ABSTRACT
Oil and petroleum contamination stands as a major global environmental challenge. Monocyclic aromatic hydrocarbons like benzene and xylene are natural constituents of oil and petroleum, posing toxicity risks to both humans and animals. Exposure to these hazardous hydrocarbons can result in severe health issues, including cancer, hepatic and renal impairment, neurotoxicity, and death even at low concentrations. In the present study, bacteria were isolated by enrichment culture technique from the oil contaminated soil using minimal salt (MS) media supplemented with benzene and p-xylene. Morphological characterization identified these bacterial isolates as gram-positive, rod-shaped organisms, while 16S rRNA sequence analysis revealed that these strains are closely related to Peribacillus acanthi, Bacillus rugosus, Bacillus licheniformis, and Bacillus amyloliquifaciens. Optimal growth conditions were determined to be at a neutral pH of 7.0 and a temperature of 45 °C for all four isolates. These bacterial strains were subsequently subjected to incubation under varying concentrations of benzene and p-xylene (1% v/v, 2% v/v, 3% v/v, and 5% v/v). The investigation revealed the profound capacity of these isolates to efficiently degrade benzene and p-xylene, with notable effectiveness observed at 5% v/v concentrations. Moreover, Fourier transform infrared spectroscopy (FTIR) analysis unveiled noticeable structural alterations in the functional groups of the treated samples relative to control. While GC-MS analysis confirmed the biodegradation of benzene and xylene into new metabolites. Bio-toxicity assays conclusively demonstrated that the metabolites resulting from the degradation of benzene and p-xylene posed no adverse effects on environmentally beneficial bacterial strains. The ability of these isolates to degrade benzene and p-xylene at 5% v/v concentrations is promising, and their non-toxic metabolites are an encouraging sign for environmental restoration. Therefore, this research suggests that these four strains hold capability for the remediation of benzene and p-xylene contaminated environments.
Keywords: benzene, xylene, bioremediation, PCR, 16s rRNA, FTIR, GC-MS.