CHAPTER I
INTRODUCTION

Nowadays, an environmental remediation of wastewater disposed from industrial sources prior to discharge to the public reservoir as industrial waste is crucially concerned. The aromatic compounds and its derivatives are a major class of toxic chemicals containing in the wastewater leading to a severe harmful to human either suspected as carcinogens or mutagens even in an extremely low concentration at ppm and sub-ppm level. Without using an organic solvent, which is often toxic, surfactant-based separations are an alternative to traditional separation processes utilized relatively benign surfactant as the separating agent. Many applications of surfactant-based separation are successful in wastewater clean-up of polluted materials such as the micellar-enhanced ultrafiltration of multivalent ionic solutes, the flotation of solid particles and oily wastewater (Scamehorn and Harwell, 1989; Scamehorn *et al.*, 2004). This research work is focused on the cloud point extraction (CPE), which utilized a nonionic surfactant as the separating agent and has been recognized as an effective technique to remove dissolved organic contaminants from wastewater. Due to a unique phenomenon of aqueous nonionic surfactant solution at concentration above its CMC, it will undergo a phase separation into a micellar-rich phase and a micellar-dilute phase, when the temperature of the solution is higher than the certain temperature known as cloud point (CP). These two phases are great different in surfactant concentration. The organic solutes containing in the solution are incorporated into surfactant micelles by mean of solubilization phenomenon due to its affinity and concentrate into a micellar rich phase after the phases have separated. Therefore, the CPE is a promising technique to extract the aromatic solutes containing in the wastewater into surfactant micelles.

Many studies have been made over the years on cloud point extraction of organic compounds and also biomaterials but none of them investigated on how this technique is applicable for the real waste treatment system in the petrochemical industries. Recently, cloud point extraction (CPE) technique has been successfully scaled up to remove aromatic contaminants from wastewater stream continuously in a multi-stage rotating disc contactor (RDC) by our research group (Trakultamupatam et al., 2004). Therefore, this work is the continuous work to study further on the scaled up cloud point extraction unit.

The purposes of this research are firstly to continue the study of the continuous cloud point extraction of aromatic solutes from wastewater on pilot multistage cloud point extractor in order to serve an industrial application. To achieve the highest in column efficiency, the optimum conditions were evaluated by varying the wastewater and surfactant feed flow rates, rotating disc speed and operating temperature as the preliminary studies. The effects of structure and initial concentrations of solute were studied in a continuous operation and compared the results with batch experiments as described in Chapter IV.

Secondly, the effect of nonionic surfactant molecular structure on the cloud point extraction performance in single stage mode, batch experiment was studied as a parallel work as summarized in Chapter V, not only to fundamentally investigate the effect of nonionic surfactant molecular structure on CPE for removal of aromatic pollutants from wastewater which a few research have been reported, but also to precisely understand the system limitations. So that, the CPE knowledge can be applied in a continuous operation in the CPE unit that has been successfully scaled up.

Lastly, as an entrainment of surfactant coacervate to dilute phase found in continuous operation are noted as an important factor that decreases the performance of the column, the potential solutions for a reduction of the entrainment were proposed and discussed in Chapter VI.