CHAPTER 4

Conclusion

As the purpose of this research was aimed to modify the cotton cloth in order to remove oil (organic substance) in water treatments and used to prepare water-resistant food packaging. Therefore, the main goals of this work are set as; (1) to prepare inorganic layer of $SiCl_4$ on cotton cloth and study its deposition time and deposition cycle for reaction; (2) to enhance cotton cloth by pretreating with $SiCl_4$ followed by POTS, DMDCS, and SA. The cotton cloth was 99% cellulose and used as a raw material in this study. The experimental procedures were carried out in five steps: (1) the characterization of cotton cloth, (2) the preparation of $SiCl_4$ modified cotton cloth, (3) the investigation of the $SiCl_4$-cotton cloth surface, (4) the fabrication of hydrophobic cotton cloth on the cotton cloth and $SiCl_4$-treated cotton cloth surface by POTS, DMDCS, and SA and (5) the characterization of the hydrophobic cotton cloth.

The properties of untreated cotton cloth and $SiCl_4$-treated cotton cloth were characterized in terms of its morphology, chemical composition, deposition time, deposition cycle number. The SEM images exhibited a smooth sheet of untreated cotton cloth and a rough surface of $SiCl_4$-treated cotton cloth. The EDS spectra showed C, O components on untreated cotton cloth and C, O, Si components of $SiCl_4$-treated cotton cloth. The best conditions for preparing $SiCl_4$-treated cotton cloth are 20 min deposition time and 6 deposition cycles. The FTIR spectrum showed signals corresponding to the functional group O-H and C-O stretching vibration of untreated cotton cloth. The FTIR spectrum was not obtained peaks of $SiCl_4$ because it is very low concentration in the ppm scale. However, the $SiCl_4$-treated cotton cloth surface exhibited more wettability than the untreated cotton cloth.

Hydrophobic cotton cloths were prepared by fabrication of untreated cotton cloth and $SiCl_4$-treated cotton cloth with POTS, DMDCS, and SA. The deposition times

for POTS and DMDCS are varied from 0 to 180 min. The concentration of SA is varied from 0 M to 0.02 M. After the deposition of hydrophobic reagent as the upper layers, the six samples of hydrophobic/superhydrophobic cotton cloths including POTS-treated cotton cloth, DMDCS-treated cotton cloth, SA-treated cotton cloth, POTS-$SiCl_4$-treated cotton cloth, DMDCS-$SiCl_4$-treated cotton cloth, and SA-$SiCl_4$-treated cotton cloth are obtained. The EDS spectra showed C, O, Si, F components on POTS-$SiCl_4$-treated cotton cloth and C, O, Si, Cl components of DMDCS-$SiCl_4$-treated cotton cloth. The DMDCS was more cover coating on the cotton cloth surface than that of POTS and the thickness of DMDCS layer was found thicker than that of POTS as shown by SEM. The morphology of the SA-$SiCl_4$-treated cotton cloth shows more different compared to the POTS-$SiCl_4$-treated cotton cloth and DMDCS-$SiCl_4$-treated cotton cloth. When the concentration of SA increases, the surface of the SA-$SiCl_4$-treated cotton cloth is smoother with hydrophobic agent film of SA coating. It could be observed that the more concentration of SA showed a smoother. According to XRD results, the patterns of all samples show the typical four peaks of [-110], [110], [200], and [004] at 2θ equal to 14.8º, 16.3º, 22.6º, and 34.3º, respectively. Those results indicate the unchanged crystalline structures of the cotton cloth before and after treatment with POTS, DMDCS, SA, POTS-$SiCl_4$, DMDCS-$SiCl_4$, and POTS-$SiCl_4$ due to physical adsorption between cotton cloth and $SiCl_4$ and/or POTS, DMDCS, SA. In the water contact angle measurement, the POTS-$SiCl_4$-treated cotton cloth exhibits an excellent super-hydrophobic behavior with degree above 150º, while both of SA-treated cotton cloth and SA-$SiCl_4$-treated cotton cloth are more like to superhydrophobic behavior about 142º. From the results obtained throughout this study, the POTS-$SiCl_4$-treated cotton cloth was proven to be good superhydrophobic cotton cloth (158º).