CHAPTER I
INTRODUCTION

Surfactant microemulsions have been applied in a wide range of applications from household products to industrial processes. Specifically, for middle phase microemulsion or Winsor Type III systems, the surfactants can provide high solubilization capacity and ultra-low interfacial tension. Microemulsions are generally formed from various surfactants which can be selected according to the specific applications. Numerous in industrial products and processes, the mixtures of surfactants are utilized (Kang *et al.*, 2001).

Surfactant mixtures have many synergistic advantages over a single surfactant (Stellner *et al.*, 1988; Rosen, 1989; Scamehorn and Harwell, 1993; Bumajdad *et al.*, 1999). In particular, mixtures of an anionic and a cationic surfactant have many unique properties, which arise from the strong electrostatic interaction between the oppositely charged head groups; such properties include a large reduction in the critical micelle concentration (CMC) and interfacial tension (Holland and Rubingh, 1990; Tomastić *et al.* 1991; Herrington *et al.* (1993); Talhout and Engberts, 1997; Li *et al.*,1999; Li and Kunieda, 2000; Bergström, 2001; Kang *et al.*, 2001; Doan, 2002; Raghavan *et al.*, 2002).

However, precipitation normally occurs in mixtures of an anionic and a cationic surfactant, particularly when the hydrophobic match is high (Talhout and Engberts, 1997). Precipitation of surfactants can often dramatically decrease the effectiveness of surfactants in altering wetting, foaming, emulsification, solubilization, and soil removal and antiredeposition in detergency. Therefore, it is essential to investigate how mixed anionic-cationic surfactant interacts without precipitation.

To avoid the precipitation of surfactant and formation of other rigid structures (e.g. gel and liquid crystal), a cosurfactant is typically added into the system because the cosurfactant provides the proper balance between hydrophilicity and lipophilicity for microemulsion formation. Alcohols are normally used as a cosurfactant in the microemulsion systems (Li *et al.*, 1996 and 1999). However, some alcohols are not dersirable in microemulsion applications; therefore recent

research has focused on development of alcohol-free microemulsion systems. It has been reported that the difference in chain lengths or structures of mixed surfactants can inhibit surfactant precipitation, thereby enhancing the space between the adjacent surfactant molecules (Herrington *et al.*, 1993 and Patist *et al.*, 1997). To form alcohol-free middle phase microemulsions, the present study investigates mixtures anionic and cationic surfactants with asymmetric tails, and compares these results with single-tailed surfactants.