CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

From the study of the kinetics of dissolution of asphaltene deposits by fluids composed of amphiphiles and alkanes using a differential reactor apparatus, the results showed that asphaltenes could be dissolved by alkane-based fluids containing two alkylbenzene-derived amphiphiles, nonylphenol and dodecylbenzene sulfonic acid. The factors influencing the rate of asphaltene dissolution by amphiphe/alkane fluids were summarized as follows: (1) Effect of amphiphile concentration: The rate of asphaltene dissolution, in general, increased with increasing the concentration of amphiphiles in the alkane-based fluid. The rate increment in asphaltene dissolution by micellar solutions with DBSA amphiphile was more significant than that with NP amphiphile. The relationship between the reaction rate constant and amphiphile concentration could be expressed in Langmuir form. (2) Effect of type of solvent: The rate of asphaltene dissolution by the light alkane-based micellar fluids was higher than that of heavy alkane-based fluids because light alkane could penetrate into asphaltene deposits easily. (3) Effect of temperature: The rate of asphaltene dissolution by micellar fluids increased with increasing the fluid temperature because thermal energy enhanced the rate of molecular interactions among asphaltene particles, amphiphile molecules and solvent molecules. The temperature dependence of the reaction rate constant could be expressed by Arrhenius equation. The activation energies were approximately 8.80, 9.19., 15.91 kcal/mol when the micellar fluids were 5wt% DBSA in dodecane, 20wt% NP in heptane media and in dodecane media respectively. (4) Effect of flow rate: The flow rate of

micellar fluids through asphaltene deposits did not influence the rate of asphaltene dissolution perhaps because the internal diffusion of fluids in the porous asphaltene deposits significantly controlled the rate of asphaltene dissolution.

From the study of the stability of different asphaltene fractions, it was concluded that the differences in solubility of asphaltene fractions prepared by using different volume ratio of dimethylene chloride and n-pentane as precipitant were due to a wide distribution of polarities in asphaltene molecules. Fraction 1 and fraction 4 were considered as the least and the most stable fractions according to the weight percentage of amphiphile used.

To further study on the kinetics of asphaltene dissolution and stability of fractionated asphaltene by using amphiphile/alkane solutions, the present reactor can be improved or the different type of reactor can be used. The mechanism of the dissolution of asphaltene deposits in porous media can be observed by using glass micromodels associated with a video-enhanced microscopic apparatus. The better understanding in asphaltene fractions can be obtained by using the fractionated asphaltene as a model deposited asphaltene in the currently used reactor and by further investigating the kinetics of dissolution.