

Kinetics of asphaltene precipitation: Effects of temperature and precipitant concentration

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The precipitation of asphaltenes from crude oils can lead to serious challenges during oil production and processing. This research investigates the kinetics of asphaltene precipitation from crude oils using n-alkane precipitants. For several decades, it has been understood that the precipitation of asphaltenes is a solubility driven phenomenon and the previous studies on the effect of time are usually limited to short time scales. By using optical microscopy and centrifugation based separation, we have demonstrated that the time required to precipitate asphaltenes can actually vary from a few minutes to several months, depending on the precipitant concentration used. Our results demonstrate that no single concentration can be identified as the critical precipitant concentration for asphaltene precipitation. Based on long term experiments, we have also been able to establish the solubility of asphaltenes as a function of the precipitant concentration and it is shown that the short-term experiments over-predict the solubility. [1]

The effect of temperature on the kinetics of precipitation has also been investigated and it is demonstrated that higher temperatures lead to substantially faster kinetics. We have also demonstrated the effects of different types of precipitants on the kinetics of precipitation. A generalized geometric population balance approach has been used to model the growth of asphaltene aggregates. The results demonstrate that the flocculation process accelerates with increasing amounts of heptane added to the asphaltenic crude. This research opens up a new paradigm for understanding asphaltene precipitation.

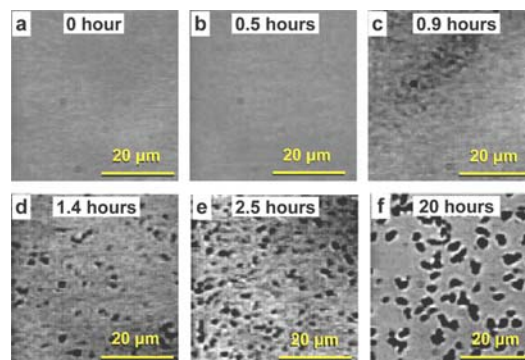


Fig. 1. Micrographs showing the time dependence of asphaltene precipitation for a crude-heptane mixture containing 50 vol % heptanes and 50 vol % K-1 crude oil.

References

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- [1] Maqbool, T., Balgoa, A.T., and Fogler, H.S. (2009) *Energy & Fuels* 23, 3681–3686
- [2] Betancourt, S. S., et al. (2009), *Energy & Fuels* 23, 1178-1188