



CHAPTER V

CONCLUSIONS AND RECOMENDATIONS

5.1 Conclusions

The properties of fatty alcohol ethoxylates was studied in the single nonionic surfactant system. The fatty alcohol ethoxylates— $C_{12-14}EO_3$, $C_{12-14}EO_5$, $C_{12-14}EO_7$ and $C_{12-14}EO_9$ —were studied the properties and the results were compared to those from nonylphenol ethoxylates, commercial nonionic surfactant—NPE-6 and NPE-9. From the results of this study, it can be concluded by following.

The number of the EO group was found to affect the interfacial properties including CMC, cloud point, and contact angle. The approximate CMC values of $C_{12-14}EO_3$, $C_{12-14}EO_5$, $C_{12-14}EO_7$, and $C_{12-14}EO_9$ were 0.007, 0.010, 0.012, and 0.014 %wt/vol, respectively whereas NPE-6 and NPE-9 are 0.007, and 0.012 %wt/vol, respectively. Moreover, the CMC slightly increased with increasing the number of the EO unit. However, the change of the CMC per the EO unit is much smaller than hydrophobe.

The effect of the number of the EO group on the cloud point temperature, the cloud point of $C_{12-14}EO_3$, $C_{12-14}EO_5$, $C_{12-14}EO_7$ and $C_{12-14}EO_9$ were ~0, 18.5, 54, and 81°C, respectively while the cloud point of NPE-6 and NPE-9 were 0, and 53.3 °C.

In comparison of the number of the EO group, the contact angle of those solutions at 1 wt% on nonpolar parafilm surface and HDPE were in the range of 38-53° and 20-34°, respectively.

In gel range experiment, the phase of these ethoxylates were observed at increasing concentration of surfactant solution which occurred the phase in order following; L_1 (micellar solution) → H (hexagonal phase) → L_2 Lamellar phase. The gel readily form as ethoxylate concentration, average ethylene oxide content were increased as obviously for $C_{12-14}EO_7$, $C_{12-14}EO_9$ NPE-6 and NPE-9, high average ethylene oxide resulting in broader gel range.

The foam properties were studied at room temperature by using three testing methods. Both the concentration and the EO group of alcohol ethoxylates were found

to affect both foamability and foam stability. The volume of foam and foam characteristics also depend on the mechanical method used for foam measurement. The AE especially at high EO groups (7 and 9) showed better foaming properties than the studied NPEs. The rate of lowering dynamic surface tension increased when increasing concentration, corresponding to the increase of foamability. The number of the EO group also influenced the dynamic surface tension in the studied range time. Both the fatty alcohol ethoxylates and nonylphenol ethoxylates, the higher EO group showed the rapid fall of the dynamic surface tension especially $C_{12-14}EO_7$, and $C_{12-14}EO_9$. Therefore, these information can make decision using fatty alcohol instead of synthetic surfactant-based.

5.2 Recommendations

Base on the present results, the following recommendations are suggested for future studies:

1. To study foam properties in mixed surfactants systems such as nonionic/cationic and nonionic/anionic systems.
2. To study the effect of water hardness on foam properties in three foam test methods for further study.
3. To study the phases diagram of each the studied surfactant varying temperature and surfactant concentration.