# CHAPTER I
# INTRODUCTION

Surfactant solution exhibit many phenomena of technological interest. There are an enormous number of natural and synthetic surfactants available for various applications. For example, surfactants are of primary importance in detergency, separation techniques, agriculture, and pharmaceutical industry.

Foaming is one of the inherent properties of all surfactant solutions which can be either desirable or undesirable depending on the applications. Some of the important uses for custom designed foams are car wash products, fire fighting products, shampoos, and handwashing products. However, where handwashing products are concerned, foam has a great psychological effect, although it does not necessary imply a direct relationship with detergency performance. On the other hand, unwanted generation of foam is a common problem affecting the efficiency and speed of a vast number of industrial processes involving the mixing or agitation of multicomponent liquids. An automatic dishwashing is one which requires low foam, since excessive foaming may cause a reduction in the efficiency of contact of the detergent solution with dishware.

Excessive foaming may also cause inconveniences when detergent solutions are used especially in mechanical washing machine. In order to avoid this problem, nonionic surfactants, which are usually classed as low or moderate foamers, have been used in detergent formulation to suppress foaming.

Nowadays, not only nonionic surfactants are used in the formulation but an antifoam is also added because the surfactants usually still have more foam than required. Usually, antifoams are mixtures of oils and solid particles which form hydrophobic droplets in foaming solution. These droplets bridge the foam films and rupture them by a dewetting action. However, cost of antifoams such as silicone is expensive.

There are many ways to solve this problem. The one way is to design new surfactants that are good detergents and poor foamers. The substitution of the terminal OH groups of nonionic poly(oxyethylene) surfactants by a more hydrophobic part (oxypropylene chain, or chlorine) gives good detergents which are poor foamer in both concentrated and dilute solutions (Colin *et al.*, 1997).

Another way to solve this problem is to use the inherent property of nonionic surfactants, which is the cloud point. They are usually called cloud point antifoams. It is well known that the foamability of nonionic surfactants reduced markedly above the cloud point. At the cloud point, the polar head groups begin to dehydrate leading to smaller head groups. The micelles then grow in size and there are greater an attractive forces between the micelles (Triolo *et al.*, 1982, Brown *et al.*, 1983, Corti and Degiorgio, 1985, Degiorgio *et al.*, 1985). Upon heating, the solution becomes cloudy and separates into two phases: a micellar-rich phase and a micellar-poor phase. The phase separation is accompanied by a reduction in foamability.

It has been proposed that the drops of the micellar-rich phase which is separated out from the micellar-poor phase play the role of an antifoam agent by emerging into the air/water interface of the foam film and rupturing the film by dewetting or the so called the bridging mechanism (Bonfillon-Conlin and Langevin, 1997).

The foaming properties of liquids are often characterized by their foamability (initial foam formed) and foam stability (duration of foam). The Ross-Miles method (ASTM D 1173-53 standard method) is one of the most widely used methods for both commercial and academic purposes to measure both parameters.

In this study, experiments were carried out to study the foamability of nonionic surfactants both below and above their cloud point by using the Ross-Miles foam test method to obtain a better understanding of the role of the micellar-rich phase on the reduction of foamability of nonionic surfactants above the cloud point.