

Microstructure and functional group characterization of various Indian coal : implication to hydrocarbon exploration.

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Samples collected from Raniganj, Jharia, and Makum areas representing both the Gondwana and tertiary coalfields were characterized for hydrocarbon. The cracks/cleats, joints, and fractures in these rocks act as an excellent source of methane in the form of CBM (Coal Bed Methane). Since, CBM is an unconventional natural gas which is associated with the coal seams, both society and the economy will be benefit a lot from CBM research, and development. As part of the study, several techniques like FTIR, FESEM, and XRD were utilized to characterize the coal samples to understand their nature and microtextural and microstructural characteristics. FTIR spectroscopy of the coal sample revealed the presence of functional groups like OH-stretching and CH bending whereas FESEM qualitative data, and images were helpful in analysing microstructural and microtextural features such as banding, fracture surfaces, numerous polygonal cracks, and micropores present within it that helps to host the gaseous contents. The coal comprises mineral content that has a rhombic, sheet-like structure and a nodular, granular texture which is observed in the FESEM. Intrusive ultramafic rocks, such as lamprophyre, and quartz veins, have been detected in core samples. The aliphatic and aromatic hydrogen concentrations peaks were detected at 2900 cm^{-1} and 800 cm^{-1} , respectively [3]. Based on XRD data, clay minerals including illite, montmorillonite, kaolinite, and quartz were detected in the coal. Overall, the maturity of the coal supports the hydrocarbon potential in these areas. Macerals in Makum coal include vitrinite, liptinite, and inertinite. Inertinite comprises 70% of its volume. Hydrocarbons are generated by inertinite macerals. Organic matter deposition occurs in dysoxic or anoxic fluvio-deltaic lagoonal environments [1]. Similarly, in the Raniganj, it is a type-III kerogen in the Jharia coalfield and late mature to overmature. Only condensate and gas are believed to be preserved from this section's oil, condensate, and gas generation potential [2].

1. Biswas et al. (2020) *Marine and Petroleum Geology*, **114**, 104206.
2. Mishra & Cook (1992). *International journal of coal geology*, **20**(3-4) 277-313.
3. Solomon & Carangelo (1982). *Fuel*, **61**(7), 663-669.

