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Distribution of naphthalene, phenanthrene and their alkyl substituents in some Egyptian crude oils as a tool of thermal maturity assessment

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The distribution of alkylated polycyclic aromatic compounds (PACs) is highly variable in hydrocarbon mixtures. This is because the concentrations are controlled by both the nature of the source organic matter and the conditions of diagenesis/thermal maturation. Different organic matter sources yield bitumen's with varying amounts of PACs and different patterns of alkylation. Aromatic fractions separated from seven different Egyptian crude oils, having different geological origins, were analyzed by gas chromatography– mass spectrometry (GC/MS) especially for the generated alkylnaphthalenes and alkylphenanthrenes. Naphthalene (N), methylnaphthalenes (MN), dimethylnaphthalenes (DMN), trimethylnaphthalenes (TMN) and tetramethylnaphthalenes (TeMN) has been identified in the m/z (128, 142, 156, 170 and 184) mass chromatograms. Phenanthrene (P), methylphenanthrene (MP), dimethylphenanthrene (DMP), and trimethylphenanthrene (TMP) isomers have been identified in the m/z (178, 192, 206 and 220) mass chromatograms. Ratios depending on the differences in the thermal stability of the isomers were applied (e.g. MPI, MPr, MNr, DMNr, TMNr2, etc.). The ratios of β-substituted to α-substituted isomers of both alkylnaphthalenes and alkylphenanthrenes revealed higher maturity of ND1 from Quassim formation in Nile Delta basin compared to other samples. WD1 oil samples from Faghur basin is characterized by a high abundance of 1,3,7- and 2,3,7-trimethylnaphthalenes (TMN) with (TMNr2=1.154) and high Pristan/Phytan ratio (Pr/Ph=2.63) compared to WD2 from the same basin suggesting in-reservoir mixing of crude oils of different maturities.

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