Degradation of Chlorinated Compounds by Microbial Communities from Sungai Ular Sediments

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Abstract. Pollution has become the biggest concern to the public due to the release of unwanted substances such as chlorinated compounds into the environment which are harmful to human health and wildlife. Agriculture activity and industrial practices actively contribute to chlorinated compounds' discharge into Malaysia's water sources. Anaerobic biodegradation has become one of the interesting cost-efficient and ecologically benign solutions for dealing with chlorinated compound pollution. Aerobic degradation treatment had global attention in which the oxic conditions are hard to maintain, slow process more susceptible to oxidative damage. Most of the bacteria involved in the anaerobic degradation of chlorinated compounds belong to a group called Organohalide-respiring bacteria (OHRBs). This study focused on the ability of the anaerobic bacteria sampled from the Sungai Ular sediment to degrade targeted chlorinated compounds. The anaerobic biodegradation of two different groups of chlorinated compounds which are aliphatic chlorinated alkanes (1,2-dichloroethane (1,2-DCA), 1,2-dichloropropane (1,2-DCP), chloroform (CF)) and alkene (perchloroethylene (PCE) by the Sungai Ular consortia were monitored for a certain amount of times. The results showed that the sediments of Ular River were able to degrade aliphatic chlorinated alkanes (1,2-DCA, 1,2-DCP) and alkene (PCE). The identification of the bacteria at the species level using 16S rRNA analysis was also carried out to confirm the identity of the responsible bacteria. The results showed the presence of several OHRB species in the consortia which belong to *Desulfitobacterium*, *Desulfovibrio* and *Desulfomonile* genus. The present research shows that the degradation of chlorinated compounds was achievable in the Sungai Ular sediment which contained several OHRB strains.

INTRODUCTION

Chlorinated aliphatic hydrocarbons (CAHs) are among one of the most prevalent substances detected in the environment including surface water, groundwater and the atmosphere [1]. The toxicity of this compound has become the biggest concern due to its will cause a massive impact on the environment and human health [2]. The 1,2-dichloroethane is one example of chlorinated aliphatic hydrocarbons which are produced in large quantities every year. This production is estimated at 12 billion per year which is larger than the rest of the halogenated chemicals [3]. Inappropriate disposal of these waste materials will lead to contaminants of soil and groundwater which will cause threats and risks to aquatic life, wildlife and human being [4].

Researchers reported that the chlorinated aliphatic compounds are typically removed by air-stripping and adsorption. This treatment method is not eco-friendly and produced unwanted byproducts. These compounds can be degraded using biological and non-biological techniques. Biodegradation has become the most desirable technique as it is less harmful and often less expensive compared to chemical or physical degradation [5]. Biodegradation of the chlorinated compounds can be categorized into two conditions which are aerobic and anaerobic reactions. Aerobic degradation occurs with the existence of oxygen while anaerobic degradation occurs without oxygen. The chlorinated compounds are difficult to biodegradable with the presence of oxygen [6]. Metabolized anaerobic bacteria usually take place to degrade chlorinated compounds using organohalide respiration reactions. The bacteria are important for the environment because they can decrease anthropogenic halogenated compounds that pose threats to human health and the environment [7]. This process will make

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