CHAPTER I
INTRODUCTION

Adsorption of surfactants on solid particles is of interest to both academia and industry because of its highly useful applications, such as surfactant-based separation processes, wastewater treatment, removal of toxic substances from soils, detergency, oil recovery, etc. In the case of ionic surfactants and oxide solids, it is generally admitted that at very low concentration individual monomers adsorb at localized ionic sites; at higher concentration, lateral interactions induce the formation of various structures (hemimicelles or admicelles) that increase in extent with increasing surfactant concentration up to approximately the critical micelle concentration (CMC). They may collapse into monolayer or bilayer structures or retain a patchwork-type aggregate structure (Monticone and Treiner, 1995). The presence of adsorbed surfactant aggregates may induce the incorporation of hydrophobic solutes from the solution onto the adsorbed aggregates at concentrations below the critical micelle concentration (CMC). This phenomenon has been termed surface solubilization or adsolubilization (Scamehorn and Harwell, 1988). There are several important parameters that affect both surfactant adsorption and adsolubilization such as type of surfactant and its concentration, pH, and ionic strength.

Most of the previous investigations have studied the adsorption of a single surfactant adsorbed at the solid/aqueous solution interface. Recently, the adsorption of mixed surfactants at the solid/liquid interface has received increasing interest because of the superior properties obtained by a mixture due to the synergistic effects between different surfactant species (Holland and Rubingh, 1992). In the systems comprising ionic-nonionic surfactants, in particular, much lower amounts of surfactant is required to obtain performance in both adsorption and adsolubilization that is similar or superior to the single surfactant systems.

The objective of this study was to examine the effect of pH on the surfactant adsorption and adsolubilization of various organic compounds in mixed cationic-nonionic surfactants (CTAB and Triton X-100) adsorbed on precipitated silica. In the first part, we studied the adsorption CTAB (cationic surfactant) and Triton

(nonionic) singly and in mixtures on precipitated silica at three different pH values (3, 5, and 8). In the second part, we investigated the adsolubilization of three organic compounds, benzene, toluene, and ethylbenzene, in the single- and mixed CTAB/Triton X-100 systems at various concentrations and three pH values. For all studies, the adsorption and adsolubilization isotherms were constructed and used as a means to examine the influence of pH on the adsolubilization in both single-surfactant and mixed-surfactant systems.