CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

In the attempts to gain better understanding in the surfactant-enhanced carbon regeneration (SECR), this research focused on the study of the adsorption and desorption of anionic surfactant on two hydrophobic surfaces, activated carbon (GAC) and polymeric resin (XAD-4), under various conditions. Sodium dodecyl sulfate or SDS was used mainly as a surfactant in the batch liquid adsorption experiments. XAD-4, representing a more homogeneous hydrophobic adsorbent was used for comparison throughout the study. Effects of temperature, ionic strength, and structure of surfactant on the adsorption and desorption were also examined.

From the adsorption experiments, it can be seen that GAC adsorbed SDS to a much higher extent when compared to XAD-4. This is due to a much higher surface area of GAC than XAD-4. In contrast, adsorbed SDS molecules on GAC were found to desorb from the surface to a lesser extent when compared to XAD-4 system as indicated by a relatively large hysteresis loop observed in GAC system. This can be attributed to the pore size, pore distribution, and heterogeneity of the surface of the adsorbents. Pores in GAC are mostly in the range of micropore which much more difficult for the adsorbed surfactant to desorb, whereas for XAD-4, pores are mainly in the range of mesopore and macropore. Therefore, it may be easier for SDS to desorb from XAD-4. In addition, GAC surfaces are more heterogeneous than those of XAD-4 and may contain a variety of functional groups which can be bonded to the surfactant molecules. On a contrary, XAD-4 is a synthetic material and therefore, the surface can be expected to be more homogeneous.

From the effect of temperature, it was found that increasing temperature from 30°C to 50°C had little effect on the adsorption of the surfactant on both hydrophobic adsorbents. However, increasing temperature was shown to enhance the desorption of surfactant from GAC surface, as indicated by a decrease in the size of hysteresis loop. In contrast, increasing temperature was shown to affect the adsorption and desorption of the surfactant in case of XAD-4 which may be due to

possible change in the configuration of adsorbed surfactant on the surface and the thermal stability of XAD-4 itself. Moreover, the addition of salt (NaCl) into the system resulted in smaller hysteresis in the adsorption and desorption for GAC. When using sodium octanoate which has a shorter carbon chain length than SDS, higher adsorption was observed for both adsorbents and the hysteresis was found to be much smaller than SDS, suggesting better surfactant desorption from the hydrophobic surfaces.

5.2 Recommendations

Upon the completion of this study, some recommendations can be made as follows. The experimental study should expand to include a variety of surfactants to be used in the adsorption and desorption and then the results can be systematically compared and discussed. For example, sodium octyl sulfate can potentially be a candidate for comparison with SDS and sodium octanoate to provide a better understanding of the hydrophobic interactions in the adsorption and desorption on the hydrophobic surfaces. On the other hand, cationic surfactants should also be used in a comparative study to investigate the effect of electrostatic interactions.