CHAPTER I
INTRODUCTION

For many decades, microemulsion systems have been applied to many applications ranging from household products to industrial processes. One of the successful microemulsion applications is soil remediation. In subsurface remediation, surfactant microemulsion systems are used in order to improve the removal of organic contaminants. The technique is based on the properties of microemulsion, especially a middle-phase microemulsion, that provide high solubilization capacity and ultralow interfacial tension (Pennell *et al.*, 1994).

In order to form the microemulsion, a cosurfactant is needed to provide the proper balance between system hydrophilicity and lipophilicity. Moreover, the cosurfactant can prevent surfactant precipitation and rigid structure formation (e.g. gel and liquid crystal). The cosurfactant also stabilizes the microemulsion with a wide range of surfactant concentration. Microemulsion stability is strongly influenced by the amount and structure of cosurfactant (Sjoblom *et al.*, 1996; Yao and Romsted, 1997; Maidment *et al.*, 1997; Trotta *et al.*, 1998; Shiao *et al.*, 1998).

Low molecular weight alcohols are typically used as cosurfactants in microemulsion formulation. Unfortunately, the short-chained alcohols can be of environmental concern because they are volatile organics and flammable substances. The alcohol cosurfactant can contaminate the groundwater as well as volatilize thereby causing additional water and air pollution. Therefore, alternative substances are desirable for environmental application of microemulsions (Selle *et al.*, 1991; Sunwoo and Wade, 1992; Shiau *et al.*, 1994; Kahlweit *et al.*, 1995a; Shiau *et al.*, 1995; Aowiriyakul, 1998). Furthermore, non-volatile alternative is desirable when air stripping is used to flush solutions from soil remediation processes, thus further improving system economics.

In our research group, both alcohol and alcohol-free microemulsions have been studied in order to improve our understanding of these additives (Rouse *et al.*, 1996; Shiau *et al.*, 1994; Carter *et al.*, 1998; Shiau *et al.*, 1995; Aowiriyakul, 1998; Acosta, 2000; Tran, 2000; Deshpande *et al.*, 2000). In this work, fatty acids have been proposed to replace alcohols in microemulsion formulation. The fatty acids are environmentally friendly substances because they are biodegradable and have low volatility. Moreover, fatty acids are commonly used in other applications, e.g. pharmaceutical, cosmetic, and food products (Ash and Ash, 1997a; Ash and Ash, 1997b; Thevinin *et al.*, 1997). In this study, we evaluate the role of fatty acids as cosurfactants while varying their chain length in the microemulsion systems containing SDS, water, hexanes, and sodium chloride. The objective of this work is to investigate the phase behaviors, solubilization, and physicochemical properties of these microemulsion systems.