APPLICATION OF BULK KINETIC PARAMETERS OF ASPHALTENE AS OIL-OIL CORRELATION TOOLS

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Introduction

Oil-Oil Correlations is geochemical comparisons among oils from various reservoir compartments or different reservoirs in order to recognize existence of genetic relationship for reconstructing of petroleum system history. This attempt has critical role in the petroleum system concept that includes all of the disparate elements and processes of petroleum geology. In this approach various techniques and measurements including biomarkers, stable carbon isotope, diamondoids are used to support the inferred correlation. However, Biomarker are considered as resistant compounds but various physicochemical processes can alter them. In order to bridge this gap, we focus here systematically on asphaltanes macromolecular fraction of crude oils because these components not only inherit structural features of parent kerogen but they are quite resistant versus biomarker degrading processes. The goal of the current study was to compare asphaltenes of two oil reservoirs from two different oil fields using Kinetic parameters.

Geology and geochemistry background

Marun and Kupal oil-fields are located in Dezful Embayment which is situated in the southwest of Zagros fold-thrust belt. In this area five active petroleum systems were recognized (Bordenave and Hughe, 2010) and we were focused on Albian-Cenomanian Petroleum system. At least two potential Source rocks were deposited during, Albian–Cenomanian (Kazhdumi Formation), and Middle to Late Eocene (Pabdeh Formation). Kazhdumi Formation is assumed to be the source for most of the prolific fields within the Dezful embayment (Alizadeh et al., 2012) but Pabdeh Formation reached relatively high levels of thermal maturity in some oilfields where it is buried sufficiently. Organic Geochemistry data shows very good Oil-Oil correlation between Asmari and Bangestan hydrocarbons in Marun oil field but there are some discrepancies between oils in Asmari and Bangestan reservoirs of Kupal oil-field due to more maturation of Pabdeh formation. These evidence illustrated that reservoir oil of Asmari in Kupal oil-field has different source or at least it is mixed from different sources.

Samples and experimental methods

This Study was conducted on four oil samples collected from Asmari and Bangestan reservoirs of Marun and Kopal oil fields. In order to determine the activation energy distribution of asphaltene firstly asphaltenes were separated from crude oils by precipitation with n-hexane. The bulk decomposition curves measured by Rock-Eval 6 apparatus at three different heating rates of 5, 15, 25 °C/min served as input for the kinet ic model. The activation energy distribution (Ea) and frequency factor (A) were evaluated and modeled using OPTEKIN and PetroMod software.

Result and Discussion

The activation energy distribution (Ea) and frequency factor (A) for isolated asphaltene form reservoir oils are shown in Fig. 1. Three investigated reservoir asphaltenes from show high
activation energy with $E_a$ ranging 60-80 kcal/mole and frequency factors ranging from 4.3E+15 and 1.9E+16 s$^{-1}$\textsuperscript{1}. Only the asphaltene fraction from Asmari reservoir oil of Kupal shows a lower $E_a$ maximum (44 kcal/mole) compare to other samples and frequency factor equal to 8.02E+10. The activation energy distributions of Asmari and Bangestan oils in Marun and Bangestane oil of Kupal oil fields are broad, indicating that the precursor material for the generation of them are not homogenous. The oil asphaltene from Asmari of Kupal shows a narrow range of activation energy that indicating its composition may differ from other samples. On the other hand stability of asphaltene is influenced by increasing level of thermal stress, which asphaltenes have experienced in the geological past (Lehne and Dieckmann, 2006). Therefore, the difference between kinetic parameters of these oil asphaltenes may due to thermal maturity or facies difference that both of them can show a negative oil-oil correlation. In order to compare the effects of the calculated kinetic parameters, the general extrapolations were made using constant heating rate of 1.5 °C/My. This study as well as previous report clearly showed that the source of oil in Asmari reservoir of Kupal oil field is different from other samples. Based on this conclusion it can be said the source of oil asphaltene from Asmari of Kupal oil-field originated from Pabdeh formation rather that other samples that sourced from Kazhdumi formation.

*Figure 1* Activation energies distribution of asphaltene from a) Asmari reservoir and b) Bangestan Reservoir of kupal oil field, c) Asmari reservoir and d) Bangestan reservoir of Marun oilfield

References