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Biodegradation of Used Engine Oil by a Methylotrophic Bacterium, *Methylobacterium Mesophilicum* Isolated from Tropical Hydrocarbon-contaminated Soil

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A Gram-negative facultatively methylotrophic bacterium putatively identified as *Methylobacterium mesophilicum* strain RD1 displayed extensive degradative ability on used engine oil (SAE 40W) in liquid cultures. The rate of degradation of used engine oil (1274.85 mg L⁻¹) by the isolate, for the first 12 days and the last 9 days were 65 and 40 mg L⁻¹ d⁻¹, respectively. Gas chromatographic (GC) analyses of residual used engine oil revealed that 61.2% and 89.5% of the initial concentration of the used engine oil were degraded within 12 and 21 days. GC fingerprints of the used engine oil after 12 days of incubation showed total disappearance of C₁₅, C₂₃, C₂₄, C₂₅, and C₂₆ hydrocarbon fractions as well as drastic reductions of C₁₃, C₁₄, C₁₆, and PAHs fractions such as C₁₉-Anthracene and C₂₂-Pyrene. At the end of 21 days' incubation, total disappearance of C₁₇-pristane, C₂₂-pyrene, one of the C₁₉-anthracene, and significant reduction of C₁₈-phytane (96.8%) fractions were observed. In addition, less than 10% of Day 0 values of medium fraction ranges C₁₃, C₁₄, and C₁₆ were discernible after 21 days. This study has established the potential of *Methylobacterium mesophilicum* strain RD1 in degradation of aliphatic, aromatic, and branched alkane components of used engine oils.

Keywords: Biodegradation, *Methylobacterium mesophilicum*, Used engine oil, pristane, phytane

INTRODUCTION

Engine oil is one of the several refined products or cuts of crude oil. It is composed of long-chain saturated hydrocarbons (base oil) and additives (Bagherzadeh-Namazi, 2008). It is used to lubricate the parts of an automobile engine, to ensure efficient performance (Hagwell et al., 1992). The most important characteristic of the lubricating oil for automotive use is its viscosity. Although it averagely constitutes about two percent of crude oil, engine oil is the most widely used cut of petroleum (Wang et al., 2007).

Used engine oil is a brown to black oil removed from automobiles when oil is changed. It markedly differs from fresh engine oil as it contains minute quantities of additives, metallic salts, and heavy metal contaminants such as lead, zinc, chromium, barium, and magnesium resulting from engine wear. It also contains higher percentages of alkyl benzenes, naphthalenes, methylnaphthalenes, and polycyclic aromatic hydrocarbons due to pyrosynthesis and chlorodibenzofurans (Wang et al., 2000; Dominguez-Rusado and Pitchel, 2003; Lu and Isaac, 2008).

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