CHAPTER I

INTRODUCTION

The behavior of surfactants at the interface of aqueous solution and mineral oxide surfaces is important in many applications, such as detergency, enhanced oil recovery, froth flotation and surfactant-based chromatographic techniques. Initially, the adsorption of surfactants on media was studied to maximize the recovery of ores. Ore flotation enhanced by surfactants adsorbed onto media was studied by allowing mineral fines to adhere to bubbles sparged into a slurry (Frommer, 1967). The study of counterion effects in surfactant adsorption has presented the critical role of counterions in the formation of admicelles, which role is critical in any surfactant-based enhanced oil recovery (Bitting and Harwell, 1987). The application has also been studied in flocculating the dispersed solid by using the mixed properties of hydrocarbon and fluorocarbon surfactants (Esumi et al., 1989).

One currently explored separation process, admicellar chromatography, has used the nature of the adsorbed surfactant layer and its adsolubilization properties (Barton et al., 1988). Reaction processes have also been studied, such as the polymerization of styrene in admicelles which serve as reaction solvents (Wu et al., 1987), admicellar catalysis in which admicelles catalyze the reaction by adsolubilizing the organic reactant and concentrating a counterion (Yu et al., 1992), and surface modification processes by ultra-thin film formation (O'Haver et al., 1994). Recently, adsolubilization of contaminants by media-sorbed surfactants is an important phenomenon for surfactant-based environmental technologies (Nayyar et al., 1994).

The development of admicellar techniques for wastewater cleanup may have a problem of desorption of surfactant, even though it was found the chromatographic packings of surfactant on solid supports showed little loss of very highly water soluble surfactants (Barton et al., 1988). To mitigate the surfactant bleed problem, the "modified bilayer or admicellar system" in a packed column was studied by operating below the surfactant's Krafft temperature (Nayyar et al., 1994).

The continuous loss of surfactant still be too high due to environmental restrictions or because of the high cost of surfactant. The technique utilized to recover surfactant is ultrafiltration, which adds a significant expense. The chemical bonding of surfactant or surfactant-like molecules to mineral oxide surfaces (bonded monolayer) may solve this problem. Although adsolubilization constants differ, monolayer properties are similar to those of bilayers. The cost of bonded monolayer on solid oxide surface will be significantly higher than that of a physically-adsorbed surfactant, but the advantage of zero make up and zero surfactant loss is attractive enough to explore this alternative.

In the last several years, a novel method was proposed for successively constructing organized molecular layers on solid surfaces using surface-active compounds, bifunctional silane-terminated ethylenic surfactants, chemically adsorbed at the liquid-solid interface (Netzer and sagiv, 1983). The octadecyltrichlorosilane-treated H-ZSM-5 was used to study the hydrolysis of water-insoluble esters in toluene-water solvent system (Ogawa et al., 1994). The monolayer on mineral oxide surfaces is also utilized for column packings for high performance liquid chromatography (HPLC) (Nakamura et al., 1981).

In this study, the chemical bond between octadecyltrichlorosilane (ODS) and the silica surface will be formed. Adsolubilization in the bonded ODS of phenol and trichloroethylene will be compared to adsolubilization in adsorbed CTAB. The stability of bonded ODS was investigated under conditions of varying agitation speed, agitation time, pH and temperature. Finally, the stability of ODS on silica in the presence of ozone was studied at various ozone concentrations and pH values of solution.