

UNIVERSITI TEKNOLOGI MARA

**EFFECT OF ORGANIC NUTRIENT ON
THE BIODEGRADATION OF
HYDROCARBON CONTAMINATED
MARINE SEDIMENT IN MALAYSIA**

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ABSTRACT

The effect of organic nutrient on the biodegradation of hydrocarbon contaminated marine sediment in Malaysia were investigated. Biodegradation was assessed in microcosm experiments containing 200g of marine sediment from Port Dickson, polluted with 10%(w/w) of crude oil and either amended with inorganic nutrients (NP), or organic matter in the form of plant-based (*Elaeis guineensis*) or fish-based nutrient amendments (*Scomber australasicus*). The addition of organic and inorganic fertilizer has managed to increase the nutrient availability in the marine sediment significantly. The microcosm amended with fish-based fertilizer showed the highest nutrient mineralization by the microorganisms. Hydrocarbon mineralization also occur in all treatments, with the highest biodegradation rates occur in *S. australasicus* supplemented sediments. The addition of *S. australasicus* have managed to reduce the oil concentration to 48% while the addition of *E. guineensis* and inorganic NP reduced the final oil concentration to 66% and 63% respectively. Bacterial analyses revealed the presence of *Pseudomonas aeruginosa* that are well known for its ability to degrade n-alkanes and polyaromatic hydrocarbon compounds in the spilled oil.

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CHAPTER ONE

INTRODUCTION

1.1 Research Background

Petroleum is operationally defined as any hydrocarbon mixture that can be recovered through a drill pipe. These hydrocarbon mixture comprised of a various nature of molecules which their molecular weight can be as heavy as an asphaltenes (tens of thousands of g/mol) or as light as methane (16 g/mol) (“The Origin of Petroleum in the Marine Environment,” n.d.) . The petroleum product can be classified into gases (natural gas), liquids (generally referred to as a crude oil), and condensates. Crude oil was mixtures of organic matter deposited under various environments and may vary in age from a few tens of millions of to several hundred millions of years. Paraffins, isoparaffins, cycloparaffins, aromatics, and olefins are the major categories of hydrocarbons found in the petroleum. Among these categories, polynuclear aromatic hydrocarbons (PAHs) have the highest molecular-weight aromatics and fused rings which made these compounds relatively incessant in the environment and most likely poisonous, carcinogenic, or mutagenic. For that reason, it is important for us to monitor the PAH compounds once crude oil spill occur. (Yang et al., 2017).

Natural discharges of hydrocarbon fluids (crude oil and/or natural gas) occur frequently in nearly all of the petroleum basins worldwide. These hydrocarbon fluid will overflow into the seabed or terrestrial land through channels such as fault plane and depositional layer gap (Abrams, 2005). Besides natural seepage, oil spill can also occur throughout the process of oil exploration, production and transportation. Statistics have shown that nearly 10% of the average yearly hydrocarbon input in the ocean around the world are caused by oil spilled from tank ships. (García-Olivares et al., 2017). This also proved that tank ships are still one of the high-risk sources of major spills. Based on the statistic from 1960 to 2010, the biggest contributor of major oil spills is the Asia regions with over 25 large-scale spills discharging more than 3.4 million tonnes of hydrocarbon