

Hydrocarbon Source Potential of Tertiary Lignites of Kutch Basin: Insights from Petrography, Palynology and Organic Geochemistry

R. P. Mathews¹, S. Dutta¹, S. Banerjee¹, B. D. Singh², S. M. Tripathi², and A. Singh²

¹*Department of Earth Sciences, Indian Institute of Technology Bombay, Powai, Mumbai-400076, India, runciepaulmathews@gmail.com*

²*Birbal Sahni Institute of Palaeobotany, 53-University Road, Lucknow-226007, India*

The western marginal basin of Kutch encompasses one of the best developed and undisturbed Mesozoic-Cenozoic sequences in India. Lignite bearing Tertiary sequences is spread over 400 km² in the Kutch basin parallel to the present coastline. The hydrocarbon source potential of these organic rich deposits has been investigated using organic petrography, palynology and organic geochemistry. Organic geochemical investigation has been carried out using elemental analysis, FTIR spectroscopy, Rock-Eval pyrolysis and Curie point pyrolysis-GC-MS.

The organic petrological study of Matanomadh lignite reveals the predominance of huminite (av. 69%), followed by liptinite (av. 8%) and inertinite (av. 3%) macerals, along with low to moderately high amount of associated mineral matters (av. 20%). Under fluorescence mode, however these lignites show high frequency of liptinite macerals (av. 33%) formed chiefly by liptodetrinite and resinite. Palynological assemblage recorded from the studied section is represented by pteridophytic spores, angiospermic pollen, dinoflagellate cysts and fungal remains. The total organic carbon (TOC) content of lignites ranges between 26 and 58 wt.%, whereas the TOC content of the associated carbonaceous shales is around 4.0 wt.%. The major pyrolysis products of lignites, derived from Curie point pyrolysis-GC-MS, are straight chain aliphatics, phenols and cadalene-based C15 bicyclic sesquiterpenoids.

The overall petrographic composition suggests a lagoonal condition for the formation of these lignites. The palynological assemblages, dominated by tropical angiospermic pollen, suggest prevalence of warm humid tropical climate during the deposition of these lignites. The mean huminite reflectance value of Matanomadh lignites (Ro mean: 0.28-0.34%, av. 0.31%) as well as low Rock-Eval Tmax (av. 417 °C) values for the seams, suggest brown coal or lignitic stage/rank for the studied lignites. The Hydrogen Index (HI) ranging from 23 to 452 mg HC/g TOC indicates the potential of lignite sequence to produce mixed oil and gaseous hydrocarbons on maturation.