Degradation of polycyclic aromatic hydrocarbons (pyrene and fluoranthene) by bacterial consortium isolated from contaminated road side soil and soil termite fungal comb

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Received: 18 August 2014 / Accepted: 19 May 2015 / Published online: 29 May 2015
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Abstract Polycyclic aromatic hydrocarbons (PAHs) are often present in the environment at concentrations detrimental to both human health and eco-quality. Hence, PAH degradability has been of significant interest, and biological methods seem to be preferred to other options such as chemical oxidation, photolysis and adsorption. Present study was designed to isolate potential PAH-degrading bacteria from termite fungal comb and road side soil with the aim of evaluating the degradation of fluoranthene and pyrene using the isolated microbes. Therefore, 97–99 % pure PAHs (fluoranthene and pyrene) were subjected to biodegradation using bacteria consortiums from soil and the termite fungal comb in separate tests. At varying concentrations (50, 100 and 150 mg L⁻¹) of both PAHs, amendments characterized of Ralstonia pickettii, Burkholderia cepacia and Pseudomonas resinosarum from road side soil reduced fluoranthene more than Octomyces sp. and Pseudomonas sp. isolated from termite fungal comb. The overall comparison of the PAH degradation showed that the microbial consortium degraded pyrene more than fluoranthene. However, the efficiency of the biodegradation tests on fluoranthene and pyrene was <50 %. The study inferred that isolated bacterial species from termite fungal comb and road side soil when used as consortium can remedy contaminations attributed to more than one PAH. But the degree of degradation by bacteria species may depend on the source of isolation.

Keywords PAHs · Degradation · Bacterial consortium · Contaminated road side soil · Soil termite fungal comb

Introduction

Polycyclic aromatic hydrocarbons (PAHs) are one among many pollutants that are indiscriminately found in the environment. To a large extent, human exposure to PAHs appears highly unavoidable (Sen and Field 2013). PAHs are products that emanate from incomplete partial combustion of fossil fuels in cars, industries and our kitchen. The presence of PAHs in the environment is an increasing concern due to the associated toxicity, mutagenicity and carcinogenicity (Sato and Aoki 2002; Lee et al. 2013; Man et al. 2013; Kim et al. 2013). Despite the fact that PAHs in the environment undergo chemical oxidation, photolysis, bioaccumulation, volatilization and adsorption, yet microbial degradation and transformation have been identified as the principal processes for the pollutants’ removal (Zeng et al. 2010).

Recent studies have focused on bioremediation as a tool for the restoration of contaminated soil at low cost, due to its promising capacity (Lu et al. 2012; Shahravari et al. 2013). The use of bacteria in the degradation of PAHs has been widely reported (Haritash and Kaushik 2009) and various bacteria that have the ability to degrade individual PAHs had been isolated and identified (Cerniglia 1993; Safekordi and Yaghmaei 2001). However, there is limited report on bacteria with the capability to degrade a broad