CHAPTER I
INTRODUCTION

Mixed waste discharge containing heavy metals, radioactive components and organic contaminants is the most worrisome problem now a day. They are generated from many industrial productions. Contaminations in water systems due to wastewater are strongly influenced by interactions between the contaminant and the physical, chemical, and biological components of the subsurface. Several metals such as lead, cadmium, and chromium are toxic pollutants which cause hazardous to health and environment. Organic contaminants include hydrocarbon solvents, chlorinated compounds, polychlorinated biphenyls (PCBs) etc. Organic contaminants such as hydrocarbon solvents usually present in the form of aromatic hydrocarbons (e.g. benzene, toluene, and xylene) and polyaromatic hydrocarbons (e.g. naphthalene, phennanthrene). They are irritant and carcinogenic substances. Therefore, the industries would have to removal of heavy metal and organic contaminants. Thus need to be removed before disposal. Different treatment methods have been used and developed for removal of these contaminants from waste waters. These methods include chemical precipitation, adsorption, ion exchange, electrochemical methods, membrane separation, solvent extraction and biological methods. Nevertheless, each a technique has advantage and disadvantage depending on wastes for effective and economical removal. It is now widely recognized that sorption processes provide a feasible method for the removal of pollutants from waste water. Adsorption technique can possibly be used to treat both heavy metal and organic compound simultaneously. For several years, various natural adsorbents such as clay minerals, activated carbon and zeolite have been used as adsorbents to remove heavy metal and organic compound from contaminant wastewater, economically.

In our laboratory, we have conducted research on the treatment of mixed wastewaters by using surfactant-modified zeolite (SMZ) based on a naturally occurring zeolite-clinoptilite to adsorb heavy metal and organic contaminants. The most common natural zeolite is clinoptilolite. Zeolites are hydrated aluminosilicate materials having cage like structures high surface areas and high cation exchange

capacities. The surface is neutralized by positively charged inorganic counterions but these counterions or cations can be replaced by primary amine or quaternary ammonium cations such as cetyltrimetylammoniumbromide (CTAB), thus altering the surface properties of zeolites. As a result, clinoptilolite surface become neutral and strongly hydrophobic. The modified-zeolite can be further used to anchor metal ligand or anion surfactant such as sodium dodecylsulfate (SDS) through hydrophobic interactions to form a surfactant-modified zeolite (SMZ). The metal ion is expected to adsorb on the hydrophilic region of the surfactant by the formation of a metal complex. In addition, organic region or hydrophobic region of SMZ can adsorb organic compounds. Thus, the resulting SMZ can potentially be used to remove mixed wastes containing both heavy metal and organic contaminants.

This research work focuses on the preparation of surfactant-modified zeolite (SMZ) using mixed cationic and anionic surfactants and the adsorption characteristics of surfactant-modified zeolite (SMZ) for heavy metal and organic contaminants. In the first part of the study, SMZ was prepared by adsorbing CTAB and anionic surfactant on clinoptilolite surface. Effects of various types of anionic surfactant and cationic-anionic surfactant ratio were examined. The resulting SMZ was then characterized for the surface functional group and the surface potential by FTIR, and zeta meter. In the second part, batch liquid adsorption experiments were carried out to evaluate the adsorption capacity of SMZ for heavy metal such as lead and cadmium and organic contaminant such as toluene.