Trimethyldibenzothiophenes: molecular tracers for oil filling pathway in oil reservoirs

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By rebuilt of oil charging orientation and filling pathways can assist in determining hydrocarbon filling points, corresponding source kitchens and predicting "satellite reservoirs" in petroleum reservoirs (England et al., 1987). Hydrogen bonds can be formed between sulfur and the hydrogen atoms of circumferential medium in carrier beds for the relatively higher electronegativity and unshared pair of electrons in the outer shell orbital of a sulfur atom. Therefore, trimethyldibenzothiophene isomers can be used as molecular tracers for reservoir filling pathways within a reservoir scope.

Based on the thermodynamic stabilities, two trimethyldibenzothiophene molecular indicators, 2,4,6-/(1,4,6+1,4,8+3,4,6)-trimethyldibenzothiophene (TMDBT) and (2,4,7+2,4,8)-/ (1,4,6+1,4,8+3,4,6)- TMDBT, were proposed to be tracers for reservoir orientation and filling pathways. Due to the interaction between TMDBT isomers and circumferential medium in carrier beds, which would lead to geochromatographic fractionation, 2,4,6-/(1,4,6+1,4,8+3,4,6)- TMDBT and (2,4,7+2,4,8)-/ (1,4,6+1,4,8+3,4,6)-TMDBT ratios in crude oils will decrease along the oil migration pathway evidently. The isopleth of map of these two TMDBT ratios can indicate the oil charging orientation and the preferential filling pathways. And in this study, we successfully apply the aforesaid parameters both in an Ordovician carbonate reservoir of the Tuoputai region from the Tarim Basin, and in an Eocene clastic lacustrine reservoir of the Fushan Depression from the Beibuwan Basin, South China Sea. On condition was that all oils belong to one population and derive from the same source kitchen.

This study also indicates that the migration fractionation is the only main control factor for the relative concentration of trimethyldibenzothiophene in oils derived from the same source kitchen. Besides trimethyldibenzothiophene parameters can be applied in the biodegraded oil reservoir for tracing oil filling pathways since the relative abundance of alkylated DBT isomers with same number of methyl groups have no significant change with increasing degree of biodegradation (Shi et al., 2015).

References

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