CHAPTER 1

INTRODUCTION

During the past decade, the amount of hazardous waste in Thailand has risen markedly since the economics rapidly extended. In 2003, the amount of hazardous waste was approximately 1.8 million tons. The industrial hazardous waste was produced from different sources as well as automobile, insecticide, and petrochemicals, which were 0.7% of produced hazardous wastes or 10,000 tons. Most of hazardous waste, 1.26 million tons, was produced in Bangkok and urban regions (Pollution Control Department [PCD], 2003). These hazardous wastes were widely released into the environment including air, surface water, soil and sediments. One of the significant toxic chemicals is polycyclic aromatic hydrocarbons (PAHs). PAHs consist of two or more fused benzene rings. PAHs are hydrophobic compounds. Their persistence in ecosystem is mainly due to their low solubility (Churchill *et al.*, 1999). These substances are considered as important international environmental contaminants because of their toxic and carcinogenic properties. The combustion of organic material is chiefly responsible for their ubiquitous distribution. PAHs also constitutes in material derived from coal such as coal tar and creosote, and crude oil. Accidentally and deliberately spill from either industries or domestics and improper disposal during the transportation and processing resulted in a plenty of the contaminated sites presenting serious health and ecological risk (Vila *et al.*, 2001).

The surface water is one of mainly waste reservoirs. When the pollutants were released into the water, contaminants can be absorbed onto the suspended particles and subsequently accumulated in the sediments (Hauge *et al.*, 1998, Lau and Chu, 1999, and Carpentier *et al.*, 2002). Their hydrophobic characteristic and low biodegradability of PAHs can cause bioaccumulation and biomagnification effect in food chain of the aquatic organisms (Van der Oost *et al.*, 1988, Oliver and Niimi, 1988, Spies *et al.*, 1988, and Adamo *et al.*, 1997). Consequently, the human can expose PAHs from these contaminated aquatic organisms as common foodstuff. Therefore, these xenobiotics are needed to be essentially removed from the contaminated environments.

Various treatments such as physical and chemical techniques can be used to remove the hazardous wastes including PAHs. Indeed, the bioremediation is one feasible choice that can detoxify these contaminants. This biological process utilizes the consortium or pure strain of microorganisms to break down hazardous materials to non-toxic compounds such as carbon dioxide and water. Biotransformation is a mechanism that microorganisms used to degrade organic contaminants to less toxic metabolites. The microbes used for bioremediation are usually isolated from the contaminated site (Wilson and Jones, 1993). Microorganisms naturally existing in contaminated sites developed the capability to degrade such contaminants (Rockne and Reddy, 2003). Microorganisms in soil or sediments can enhance the depletion rates of PAHs when they are cultured and reapplied to the contaminated sites for bioremediation (Heitkamp and Cerniglia, 1987, Bauer and Capone, 1988, Thomas *et al.*, 1989 and Wilson and Jones, 1993). Therefore, the PAHs degrading isolated bacteria from PAHs contaminated sites in Thailand may be very useful for bioremediation of respective contaminated area.

Objectives of study

The purposes of this study were isolation and characterization of the PAHs degrading bacteria from the petroleum-contaminated sediments in the Chao-Phraya River and some canals in Bangkok based on utilization of either fluorene, fluoranthene or pyrene. Moreover, the PAHs degrading potential and substrate specificity of the isolated strains were determined in order to evaluation the properties of the new isolated strains.

Scope of study

On the basis of utilization of either fluorene, fluoranthene and pyrene the PAHs degrading bacteria were isolated from the petroleum contaminated sediment from the Chao-Phraya River, Saen-Saeb Canal and Pradungkrungkasem Canal in Bangkok. The isolated bacterial strains were characterized via their morphological and biochemical characteristics as well as the 16S ribosomal DNA (16S rDNA) sequence analysis. The degrading capability of the newly isolated strains of growth substrates (either fluorene, fluoranthene and pyrene) and other PAH compounds (acenaphthylene, acenaphthene, dibenzofuran and phenanthrene) were evaluated. Furthermore, the concentrations of 7 PAHs, acenaphthylene, acenaphthene, dibenzofuran, fluorene, fluoranthene, phenanthrene and pyrene in sediment samples were determined.