CHAPTER I
INTRODUCTION

Hydrophobic organic compounds (HOCs) and heavy metals are the major constituents of wastewater produced from many important industries such as petrochemical, plastic, rubber and petroleum refineries, etc. These contaminants pose a major threat to human and the surrounding ecosystem. Many of organic compounds such as dichloromethane, benzene, xylene and polyaromatic hydrocarbons (PAHs) such as benzopyrene are extremely toxic and carcinogenic. Heavy metals also cause serious soil and water pollution. Pb^{2+}, Cd^{2+}, Hg^{2+}, and Cr^{3+} are especially common metals that tend to accumulate in organisms, causing numerous diseases and disorders.

Currently, there are many treatment processes available for the removal of pollutants from wastewaters. For the removal of trace organic contaminants, the technologies generally practiced today are microbial biodegradation, liquid-liquid extraction, steam stripping, chemical oxidation and incineration. In addition, several processes exist for removing dissolved heavy metals, including ion exchange, precipitation, phytoextraction, ultra filtration, reverse osmosis and electro dialysis. However, many of the above mentioned processes have been developed for particular waste species and hence are not suitable for being applied for mixed waste comprising different contaminants.

In recent time, the use of alternative low-cost materials as potential adsorbents used for adsorption process has been proposed for the treatment of mixed wastes. Surfactant-modified adsorbents are an engineered material that is synthesized by exchanging mineral's naturally occurring inorganic cations which is ordinary unique for natural zeolite and mineral clay with organic cations. The naturally occurring inorganic cations on their surface are not part of structure and thus they can easily be replaced by organic cations both on external mineral surfaces and in the interlamellar space by an ion exchange process. By exchanging organic cations onto the surface of minerals, a material with thoroughly different physical and chemical properties is produced. In this study, clinoptilolite, which is a natural zeolite and mineral clay, are used as base minerals. Synthesized organo-mineral is organophobic

rather than hydrophilic like base mineral and is capable of adsorbing nonpolar organic contaminants from water, unlike unmodified minerals, which are poor sorbents for these compounds. Due to their sorptive capacity for organic contaminants and low permeability in the presence of nonpolar liquids, organo-mineral has been proposed as additives to waste containment facilities, landfill liners, and slurry walls.

This study specifically examines the sorptive capabilities of organo-minerals prepared from clinoptilolite and bentonite for the removal of the heavy metal and organic compounds from aqueous solution. Firstly, clinoptilolite and bentonite were modified by cationic surfactant, cetyltrimethylammonium bromide or CTAB, to form a monolayer. Afterward, CTAB-modified clinoptilolite and CTAB-modified bentonite were further modified by an anionic surfactant, DOWFAX 8390 through a bilayer adsorption. Thirdly, the batch adsorption experiments using both SMADs were carried out for heavy metal and different organic compounds which different in functional group of benzene as its derivatives in separated single-solute system. Finally, the batch adsorption experiments of heavy metal and organic compound were conducted in mixed-solute system.