



CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The synergism of the anionic and cationic surfactants system for SDS/PADD through the adsorption, adsolubilization and retardation of styrene and ethylcyclohexane onto negatively charged silica was studied in the column at electrolyte concentration of 0.001 M NaCl and temperature of 25°C.

Table 5.1 Adsorption of surfactant, adsolubilization of organic solutes, and retardation factor obtained in this study.

Surfactants	Adsorption (molecules/nm ²)	Adsolubilization (molecules/nm ²)	Retardation factor
Styrene (w/o surfactant)			1.67
PADD	0.98	0.25	4
SDS:PADD 1:3	2.08	0.89	12.8
Ethylcyclohexane (w/o surfactant)			1.3
PADD	0.98	0.56	32.1
SDS:PADD 1:3	2.08	1.08	60.95

From Table 5.1, the results showed that the transport of organic solutes, adsorption, and adsolubilization were promoted by the mixed anionic and cationic surfactants. When organic solutes were flushed into the treated column, the organic solutes would be trapped in the surfactants admicelles and resulted in higher

retardation factor. Thus it can be summarized that the transport of organic solutes in mixed anionic and cationic surfactants system was slower than single cationic system.

For the surfactant adsorption studies, the results reveal that the mixed SDS and PADD at the ratio 1:3 exhibit strong synergism by an increase in surfactant molecules adsorbed onto the silica surface and using lower surfactants concentrations. This may be because the negatively charged of SDS reduced the electrostatic repulsion between positively charge cationic surfactants.

The adsolubilization experimental result indicated that mixtures of anionic and cationic surfactants had greater effect on the adsolubilization of ethylcyclohexane than that of styrene as compared to adsolubilization in the single PADD system. This finding may resulted from an improvement of the adsorption capacity of the mixed anionic and cationic surfactants with single and double head groups since it would be able to facilitate a larger adsolubilization of organic solutes than with single surfactants.

The explanation for these results may be related to the tight packing arrangement of the mixed anionic and cationic surfactants system as it can promote adsolubilized ethylcyclohexane in the core region and resist the adsolubilized styrene in the palisade region of the admicelle. The admicellar partition data from mass balance further supported that styrene partitioned into the palisade region and ethylcyclohexane partitioned into the core region of admicelles. Not only this mixed anionic and cationic surfactants system demonstrated strong adsorption synergism, but also provided great potential for enhancing adsolubilization of organic contaminants. As a consequence, this research provides the useful information for

designing surface modification by surfactants to enhanced contaminant remediation can be obtain from this study.

By and large, based on the results of this research, the brief conclusions can be drawn as follows:

1. The adsorption of a mixed anionic and cationic surfactants system, SDS and PADD, onto negatively charged silica showed stronger synergism than the adsorption of single cationic surfactant system.
2. The mixed anionic and cationic surfactants system tended to promote the adsolubilization of non-polar organic solutes in the core region and the adsolubilization of polar organic solutes in the palisade region of the admicelles.
3. The transport of organic solutes in mixed anionic and cationic surfactants system was slower than single cationic system.

5.2 Recommendations

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 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 migration to groundwater by 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.

For future research works, the study may be expanded to other organic solutes and different kinds of surfactants are required.