

Organic geochemical characterization of Aleksinac oil shale deposit (Serbia)

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Oil shales represent a good source of energy and industrial raw material. The Aleksinac oil shale deposit is the biggest and most important oil shale deposit in Serbia. It covers an area of over 20 km², and it has three fields: "Dubrava", "Morava" and "Logorište". The potential reserves of oil shale in the Aleksinac deposit are estimated at about 2.1 billion tons. The genesis of oil shales is associated with the lacustrine depositional environments, which existed from Upper to Lower Miocene.

In order to determine the generative potential, type of organic matter (OM) and thermal maturity, Rock-Eval pyrolysis was used.

In analyzed oil shale samples the content of total organic carbon (TOC), as a general indicator of petroleum generation potential, range from 1.48 to 29.57%. The content of naturally generated hydrocarbons, expressed as S1 peak from the Rock-Eval pyrolysis in most analyzed samples have extremely low values 0.002-0.28, which indicate low maturity level [1]. The pyrolysable hydrocarbons expressed as S2 peak from the Rock-Eval pyrolysis, represent the potential to generate hydrocarbons and with that the potential of oil generation through thermal decomposition of kerogen. S2 ranging 3.93-141.36 mg HC/g rock is higher than 20 mg HC/g rock and indicates excellent source rock potential [1].

In order to accept a formation as a source rock, it should exhibit TOC more than 0.5 % and sufficient maturity, but also OM types should be suitable for the oil and gas generation. The kerogen type is determined by Hydrogen Index (HI) and diagram HI vs. Tmax (temperature, corresponding to S2 peak maximum). HI in range 265-728 mg HC/g TOC, indicates Type I and Type II kerogen or their mixture i.e. oil prone kerogen [1], whereas only one sample appears to be oil/gas prone (Type II/III). Similar results are obtained by plotting the Tmax against HI.

Maturation degree depends on the overall thermal history of the evaluated rocks; it is very important parameter for evaluation of hydrocarbon generation potential. Tmax in range 433-442 °C, meaning that oil shale OM is thermally immature and marginally enter in the beginning of oil window. The production index, PI = S1/(S1+S2), is an indication of amount of hydrocarbons which has been produced geologically relative to the total amount of hydrocarbons which the sample can produce, range 0.004-0.016 mg HC/g TOC. Very low PI values ≤ 0.1 indicate immature OM and no external contribution of migrated hydrocarbons to the organic-rich facies, consistent with low S1 values.

Obtained results show that Aleksinac oil shales contain immature OM, in sufficient quantity, represented by oil prone kerogen with exception of one sample, which has good gas potential. Therefore, investigated oil shale can be used for obtaining "synthetic petroleum".

[1] Peters, K. E., Walters, C. C. & Moldowan, J. M., 2005. The Biomarker Guide, Volume 1: Biomarkers and Isotopes in the Environment and Human History. Cambridge University Press, Cambridge, p. 75-118.