CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

In this study, the adsorption of two single surfactants and a binary mixture of the two on Hi-Sil®255 was studied. The results showed that using the mixed surfactant (Arquad®T-50 and Teric®X-10, 3:1 molar ratio) provided the highest surfactant adsorption, ≈700 μmol/g silica. The adsolubilization of styrene and isoprene into three different levels of adsorbed surfactant (500, 350, and 200 μmol/g silica) were found to depend on the amount of surfactant adsorbed on silica as well as the polarity of the solute. The partition coefficient (K) suggests that the adsolubilized styrene was located in both the palisade layer and the core of the admicelle. In contrast, isoprene partitioned primarily into the palisade regions of the admicelle. The modified silica and styrene-isoprene copolymer thin films were characterized. The investigated process variables (amount surfactant adsorption and mole ratio of adsorbed surfactant : adsolubilized co-monomer) significantly affected the amount and characteristics of the copolymer formed. The results revealed that the modification of the silica increased the mean agglomerate particle size and lowered the BET surface areas compared to that of the unmodified ones. TGA and GPC confirmed the extent of copolymer coverage and molecular weight of copolymer formed increased with the increase in the surfactant adsorption and reduced mole ratio of the adsorbed surfactant : adsolubilized co-monomer. The grain boundary of the modified silica was larger than the unmodified silica, as shown by the AFM. Admicellar polymerization process was successful to increase the hydrophobicity of all modified silica by 60-90%.

The results show that the rubber compound physical properties improved with the mole ratio of the adsorbed surfactant: adsolubilized co-monomer and the maximum improvement on the rubber properties was at 16:1H. If the mole ratio of adsorbed surfactant : adsolubilized co-monomer was increased more than this ratio, the improvement on the rubber properties decreased. The same trend at the other surfactant adsorption levels can also be seen. However, the modified silica with low

surfactant adsorption at 16:1L can maintain or even improve the rubber properties as good as the high surfactant adsorption while providing much reduction in the production cost.

5.2 Recommendations

It would be interesting to develop the rubber properties that correspond to the real applications. In addition, the dispersion of the modified silica in a rubber matrix should be investigated by SEM to confirm the compatibility of the rubber and silica. Moreover, low cut growth resistance of the rubber compound is a problem for real applications so there is need to improve the efficiency of mixing, which may be considered with mixing time, temperature during mixing process, and the efficiency of mixer machine.