Extensive Biodegradation of Nigerian Crude Oil (Escravos Light) by Newly Characterized Yeast Strains

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Abstract

Because microbial degradation is known to be an efficient process in the in situ decontamination of oil-bearing environments, it is believed that development of effective bioremediation strategies will be aided by microbial sourcing of novel and competent hydrocarbon degraders with a broad and unusual substrate spectrum. Thus, in keeping with this objective, two Candida strains (MNI and MCI) isolated after a repeated batch enrichment technique were tested for their biodegradation potentials on Nigerian crude oil, Escravos light. Axenic cultures of strains MNI and MCI grew at a rate of 1.623 and 0.586 d^{-1}, respectively, in mineral salts medium supplemented with 8.4 g L^{-1} of crude oil. Whereas strain MNI degraded aliphatic fractions by 97.6% and the aromatics by 74.61%, the corresponding values obtained for MCI were 97.2% and 67.29% during the 14-day incubation period. The gas chromatography (GC) fingerprinting of aliphatic fractions showed major degradation of heptadecane (C17), octadecane (C18), nonadecane (C19), eicosane (C20), undodecane (C21), tricosane (C23), hexacosane (C26), octacosane (C28), and nonacosane (C29) in less than 6 days, whereas nearly 100% of these fractions including the isoprenoid molecules was metabolized in 14 days. Among the aromatic fractions that were nearly eliminated during the cultivation period were naphthalene, phenanthrene, fluoranthrene, chrysene, benzo(a)anthracene, benzo(b)fluoranthrene, and benzo(a)pyrene. Intrestingly, substrate uptake studies showed that both strains grew very well on petroleum cuts, biphenyl, phenol, xylene, and quite a number of polycyclic aromatic hydrocarbons including pyrene, phenanthrene, and anthracene.

Keywords: biodegradation, bioremediation, Candida spp., hydrocarbons, pollution

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