CHAPTER I
INTRODUCTION

There are several techniques to separate the desired chemicals, such as distillation and liquid extraction methods. However, these conventional separation processes still have some disadvantages; for examples, distillation process requires a lot of energy and some liquid extraction processes use hazardous solvents. In order to avoid these problems, the surfactant-based separations have been proposed. One of the interesting surfactant-based separations is the cloud point extraction (CPE). Unlike the distillation process, the CPE method consumes relatively low energy. Furthermore, using of nonionic surfactant as a mass separating agent can avoid the use of large toxic and flammable solvents in the liquid extraction. In recent years, this technique has been extended to extract organic compounds *e.g.* volatile organic pollutants in wastewater (Hinze and Pramauro, 1993).

The cloud point phenomena occurs when nonionic surfactant solution is heated above its cloud point temperature which is so-called a lower consolute temperature. Above the cloud point, the turbid solution splits into two homogeneous phases, which are coacervate phase and dilute phase. The coacervate phase is generally dense with surfactant micelles, while the dilute phase is lean in micellar surfactants and mostly contains water (Clint, 1992). However, the concentration of surfactant in the dilute phase is typically above the critical micelle concentration. In the cloud point extraction system, any organic solutes that subjected in the solution can solubilize in the micelle aggregates and concentrated in the small volume of coacervate phase (Scamehorn and Harwell, 1989).

This thesis focuses on the CPE technique to remove volatile organic compounds *e.g.* toluene from wastewater by using nonionic surfactants, which are alkyl phenol ethoxylates and alcohol ethoxylates. The purpose of this work is to study the effect of temperature and surfactant structure on the extraction efficiency. The effect of temperature can be investigated by varying the operating temperature. In order to study

the effect of number of carbon atoms in the hydrophobic part, the homologous series of various alkyl chain lengths are used. Moreover, the various numbers of ethylene oxide in the hydrophilic head group are investigated to study the effect of number of ethoxylate in the hydrophilic group.