CHAPTER III
EXPERIMENTAL

3.1 Materials

3.1.1 Chemicals

Cetylpyridium bromide (CPB, 97% purity) was used in this work. It is a cationic surfactant with a positively charged pyridinium head group was purchased from Sigma-Aldrich, Inc., 3050 Spruce, St.Louis, MO, USA. The nonionic surfactant, polyoxyethylene octyl phenyl ether ($OP(EO)_{10}$, 99% purity) was from Fluka. All chemicals were used without further purification.

3.1.2 Plastics

All plastics were provided by these kindly companies. Polycarbonate (PC), grade PC110, was from Chi Mei Corporation. Polyvinylchloride (PVC), grade SG580, was from Thai Plastic and Chemicals Public Co., Ltd. High density polyethylene (HDPE) was from Thai Polyethylene Co., Ltd. Polymethyl methacrylate (PMMA) was from Diapolyacrylate Co., Ltd. Acrylonitrile butadiene styrene (ABS) was from IRPC Public Co., Ltd. And polyhexamethylene adipamide (Nylon66), grade A31, was from SY Smile Co., Ltd.

3.2 Equipment

These following equipment were used in this work, such as,

1. Grinder
2. Sieve (diameter size is 74, 125, 300, and 425 μm)
3. Water bath
4. Syringe filter (VertiPure, nylon 0.45 μm)
5. UV-Vis Spectrophotometer (Shimadzu Lamda 10)
6. Contact angle tester (Krüss, DSA10)
7. Quantachrome Autosorb-1
8. Compressing molder

3.3 Methodology

3.3.1 Plastic Powder Preparation

First, plastic pellets were ground into a powder by a grinder. Then, the powder was sieved to get particles that were in the range of 74-425 μm in diameter. This powder was further used in the adsorption experiment.

3.3.2 Adsorption Experiment

The adsorption experiments were carried out by mixing 20 ml of surfactant solutions having different concentrations with 0.25 g of plastic powder and the mixtures were incubated for 5 d at 30°C in a water bath. The molar fraction of nonionic surfactant in mixture solutions was varied to 0, 0.25, 0.50, 0.75, and 1. The supernatant solutions which were obtained by filtering with nylon syringe filters were taken for analysis of surfactant concentration. Surfactant adsorption on plastic surfaces was calculated from the concentration difference method, and the adsorption isotherm was plotted.

3.3.3 Analysis of Surfactant Concentration

Cationic surfactant and nonionic surfactant concentrations were determined by using a UV-Vis spectrophotometer (Shimadzu, UV-2550) at wavelengths of 254, and 282 nm, respectively, in which the pyridinium and the phenyl groups have strong adsorption bands.

3.3.4 Surface Tension Measurement

The surface tension of surfactant solutions (γ_{LV}) was measured by using a contact angle tester (Krüss, DSA10). All surface tension measurements were controlled at 30°C. Before measuring the surfactant solution surface tension, the surface tension of water was first calibrated for setting the baseline, and the pendant drop was used. The liquid was released from the syringe until reached the maximal volume before dropping out of the syringe to measure the surface tension of the surfactant solution. From the surface tension isotherm, the critical micelle concentration (CMC) could be determined.

3.3.5 Contact Angle Measurement

The contact angles, θ, of all studied solution samples on the studied surfaces were measured using the sessile drop technique by the contact angle tester. A volume of 0.01 ml drop of surfactant solutions or pure water was placed onto studied plastic smooth sheets and the contact angle was measured after 2 min to allow equilibrium to occur. During the measurement, the chamber temperature was kept at 30°C and saturated with water vapor to prevent the drop evaporation effect.

3.3.6 Surface Area Measurement

The surface areas of the plastics were measured by using the Quantachrome Autosorb-1. It measured the quantity of gases adsorbed onto or desorbed from a solid surface at some equilibrium vapor pressure. Nitrogen, with a cross sectional area 16.2×10^{-2} m^2/molecule, was employed as an adsorbate at the liquidfied nitrogen temperature (77K). The plastic powder was dried and outgassed in the sample cell at 80°C for 17 h before the adsorption. The specific surface areas of each plastic were evaluated from the seven adsorption isotherms. The results were analyzed using the Autosorb-1 ANAGAS software Version 2.10.