CHAPTER V
CONCLUSION AND RECOMMENDATION

5.1 Conclusions

Five basic alkylbenzenes which have different functional groups were performed in pKa measurements: nonylacetophenone, octyloxybenzonitrile, nonylphenol, nonylaniline, and dodecyloxybenzaldehyde. Nonylphenol was chosen to be the representative alkylbenzene to consider the ideal concentration of all alkylbenzenes. At 1,000 ppm of nonylphenol or 0.34 mol alkylbenzene/mol asphaltene, nonylphemol obviously destabilizes asphaltenes and the physical dispersion does not occur. Therefore, all alkylbenzenes were performed in microscopy experiments at 0.34 mol alkylbenene/ mol asphaltene. The relationship between pKa measurements and microscopy experiments suggest that there is a correlation between the pKa and the degree of destabilization. The strongest bases are the least destabilizing and the weakest bases are the most destabilizing. Moreover, there appears to be a linear correlation between the pKa of alkylbenzene and the solubility parameter which the weakest bases increased the solubility parameter of reacted asphaltene the most.

5.2 Recommendations

In order to better understand the relation between pKa and degree of destabilization of asphaltenes, acidic alkylbenzenes should be studied to fulfill microscopy, pKa, and solubility parameter results. Some of the microscopy results from different five basic alkylbenzenes were overlapped after including error bars. Dodecylbenzenesulfonic acid (DBSA) gave distinguished difference in stability compared to other basic alkylbenzenes. However, DBSA is the only commercially available acidic alkylbenzene. DBSA has extremely high acidity to titrate with any acidic titrants. Hence, DBSA is not used in this work and other acidic alkylbenzenes need to be synthesized.

Asphaltenes are soluble in few solvents and most of them have very low permittivity or dielectric constants to conduct pKa measurements except tetrahydrofuran. Tetrahydrofuran has sufficient dielectric constant (ϵ = 7.52) and asphaltenes are absolutely soluble in it. However, tetrahydrofuran has very high vapor pressure (~21.6 kPa), so it evaporates quickly leading to composition changes and might ruin the results. Moreover, the containers in characterization techniques are polymer, so tetrahydrofuran might react with those containers. Hence, to study the mechanism of alkylbenzene-asphaltene destabilization in the future, other solvents which are mild to polymer, non-volatile, and soluble with asphaltenes should be used such as toluene.

In addition, many characterization techniques can be used to probe the mechanism of alkylbenzene-asphaltene destabilization at different alkylbenzene concentrations. The different concentrations of alkylbenzenes make different degree of destabilization of the system. For instance, SAXS and XRD can reveal the size of reacted alkylbenzene-asphaltene aggregate, and FTIR can reveal the interaction absorbance between the functional groups of alkylbenzenes and asphaltenes. All evidences from different characterization techniques would reveal and improve understanding of asphaltenes.