CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The solubility of mercury required at least 17 hours to reach its equilibrium in hydrocarbons. The suspected errors on accuracy of solubility due to mercury in the vapor phase and suspended mercury was found to be low and within acceptable limits in both cases. For the mercury solubility in the single solvent, cyclohexane gave the highest solubility of mercury of 2500 ppb at 40°C while methylcyclohexane gave the lowest at 1756 ppb at 40°C. All solubility results were varied from 180 to 2500 ppb, depending on the types of hydrocarbons and their solubility behaviors showed exponential increase with temperature. The obtained solubility was lower than that found in literature reported for several decades ago. It was probably due to the difference of experimental conditions, techniques and analytical instrumentation and the results from this work were valid under the experimental condition in which the mercury drop size was controlled, shaken at 55 rpm for over 20 hours at the controlled temperature. However, the trend of solubility of mercury in this work was consistent to the previous work (Spencer and Voigt, 1968) at 25°C, *i.e.* the solubility in cyclohexane is the highest, comparable in both toluene and *o*-xylene, and the lowest in methylcyclohexane. For the simulated crude oil, the mercury solubility curve varied exponentially from 240 to 1500 ppb and was close to *n*-decane (86% by weight in the simulated crude oil) at temperature range of 5-25°C but large difference of the solubility was observed at high temperature (40°C). It was probably come from the synergistic effect of the regular mixing solution.

For the hysteresis study in single solvent systems, the hysteresis was not observed in the cyclohexane and methylcyclohexane systems, but existed in the toluene and *o*-xylene systems. The results suggested that the solubility parameter of the polar component of aromatics may have a significant effect on the hysteresis. For the hysteresis in simulated crude oil, it was clearly observed when compared to that of *n*-decane. The hysteresis observed in the simulated crude oil was not the effect of addition but possibly due to the synergistic effect of the mixture.

5.2 Recommendations

Ethylbenzene showed unusual appearance of mercury concentration and mercury droplet as black particles on mercury surface. It was possibly owing to the transformation of mercury into some compounds. The additional experiments suggested that the black particles were not sulfur transformation compound which were re-dissolved well in toluene at room temperature. Also, the surface resumed its usual shiny appearance after heating to 80°C. In order to find out what happened in the ethlybenzene solution, further investigation and more detailed analyses are required.

To understand the solubility and hysteresis manner of the simulated crude oil, additional studies on binary and ternary system are necessary. Further experiments should be studied on the effect of a type and composition of hydrocarbons. Also, a mercury-free real crude oil is interesting to study and compare with the simulated crude oil; however, their composition should be comparable.

The assumptions made in this work need to be confirmed for hysteresis. To test the ideas of kinetics of mercury precipitation and molecular association, solubility of mercury in hydrocarbons should be investigated for longer time and compare with the solubility at increasing temperature. It is also recommended to filter prior to analysis. Also, the speciation of mercury in hydrocarbons at decreasing temperature is required.