which measures the difference between calculated and experimental volatile matter, is indicative of abnormality in coals which may be related to petrological or chemical parameters. The volatile displacement ($\delta_v$) values of Meghalaya coals were calculated from their chemical analyses. Correlations of volatile displacement ($\delta_v$) with parameters such as carbon, hydrogen, moisture, oxygen, oxygen plus sulphate sulphur, oxygen plus pyritic sulphur, oxygen plus organic sulphur and total sulphur were studied. An approximately linear relationship exists only between $\delta_v$ and moisture, and $\delta_v$ and total sulphur, and not between other parameters. Plots on Seyler’s chart indicate the coals as perhydrous to orthohydrous. The linear relationship with total sulphur indicates that the coals may have become abnormal mainly due to the marine environment of deposition and weathering.

1. Introduction

Meghalaya in NE India (figure 1), has limited reserves of about 640 million tonnes of coal, of which Garo Hills alone has a share of 360 million tonnes. The annual production is about 35 lakh tonnes and the coal is mostly of the sub-bituminous type. The ash content of this coal is much lower than that of any high quality coal of the country and its calorific value exceeds some of the best grade coal. However, these coals are not considered good grade because of a high sulphur content which is a major drawback in metallurgical and other industrial uses.

Seyler (1938) devised a formula for the calculation of volatile matter (V.M.) from results of the ultimate analysis of carbon and hydrogen. His observation was that if the coal was a normal one, there will be negligible difference in the values of volatile matter found by experiment (Proximate Analysis) and that calculated by the formula. The bright coals do not show much variation between experimental V.M. and calculated V.M., but the dull coals of India rich in durain and clarain show large differences between experimental value and calculated value of volatile matter due to the complexity of its composition developed by weathering, heat effect and other related causes. These coals are termed as abnormal coals.

The volatile matter of coals can be calculated using the following formula:

$$V.M. \text{ (calculated)} = 10.61\text{ H} - 1.24\text{ C} + 84.15$$

where

- $\% \text{ H} = \text{ Hydrogen}$
- $\% \text{ C} = \text{ Carbon}$

Volatile displacement ($\delta_v$) = Volatile matter (experimental) – V.M. (calculated).

In Seyler’s (1938) chart (figure 2), a narrow band is drawn between the carbon limits 87–70% and hydrogen 2.0 to 5.8%, which he believed to include the composition of all normal (humic) bright coals within this range of carbon content. The coals which show volatile matter displacement will fall outside Seyler’s band drawn for normal coals and will be termed as abnormal coals.

Chandra and Srivastava (1980) studied the volatile displacement ($\delta_v$) and chemical

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composition of burnt coals (coals either heated in presence of oxygen or carbonized in the laboratory under controlled conditions in the absence of oxygen) collected from Jharia coalfield, and found them abnormal. Chandra and Gupta (1976) also studied coal samples from the same field and observed that \( \delta v \) occurs due to weathering or oxidation of coals. The Ib-valley coals of Orissa were also found to be abnormal (Behera 1991). Niyogi (1989) studied the Talcher coals of Orissa and found them abnormal due to weathering. It has been observed that if \( \delta v \) is greater or less than \( \pm 2.5 \), the coals are abnormally rich in durain (Seyler 1938), or are oxidized or weathered (Chandra and Srivastava 1980). Coal could be abnormal if it is rich in exinite, inertinite or high in hydrogen content (Chandra et al. 1997).

Coals found in India belong to two geological formations, i.e., Gondwana and Tertiary. Coals found in these two geological formations show contrasting characters, may be due to their environment of deposition. Meghalaya coals belong to the Tertiary sequence of NE India.

The purpose of the present study is to find out the causes of abnormality of the Meghalaya coals and its relation to the sulphur content.