

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

In this work, the adsorption isotherms of surfactants on three kinds of hydrophobic plastics which covering the whole range of hydrophobicity are investigated and related to the contact angle of surfactant solutions on those plastics. Three surfactants used for this study are 4-octylbenzenesulfonate sodium salt, NaOBS, (anionic surfactant), Cetylpyridinium chloride, CPC, (cationic surfactant) and polyoxyethylene octyl phenyl ether, OPEO₁₀ (nonionic surfactant) and the plastics are polytrifluoroethylene (PTFE), polyvinylchloride (PVC) and polycarbonate (PC).

From the experimental results, the conclusions can be drawn as following:

Adsorption and Wetting of CPC

1. At the below its CMC region, the amount of CPC adsorption increases obviously with increasing its concentration and becomes nearly constant at about CMC region. Moreover, an increase in the NaCl concentration produces a slightly increase in the adsorbed CPC amount since NaCl can reduce the electrostatic repulsion between the head groups of adsorbed CPC molecules.
2. A comparison of contact angle reveals in the following order PTFE > PVC > PC which correspond to the hydrophobicity of plastics.
3. The contact angle of CPC solutions on all studied plastics decrease when CPC concentration increases. The reduction of contact angle does not only result from the reduction of liquid/vapor surface tension, γ_{LV} , but also the reduction of solid/ liquid interfacial tension, γ_{SL} .
4. The solid/liquid interfacial tension, γ_{SL} , is not constant but decreases with increasing CPC concentration and CPC adsorption on plastics.
5. In the case of PTFE, the adsorbed CPC amount at the solid/liquid interface is equal at the liquid/vapor surface due to the nature of PTFE surface is considered as strong hydrophobic which is similar to the liquid/vapor surface. Hence, the γ_{SL} can be reduced as effectively as γ_{LV} .

6. Contrary to PTFE, NaOBS solutions do not produce the same contact angle for PVC and PC surfaces at the same γ_{LV} . The difference in the nature between these interfaces is a possible reason. PVC and PC surfaces are considerably more polar solids so the adsorption of surfactants at the solid/liquid interface is lower than at the liquid/vapor surface and the presence of NaCl cannot allow surfactants to adsorb fully at the solid/liquid interface. Therefore, the γ_{SL} does not decrease as well as γ_{LV} .

Adsorption and Wetting of NaOBS

1. The adsorbed amount of NaOBS increases with increasing its concentration and becomes constant at about CMC region and the effect of ionic strength is similar to the adsorption of CPC.

2. A comparison of contact angle shows the same order as revealed in the CPC case.

3. The contact angle of NaOBS solutions on all studied plastics decreases when NaOBS concentration increases which is resulted not only from the reduction of γ_{LV} but also γ_{SL} . Moreover, the presence of NaCl resulted in better wetting for solutions that have the same NaOBS concentration.

4. The solid/liquid interfacial tension, γ_{SL} , is not constant but decreases with increasing NaOBS concentration and NaOBS adsorption on plastics.

5. Contrary to CPC case, for all types of plastics NaOBS solution produces almost the same contact angle at the same γ_{LV} . The polarity of plastic seems to have no effect on wettability. However, in the case of PC, the polarity has a slightly effect at high γ_{LV} .

Adsorption and Wetting of OPEO₁₀

1. Similar to CPC and NaOBS cases, the OPEO₁₀ adsorption increases when the concentration increases and becomes constant at about CMC region.
2. At the same OPEO₁₀ concentration, the OPEO₁₀ solutions with varying salt concentration have the same γ_{LV} . The addition of NaCl has no effect on the reduction of γ_{LV} .
3. A comparison of contact angle shows the same order as reveals in the CPC and NaOBS cases which are PTFE > PVC > PC.
4. The solid/liquid interfacial tension, γ_{SL} , decreases with increasing OPEO₁₀ concentration and OPEO₁₀ adsorption on plastics.
5. The adsorbed amount at the solid/liquid interface is almost equal at liquid/vapor surface for PTFE while is lower than the adsorbed amount at liquid/vapor surface in the case of PVC and PC.

5.2 Recommendations

- 1 The structure of surfactants seems to has an effect on wettability which should be studied further.
- 2 The adsorption and wetting should be investigated on the more polar solid to study the significant effect of polarity.