ABSTRACT

Soil samples were collected from oil-contaminated sites surrounding the Indian oil corporation limited (IOCL), Haldia and IOCL, Barauni (India). Polycyclic aromatic hydrocarbon (PAH) tolerant bacterial strains were isolated. Four most tolerant strains were selected for PAH degradation study, the strains were identified on molecular basis (16S rRNA) and have been registered online with the accession numbers as follows: *Bacillus* sp.-PAH6: KY378901.1, *Pseudomonas panacis*-PAH8: MF964938.1, *Bacillus subtilis*-PAH17: MF806594.1, *Pseudomonas aeruginosa*-PAH24: MF964936.1. In order to validate the efficiency of isolated strains, one strain MTCC2445 (known for PAHs degradation) was bought. A consortia of bacteria composed of only the isolated strains was also prepared and studied. Two PAHs, anthracene and fluorene were used for degradation studies. The growth conditions (pH and temperature) were optimized and degradation was performed for varying concentration of PAHs, over an incubation period of 15 days. Following was trend in degradation for fluorene: Consortium (93.7%) > *P. panacis*-PAH8 (89.3%) > *P. putida*-MTCC2445 (86.7%) > *P. aeruginosa*-PAH24 (81.3%) > *B. subtilis*-PAH17 (75.03%) > *Bacillus* sp.-PAH6 (69.94%); For anthracene: Consortium (92.3%)> *P. panacis*-PAH8 (87.9%) > *P. putida*-MTCC2445 (87.1%) > *P. aeruginosa*-PAH24 (85.09%)> *B. subtilis*-PAH17 (70.5%) > *Bacillus* sp.-PAH6 (65.5%). The consortium degraded highest amount of PAH followed by strain *Pseudomonas panacis*-PAH8. Least degradation was observed by strain *Bacillus* sp.-PAH6 on the 12th day of the incubation period. *Pseudomonas panacis*-PAH8 has not been previously reported for PAH degradation in the literature and was observed for the first time during the course of this study. Amongst different PAH concentrations, the higher degradation rates was noticed at 500 mg L^{-1} for both fluorene and anthracene. The effect of PAH concentration on the specific growth rate of bacteria was also studied using a growth kinetic study of the application of different models. It was observed that the model Aiba-Edwards was the best fit and the kinetics followed was inhibitory type. The specific growth rate of bacteria increased with increase in concentration up to a certain peak, and then declined to further increase in concentration. Several kinetic parameters defining the inhibition constant, maximum specific growth rate, root mean square value and half saturation constant of the system have also been calculated. The

bacteria were also assessed for their ability to produce biosurfactants. All the isolated strains were able to produce biosurfactants and their surface properties were calculated. The FTIR spectra of the media revealed the type of biosurfactant produced. *Pseudomonas panacis*-PAH8 and *Pseudomonas aeruginosa*-PAH24 produced lipopeptide (rhamnolipid type) and *Bacillus subtilis*-PAH17 produced surfactin. Therefore, the study concluded that the isolated strains were efficient for PAH degradation in high concentrations with the capability to produce biosurfactants. Also, the optimized consortia can be used for PAHs decontamination.