

CHAPTER I

INTRODUCTION

Immobilized surfactant aggregates at solid/liquid interfaces are important in many applications, such as ore flotation, enhanced oil recovery, surface modification of various substrates through polymerization of monomers in admicelles, and admicellar catalysis. Initially, the adsorption of surfactant on media was used 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). Petrogeologists have investigated the possible use of surfactants to improve the secondary and tertiary removal of oil through surfactant floating of reservoirs (Miller et al., 1987). 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 organic solute by media-sorbed surfactants has become an important phenomenon for surfactant-based environmental technologies (Nayyar et al., 1994). The development of an admicellar technique for wastewater treatment has been facing a problem of surfactant desorption. This problem leads to surfactant contamination in the treated water. To decrease the surfactant bleed problem, the surfactant admicelle system was studied by operating below the surfactant's Krafft temperature (Nayyar et al.,

1994). Nevertheless, the continuous loss of surfactant still may be too high due to environmental restrictions or because of a high cost of surfactant. One of the techniques utilized to recover surfactant is ultrafiltration which adds a significant expense. The chemical bonding of surfactant or surfactant-like molecules to mineral oxide surface may solve this problem. Although the cost of bonded monolayer onto solid oxide surface will be significantly higher than that of physically-adsorbed surfactants, the advantage of no surfactant recovery cost and zero surfactant loss is sufficiently attractive to explore this alternative.

In 1996, the chemical bonding of octadecyltrichlorosilane (ODS) was constructed to study the adsolubilization of phenol and trichloroethylene and compare to adsolubilization of physically adsorbed CTAB (Thakulsukanant et al., 1997). Both bonded ODS and CTAB admicelles on silica showed similar trends in adsolubilization of TCE due to the nonpolar property of TCE, but the adsolubilization of polar phenol was significantly different. Although there is a small loss of bonded ODS with increasing agitation speed, agitation time, temperature, and pH, the loss of bonded ODS under ozone conditions is quite significant.

In this study, since fluorocarbon are more stable to harsh chemical environment, the chemical bonding of (Heptadecafluoro-1,1,2,2-tetrahydrodecyl) dimethyl-chlorosilane (HFD) to a silica surface was prepared. The amount of HFD used was varied to produce surface C10 layers of varying coverage. Adsolubilization of phenol and trichloroethylene in the chemically bonded HFD was measured and compared to that of bonded ODS. The stability of both bonded ODS and HFD was investigated under various agitation speeds, agitation time, temperatures, and pH values. The stability of bonded ODS and HFD in the presence of ozone was also studied at various ozone concentrations and pH values.