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BIOSURFACTANTS FROM Pseudomonas aeruginosa MM OBTAINED FROM FRYING OIL: USE IN SURFACTANT-ENHANCED BIOREMEDIATION

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Pseudomonas aeruginosa MM is a hydrocarbon-degrading, surfactant-producing bacterium isolated from an urban stream in Moreno, Buenos Aires Province. Previous studies demonstrated that P. aeruginosa MM could produce both rhamnolipids and lipopeptides using raw sunflower oil (RSO) as a carbon source. When a crude extract (SCE) of these biosurfactants was used in surfactantenhanced bioremediation (SER), 47% of hydrocarbons were removed compared to an untreated control. Given that the high production costs of bacterial biosurfactants limit their use in SER, this study aimed to obtain a surfactant crude extract (SCE) using an inexpensive carbon source, such as frying oil. P. aeruginosa MM was cultured in E2 minimal medium supplemented with sterile frying oil as a carbon source. Cultures were incubated at 37°C for 2 days at 150 rpm. After incubation, a cell-free supernatant was obtained by centrifugation (10 min at 12,000 rpm). The cell-free supernatant was acidified, incubated at 4°C overnight, and then centrifuged at 12,000 rpm for 20 min. The resulting pellet was resuspended in 0.1M Tris-HCl, pH 8, and extracted thrice with 1 volume of ethyl acetate. The solvent was evaporated, and the remaining dry compounds were resuspended in distilled water to obtain the frying oil crude extract surfactants (F-SCE). The critical micellar concentration (CMC) of the F-SCE was measured using a Du Nouy tensiometer, yielding a CMC of 137 µg/mL showing better performance than the obtained with the RSO-SCE (CMC of 317 ?g/m). About the surface tension (ST) obtained at the CMC, the F-SCE reached a ST of 38.5 nN/m while the RSO-SCE was 33.5 mN/m. Finally, the F-SCE was tested as an additive in SER microcosm assays. For these tests, 10 g of soil was supplemented with KNO? and K?HPO?, adjusted to 60% field capacity, and artificially contaminated with 10% v/w diesel. Two sets of five units each were designed: one without surfactants (control) and one with F-SCE at a concentration of twice the CMC relative to the water present in the microcosm. The microcosms were incubated for 24 days at 24°C. After incubation, the remaining diesel was extracted and analyzed by GC-FID. The results showed a diesel degradation of 59.2 ± 6.6% compared to the control without surfactant. This study demonstrated that using frying oil as a carbon source for P. aeruginosa MM biosurfactant production improved the characteristics of the SCE derived from raw sunflower oil and reduced production costs.

Palabras clave: Pseudomonas - Biosurfactants - Bioremediation - Hydrocarbon