

Geochemical Study of the Bound Hydrocarbon in the Asphaltene of Biodegraded Oils of Cambay Basin

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Abstract : Biodegradation leads to a systematic alteration of the chemical and physical properties of crude oil showing sequential depletion of n-alkane, cycloalkanes, aromatic which increases its specific gravity, viscosity and the abundance of heteroatom-containing compounds. The biodegradation leads to a change in the molecular fingerprints and geochemical parameters of degraded oils, thus make source and maturity identification inconclusive or ambiguous. Asphaltene is equivalent to the most labile part of the respective kerogen and generally has high molecular weight. Its complex chemical structure with substantial microporous units makes it suitable to occlude the hydrocarbon expelled from the source. The occluded molecules are well preserved by the macromolecular structure and thus prevented from secondary alterations. They retain primary organic geochemical information over the geological time. The present study involves the extraction of this occluded hydrocarbon from the asphaltene cage through mild oxidative degradation using mild oxidative reagents like Hydrogen Peroxide (H_2O_2) and Acetic Acid (CH_3COOH) on purified asphaltene of the biodegraded oils of Mansa, Lanwa and Santhal fields in Cambay Basin. The study of these extracted occluded hydrocarbons was carried out for establishing oil to oil and oil to source correlation in the Mehsana block of Cambay Basin. The n-alkane and biomarker analysis through GC and GC-MS of these occluded hydrocarbons show similar biomarker imprint as the normal oil in the area and hence correlatable with them. The abundance of C₂₉ steranes, presence of Oleanane, Gammacerane and 4-Methyl sterane depicts that the oils are derived from terrestrial organic matter deposited in the stratified saline water column in the marine environment with moderate maturity (VR_c 0.6-0.8). The oil source correlation study suggests that the oils are derived from Jotana-Warosan Low area. The developed geochemical technique to extract the occluded hydrocarbon has effectively resolved the ambiguity that resulted from the inconclusive fingerprint of the biodegraded oil and the method can be also applied in other biodegraded oils as well.

Keywords : asphaltene, biomarkers, correlation, mild oxidation, occluded hydrocarbon

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