CHAPTER 1
INTRODUCTION

1.1 Motivations

Soil contamination associated with chlorinated hydrophobic organic compounds (CHOCs) such as hexachlorobenzene (HCB), pentachlorophenol (PCP), and polychlorinated biphenyls (PCBs) has aroused intensive concerns (Pan et al., 2008). One of the most toxic which was also classified as one of the 12 persistent organic pollutants (POPs) by the United Nations Stockholm Convention is HCB (Chen et al., 2010). HCB has been detected in water, air, and soil samples from around the world which is greatly concern because of its toxicity, resistance to degradation, and tendency to accumulate. Normally, HCB is a by-product of chemical solvents and other compounds containing chlorine, and pesticide manufacturing. In the United States, HCB commercial production was firstly produced and used as a pesticide in 1965, but its use is now uncommon. It was banned by the United Nations because it deteriorates environmental quality due to its hazard properties. At present, it appears mainly as a by-product of several chemical processes or an impurity in some pesticides. As mentioned, HCB continues to be released to the environment from several sources. Moreover, the properties of HCB are highly insoluble in water and soluble in organic solvents (Pearson, 1982). Therefore, it is distributed throughout the environment because it is mobile and persistent.

In Thailand, HCB was banned from using as a pesticide in 1980 (Buxton, 2001). Although, there is an import prohibition of HCB, the problem of this hazardous waste still existed. The contamination of HCB was found in sediment and water samples that took from the Hua Lam Poo Canal, Samut Prakarn Province (Brigden et al., 2003; Wanitchapichat, 2006) and the mouth of the Bang Pa Kong River (Bangkok Post, 2001). Furthermore, there is a report revealed that HCB was detected in mussels and oysters collected along the east coast of Thailand (Chevaporn et al., 2005). It indicated that HCB will tend to accumulate in the sediment and/or living organisms due to the properties of highly insoluble in water. In addition, the inefficient process control and waste management practice was shown in those areas. People who live near an industrial site can possibly exposed to HCB via food chain. As a result, the

decomposition of HCB is important and necessary to protect the environment and public health.

Bioremediation techniques are mostly used for HCB remediation dechlorinating HCB with microorganisms because of low cost and environmental harmless. In fact, HCB contained high chlorine that promotes the highly oxidizing of the carbon atoms in HCB; it led the biodegradation under reductive environment preferable. Many researches reported that bacteria under anaerobic conditions are highly versatile and can transform HCB to lesser-chlorinated and less toxic chlorobenzenes. According to our earlier researches, HCB could be easily dechlorinated under anaerobic condition in the bottom sediment taken from the Hua Lum Poo Canal. HCB dechlorination occurred and completed in all media being tested even in the raw canal water. To evaluate the microorganisms, potential on HCB-dechlorination, the bottom sediment from the Erh-Jen River (Taiwan) combined with that from the Hua Lum Poo Canal was studied. In addition, the dechlorinations of HCB by the indigenous microbes collected from the Hua Lum Poo Canal, Bang Pla Kod Canal, a canal nearby small material recovery facilities, a canal nearby the South-Bangkok Power Plant Samut Prakarn Province, Thailand and the Erh-Jen River in Tainan, Taiwan were also investigated together with the effects of bioaugmentation and biostimulation.

1.2 Objectives

This research is focusing on the HCB dechlorination by the indigenous microorganism in Thailand and Taiwan and also aimed to investigating microbial augmentation under anaerobic environment. Therefore, several objectives have been established as follows:

1. To investigate the ability of natural anaerobic consortia in HCB dechlorination.
2. To determine the effect of organic substrates and nutrient supplements on HCB dechlorination.
3. To examine the dechlorination activity of blended consortia from various sediments, such as the Hua Lum Poo Canal, the Bang Pla Kod Canal, small material recovery facilities, nearby the South-Bangkok Power Plant in Samut Prakarn Province, Thailand, and the Erh-Jen River in Tainan city, Taiwan.

1.3 Scopes of work

1. Using raw water and sediments from the Hua Lum Poo Canal, Bang Pla Kod Canal, a canal nearby small material recovery facilities, a canal nearby the South-Bangkok Power Plant in Samut Prakarn Province, Thailand and the Erh-Jen River in Tainan, Taiwan as the sole microbial sources and media.
2. The experiments were performed in the laboratories of the Department of Environmental Engineering, King Mongkut's University of Technology Thonburi and Chia Nan University of Pharmacy and Science in Taiwan by using serum bottles.
3. All serum bottles were kept in the dark at room temperature.
4. The tests of HCB dechlorination were performed by blending mixed cultures from various sources of sediments.