CHAPTER 5

SUMMARY CONCLUSIONS
AND ENGINNERING SIGNIFICANCE

5.1 Summary

The synergism of the anionic and cationic surfactant system for SHDPDS-DPC through the adsorption and adsolubilization of styrene and ethylcyclohexane onto positively charged alumina was studied at different cationic surfactant mole fractions in the mixed surfactant system at electrolyte concentration of 0.0015 M NaCl, equilibrium pH of 6.5-7.5 and temperature of 20±2°C. The results showed that the adsorption, solubilization, and adsolubilization were promoted by the cationic surfactants. The adsorption of SHDPDS and DPC system showed low synergism due to only the adsorbed cationic surfactants were enhanced, but there are no significantly different on the adsorbed anionic surfactants with the additional cationic surfactants. This may be due to the twin-head structure of the SHDPDS surfactant, which decreases the synergism in other precipitation tendency but also appears to reduce synergism. However, the different mole fractions of cationic surfactants in the mixed anionic and cationic surfactants system had greater impact on solubilization and adsolubilization than on adsorption. The solubilization capacity of both styrene and ethylcyclohexane increased with increasing the cationic surfactant mole fraction in the mixed surfactant system due to reduced electrostatic repulsion between anionic head groups reducing increased micelle formation. Through the adsorption study there is expected to exist of a maximum form of admicellar aggregates. For the adsolubilization studies, the increasing cationic surfactant mole fraction in the mixed system increased the adsolubilized ethylcyclohexane and decreased adsolubilized styrene. From these results, it can be inferred that the tight packing arrangement of the mixed anionic and cationic surfactant systems promoted adsolubilized ethylcyclohexane in the core region and resisted the adsolubilized styrene in the palisade region of the admicelle. The admicellar partition coefficient data further supported that styrene partitions into the palisade region and ethylcyclohexane partitions into the core region of admicelles. The admicellar partition coefficient (K_{adm}) of the organic solute was of the same order as the corresponding to micellar partition coefficient (K_{mic}). As a result, admicellar partitioning can be attractive as the micellar partitioning and this phenomenon can be use in environmental applications. Although this mixed anionic and cationic surfactant system demonstrated low adsorption synergism, it has great potential for enhancing solubilization and adsolubilization of organic contaminants. Thus, this research provides useful information for designing surface modification by surfactants to enhanced contaminant remediation.

5.2 Conclusions

Based on the results of this research, the following conclusions are made.

1. The adsorption of a mixed anionic and cationic surfactant system, SHDPDS and DPC, onto positively charged alumina showed a slight synergism with only the adsorption of cationic surfactants increased in the mixed system.

2. Increasing the cationic surfactant mole fraction in the mixed system promoted slight increases in the solubilization capacity of styrene and ethylcyclohexane
3. Increasing the cationic surfactant mole fraction in the mixed surfactant system promoted the adsolubilization of non-polar organic solutes in the core region and resisted the adsolubilization of polar organic solutes in the palisade region of the admicelles.
4. The admicellar partition coefficient (K_{adm}) for the adsolubilization process is comparable to study can be attractive as the micellar partition coefficient (K_{mic}) for the solubilization process.

5.3 Engineering significance

Surfactant-modified surfaces can be used in many industrial and commercial processes and environmental engineering applications. Metal oxide coated with surfactants appears particularly promising for treatment of groundwater and wastewater for removal of organic compounds by the adsolubilization process.

In field application for subsurface remediation, surfactant modified surfaces can be used in landfill liners or subsurface barriers which effectively prevent organic contaminants from mitigating in groundwater. For wastewater treatment, surfactant modified surfaces could be used as a strong adsorbent for organic compound removal in wastewater streams which is known as admicellar-enhanced chromatography.

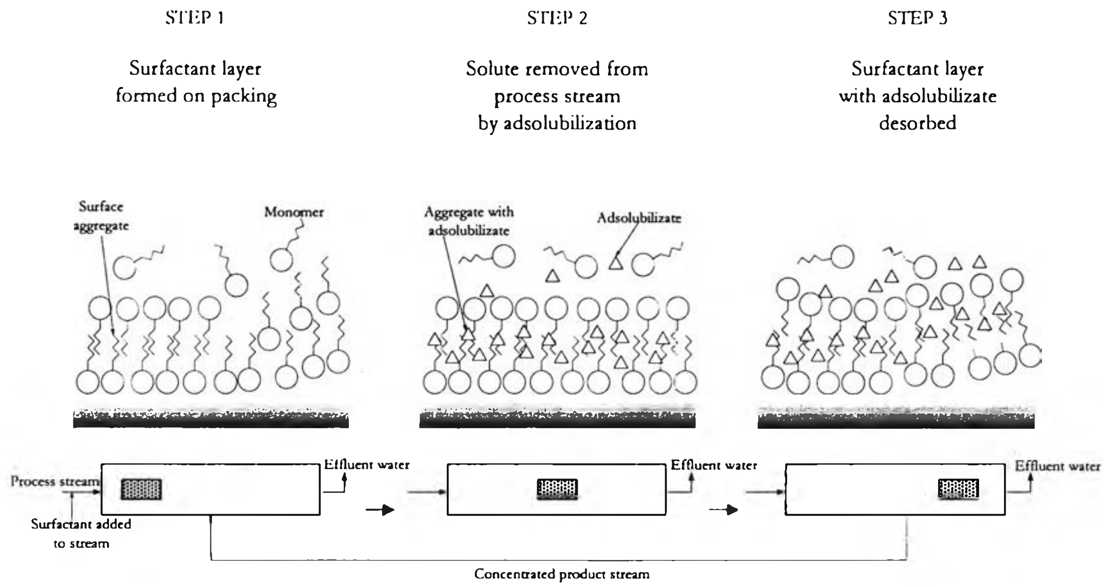

Figure 5.1 The admicellar-enhanced chromatography processes (adapted from Harwell and O'Rear, 1992)

Admicellar-enhanced chromatography (AEC) utilizes adsorbed surfactant aggregates on solid surfaces and the phenomenon of adsolubilization. If the aqueous solution, which contains dissolved organic solute, is contacted with solid containing adsorbed surfactant aggregates, the solute will tend to adsolubilize into these aggregates, and a purified water stream then results. The adsorption bed can then be contacted with a solution of different pH, causing the surfactant to be desorbed along with the organic solutes, producing a concentrated solution. The bed can be retreated with surfactant and the process repeated indefinitely. The admicellar-enhanced chromatography process is shown in Figure 5.1.