CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

It was shown experimentally that, for any given asphaltenes, there are critical values of volume percentage of toluene, 1-methyl naphthalene and decalin in the solvent mixtures for drastic increases in the asphaltene solubility. The critical percentages of toluene, 1-methyl naphthalene, and decalin for the asphaltenes from the stable crude (NM5) were found to be lower than those from the unstable crude (NM1).

Both asphaltenes from NM1, the unstable crude, and NM5, the stable crude, could dissolve more easily in the mixtures of 1-methyl naphthalene/heptane, toluene/heptane and decalin/heptane, respectively. The reason is because 1-methyl naphthalene is a 2-ring aromatic compound whereas toluene is 1-ring aromatic compound and decalin is not aromatic compound. Therefore asphaltenes which are mainly composed of polyaromatic molecules can dissolve more easily in the denser aromatic solvents.

Both NM1 and NM5 asphaltenes were found to dissolve more easily at higher temperatures. However, at the low percentages of toluene, 1-methyl naphthalene, and decalin in heptane, temperature had no significant effect on the solubility of asphaltenes. This is because a low concentration of aromatic results in lower in the polarity of the system leading to lowering the solubility of asphaltens. On the other hand, the temperature greatly affected the solubility of asphaltenes at the high percentages of toluene, 1-methyl naphthalene, and decalin in heptane.

The polar-based fractionation technique provides an excellent tool for the characterization of asphaltenes. The solubility of the most polar fractions is lower than the least polar fractions. The solubility of an unfractionated asphaltenes lies between those of its polar fractions.

The unaged asphaltenes of the Cold Lake reservoir had slightly greater solubility than those of nitrogen aged, oxygen aged and air aged asphaltenes, respectively. However, there was no significant difference in the solubility of oxygen aged and air aged asphaltenes in the toluene/heptane solvent. One possible

explanation, maybe, was that the aging time was not sufficiently long enough for the chemical reaction to occur during the aging procedure, such as oxidation.

The prediction of the molecular weights of both NM1 and NM5 asphaltenes from the solubility data gave satisfactory results. The higher the polar fraction, the higher the molecular weight of asphaltene was obtained. However, the different values of ψ_1 and ψ_2 will give different molecular weights. The uncertainty in molecular weight data for asphaltenes seriously hampers the development of accurate models. The true nature of asphaltene precipitation and formation still needs further investigation to reveal the mechanisms, interactions, and equlibria involved (Andersen and Speight, 1999).

The solubility parameter of asphaltenes may be obtained from spot-tests, evaluation of solubility in a range of solvent, or by flocculation titration threshold measurements (Andersen and Speight, 1999; Redelius, 2000).