

EGU21-291

<https://doi.org/10.5194/egusphere-egu21-291>

EGU General Assembly 2021

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Simulation of hydrocarbon generation and expulsion for the dark mudstone with Type- II kerogen in the Pinghu Formation of Xihu Sag in East China Sea Shelf Basin

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In order to finely describe the hydrocarbon generation and expulsion process of source rocks and provide reasonable key parameters for quantitative evaluation of oil and gas resources, we carried out a simulation research under semi-open system on hydrocarbon generation and expulsion for the dark mudstone with Type- II kerogen in the Eocene Pinghu Formation in the Xihu Sag, East China Sea Shelf Basin. The results show that the process of hydrocarbon generation and expulsion can be divided into five stages as follows:

- $R_o = 0.5\% \sim 0.7\%$, oil was generated slowly without expulsion;
- $R_o = 0.7\% \sim 1.0\%$, oil was generated and expelled rapidly;
- $R_o = 1.0\% \sim 1.5\%$, oil began to be cracked into hydrocarbon gas;
- $R_o = 1.5\% \sim 2.3\%$, gas generation predominated;
- $R_o > 2.3\%$, only dry gas was generated.

Oil expulsion threshold (R_o) of the source rock of this type is about 0.7% ($R_o = 0.7\%$), having a wide gas-window of $R_o = 1.0\% \sim 3.0\%$. So it can maintain relatively strong gas generation ability at high- and over-mature stages, belonging to gas-prone source rock. Following the study on experimental results and the characteristics of hydrocarbon generation and expulsion in samples, we established a set of mathematical models for the evaluation of the process and potential of gas generation and oil generation and expulsion of the dark mudstone with Type- II kerogen in the study area. Compared with the thermal simulation experiment in a closed system, the cumulative yield of oil in the semi-open system is higher and closer to that under actual geological conditions. Accordingly, we may conclude that more oil and gas resources may exist in the Xihu Sag.