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Molecular typing of crude-oil-degrading bacterial strains from Riau, Indonesia

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Abstract

Petroleum contamination is a global concern in microbial enhanced oil recovery (MEOR) procedure, including in Riau, Indonesia, being one of the provinces with petroleum activities. These contaminants could be removed through bioremediation using crude-oil-degrading microorganisms or hence called hydrocarbonoclastic bacteria, especially the well-adapted indigenous bacterial strains from the contaminated sites. In this study, three indigenous isolates, *Bacillus cereus* IMB-11, *Lysinibacillus fusiformis* IMB-12, and *Pseudomonas stutzerii* IMB-15, were successfully recovered and identified from a petroleum-containing site of Chevron Pacific Indonesia (CPI) Ltd., Petapahan, Riau, Indonesia. These hydrocarbonoclastic isolates were strain-typed based on 16S rDNA and the results showed that *B. cereus* IMB-11 was closely related to the USA strain, *L. fusiformis* IMB-12 was closely related to the China and Indian strains, while *P. stutzeri* IMB-15 was related to strains from Africa, Asia and Europe. Also, the bioremediation assay of petroleum in a 72-h incubation experiment resulted in the removal of total petroleum hydrocarbon(s) (TPH) and chemical oxygen demand (COD) reduction by these bacterial strains during fermentation in crude oil-supplemented media (10% , v/v). Results showed that the highest TPHs removal was achieved by both *B. cereus* IMB-11 and *P. stutzeri* IMB-15 at 76.64% while *L. fusiformis* IMB-12 was the lowest at 62.62%. In COD analysis, the initial concentration was 15 mg/mL, also with the control flask, however, the highest COD removal was achieved by *B. cereus* IMB-11 at 88.55%, followed by *L. fusiformis* IMB-12 at 82.01%, and then *P. stutzeri* IMB-15 at 42.05%. Based on these results, the hydrocarbonoclastic bacterial strains have the potential to be used as bioremediation agents.

Keywords: Batch fermentation, Hydrocarbonoclastic, Petroleum

1. Introduction

The impacts of petroleum-based commodities are very significant in the production of energy for both industrial and human daily activities. During petroleum exploration which involves refining, and transportation, accidental leaks and spills could occur, thereby causing serious damage to the environment, including land and aquatic habitats [1]. In cases of large petroleum discharges, it is always difficult to be recovered, thereby leading to persistent pollutants in the environment, which are continuously accumulated by the organisms [2]. Accumulation of these pollutants or xenobiotics in animal and plant tissues could lead to the occurrence of disruptive genetic mutations and even death [3]. Therefore, the application of remediation technology and technique is needed to reduce the impact of environmental damage caused by these hydrocarbons contamination.