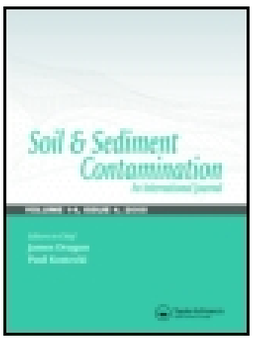

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# Hydrocarbon Degradation and Biosurfactant Production by an Acenaphthene-degrading *Pseudomonas* Species

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**ABSTRACT**

An acenaphthene-degrading bacterium putatively identified as *Pseudomonas* sp. strain KR3 and isolated from diesel-contaminated soil in Lagos, Nigeria was investigated for its degradative and biosurfactant production potentials on crude oil. Physicochemical analysis of the sampling site indicates gross pollution of the soil with high hydrocarbon content (2100 mg/kg) and detection of various heavy metals. The isolate grew luxuriantly on crude oil, engine oil and acenaphthene. It was resistant to septrin, amoxicillin and augmentin but was susceptible to pefloxacin, streptomycin and gentamycin. It was also resistant to elevated concentration of heavy metals such as 1–15 mM lead, nickel and molybdenum. On acenaphthene, the isolate exhibited specific growth rate and doubling time of 0.098 $day^{-1}$ and 3.06 days, respectively. It degraded 62.44% (31.2 mg/l) and 91.78% (45.89 mg/l) of 50 mg/l acenaphthene within 12 and 21 days. On crude oil, the specific growth rate and doubling time were 0.375 $day^{-1}$ and 1.85 days with corresponding percentage degradation of 33.01% (903.99 mg/l) and 87.79% (2403.71 mg/l) of crude oil (2738.16 mg/l) within 9 and 18 days. Gas chromatographic analysis of residual crude oil at the end of 18 days incubation showed significant reductions in the aliphatic, alicyclic and aromatic fractions with complete disappearance of benzene, propylbenzene, pristane, phytane, and $nC_{18}$-octadecane fractions of the crude oil. The isolate produced growth-associated biosurfactant on crude oil with the highest emulsification index ($E_{24}$) value of 72% ± 0.23 on Day 10 of incubation. The partially purified biosurfactant showed zero tolerance for salinity and had its optimal activity at 27°C and pH 2.0.

**KEYWORDS**

Biodegradation; diesel oil-contaminated soil; acenaphthene; crude oil; biosurfactant; *Pseudomonas*

## Introduction

Crude oil production and operations such as oil exploration, exploitation, transportation, and distribution, with concomitant oil spillage, seepages from oil tankers, release of effluents, and offshore drilling activities, adversely affect the ecosystems (soil and aquatic) especially in oil-producing countries (Atlas 1991; Cerniglia 1992). This problem is further exacerbated by indiscriminate disposal of spent and used oils rich in polycyclic aromatic hydrocarbons (PAHs) and heavy metals at automobile and mechanic workshops, unprecedented use of

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