Development of bioremediation strategies based on the improvement of biomass production from isolated strains in hydrocarbon contaminated soils and their application in bioremediation technologies.

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RESUMEN

Contaminated sites with petroleum compounds are frequently observed, requiring the development of innovative technologies for its remediation. The problem is caused due to the widespread usage of petroleum-based products. Their discharge and accidental spillage in the environment prove to be hazardous both to the surroundings and life forms. Bioremediation is an efficient strategy for cleaning up sites contaminated with organic pollutants. It is a non-invasive and cost-effective technique that relies on natural decontamination using microbes of isolated strains from contaminated areas for the clean-up of these petroleum hydrocarbons. The Zárate-Campana industrial center, located in Buenos Aires, represents one of the most important petrochemical areas in Argentina, with several companies carrying out petrochemical activities. In this study, we have investigated the ability of microorganisms to degrade these hydrocarbons. Samples were collected in the surroundings of the Campana area and screened for hydrocarbon degrading bacteria. 4 of the 13 strains previously isolated from contaminated sites were screened and identified as Pseudomonas sp, Cellulosimicrobium sp and Ochrobactrum sp. A new approach using MT1A3, belonging to Pseudomonas genus in petroleum biodegradation from the use of different carbon and nitrogen sources, was proposed to provide maximum biomass production and was evaluated for its degradation characteristics. MT1A3 grew in all carbon sources tested and was able to grow in a hydrocarbon mixture obtaining 1.79 g/L of biomass production at 25 °C after 7 days. When comparing the use of different low-cost agro-industrial co-products as an alternative carbon source, the biomass production was significantly higher in crude peanut oil in comparison to all other substrates ($p < 0.05$), thus resulting in a biomass of 7.29 g/L. The most efficient nitrogen source for obtaining biomass from MT1A3 was $NaNO_3$. Based on these results, the effectiveness was evaluated by monitoring total hydrocarbons (THs) and n-alkanes degradation as well as changes in bacterial population of natural attenuation, biostimulation and bioaugmentation treatments in microcosm design over a 120-day period. The best treatment, which involved bioaugmentation (MT1A3) and biostimulation strategies, showed a degradation of 40.05 % of total hydrocarbons with respect to the natural attenuation treatment used as control. The highest concentration of THAB and HDB was recorded, reaching a value of 2,17x1010 CFU and 8,91x106 UFC respectively.

Palabras Claves: UTN; FRD; UTN; FRD; biorremediación, suelos contaminados, hidrocarburos, microcosmos