Effects of Single and Consortia Inoculants on the Biodegradation Efficiency of Crude Oil in Seawater

ABSTRACT

A bioremediation study was undertaken to assess the biodegradation efficiency of crude oil in seawater using two locally isolated strains namely Candida tropicalis RETL-Cr1 and Pseudomonas aeruginosa BAS-Cr1. The inoculation was carried out using single strains labelled as T1; Candida tropicalis RETL-Cr1, T2; single strain Pseudomonas aeruginosa BAS-Cr1 and T3; mixture of both cultures respectively. The biodegradation capability of each strain was examined in a shakeflask culture at 30˚C, agitated at 200 rpm for 28 days. The growth profile was monitored by measuring the optical density (OD600) using spectrophotometry. The biodegradation efficiency of crude oil was quantified by comparing the initial and final crude oil concentrations, whereas the degradation of selected aliphatic hydrocarbons was quantified using gas chromatography-mass spectrometry (GC-MS) by comparing the initial and final area in chromatograms. The present finding showed that in 5% (v/v) of crude oil, consortia cultures had the highest degradation, with 50%, while single cultures of C. tropicalis RETL-Cr1 and P. aeruginosa BAS-Cr1 achieved 39% and 27%, respectively. The results of biodegradation showed that consortia cultures experienced 1.3- fold higher compared to a single culture of C. tropicalis RETL-Cr1 and 2-fold higher compared to a single culture of P. aeruginosa BAS-Cr1. Based on GC-MS analysis, the aliphatic hydrocarbons were found degraded through the treatment with the highest degradation recorded in consortia cultures: octadecane (73.93%) > eicosane (73.23%) > nonadecane (70.43) > docosane (67.64%) > heptadecane (66.36%) > heneicosane (65.94%) > tricosane (62.28%). From the results obtained, it can be concluded that the potency of microbes as excellent hydrocarbon degraders is as follows: consortia (mixed of two species) > C. tropicalis RETL-Cr1> P. aeruginosa BAS-Cr1. This supports the idea that microbial communities, especially in mixtures, have the ability to degrade hydrocarbon contaminants more effectively and can be environmentally friendly due to their specific ability to metabolize hydrocarbons.