

Composition of oil after hydrothermal treatment of carbonate-siliceous and carbonate domanic shale rocks

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Abstract

The hydrocarbon compositions of shale oils, generated from two different lithological- facial Domanic deposits of the Tatarstan Republic (Russia), were studied under hydrothermal impact with 30% of water addition in a 350 °C and CO₂ environment. The samples were extracted from carbonate-siliceous rocks of the Semiluky-Mendym deposits of the Berezovskaya area, and carbonate deposits of the Dankovo-Lebedyan horizon of the Zelenogorskaya area of the Romashkino oil field. The distinctive features of rocks are in the composition and content of organic matter (OM), its thermal stability, as well as the structural-group composition of the shale oil products. The hydrothermal treatment of the rock samples increased the content of saturates and decreased the content of aromatics, resins and asphaltenes in the composition of crude oil. The decomposition of the polymer-like kerogen structure and destruction processes of high-molecular compounds, such as resins and asphaltenes, are accompanied with the formation of substances highly rich in carbons— carbenes and carboids. The contents of n-alkanes and acyclic isoprenoids increase in the composition of saturated hydrocarbons. According to the chemical classification of Al. A. Petrov, the character of the molecular mass distribution of such substances corresponds to oil type A1, which is considered paraffinic. The contents of dibenzothiophene, naphthalene and phenanthrene are increased in the composition of aromatic hydrocarbons, while the contents of tri-methyl-alkyl-benzene and benzothiophene are decreased. The increase in the aryl isoprenoid ratio (AIR = C₁₃-C₁₇/C₁₈- C₂₂) and maturity parameter (4-MDBT/1-MDBT) under the influences of hydrothermal factors indicates the increasing thermal maturity degree of the hydrocarbon system. The differences in the distribution behavior of saturated and aromatic hydrocarbons—biomarkers in rocks of various lithological-facies types, which are reasoned by different conditions of initial organic matter transformation as well as under the impact of hydrothermal factors—were revealed.

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Keywords

Composition, Domanic rocks, Hydrothermal processes, Kerogen, Mineral composition, Organic matter, Transformations

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