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Development of a Bioproduct for Hydrocarbon Biodegradation

Benchouk. Amina[1*], Ighilahriz. Kahina[1]

[1]La Direction Centrale Recherche et Développement-SONATRACH, Algeria
*Corresponding author's email: amina.benchouk@sonatrach.dz

ABSTRACT

The objective of this study was to develop a bioproduct based on the bacterium *Bacillus megaterium*, isolated from petroleum sludge, aiming to degrade hydrocarbons present in contaminated areas. This biological product incorporates bacterial strain along with mineral and organic additives such as bentonite and potato peelings, which play a crucial role in bacterial growth. The obtained results demonstrated that this bioproduct significantly retained its efficacy in degrading hydrocarbons after 60 days of storage, with a slight increase in biodegradation potential from 33.53% for the bacterial strain alone to 39.26% for the bioproduct. This innovative approach thus represents an environmentally respectful solution for bioremediation.

Keywords: Bacterial Product, *Bacillus megaterium*, Hydrocarbon Biodegradation.

1 Introduction

Biological decontamination of hydrocarbon-polluted sites proves to be an effective, cost-efficient, and versatile alternative compared to physicochemical treatment methods. Enhancing this process involves introducing organic or mineral nutrients to stimulate the activity of local microorganisms. Moreover, intentionally introducing specific microorganisms, known for their ability to degrade hydrocarbons, into these contaminated environments can be beneficial in accelerating the degradation process. The primary objective of this study is to develop an innovative bioproduct incorporating the bacterial strain Bacillus megaterium, known for its ability to degrade hydrocarbons [1; 2].

2 Experimental Realization and Results

A bacterial strain from petroleum sludge was characterized as *Bacillus megaterium* [3]. After culture, cells were mixed with mineral and organic additives, including dried, ground, and sieved bentonite and potato peels. The mixture was dried at 60°C for 24 hours and stored (Fig.1).

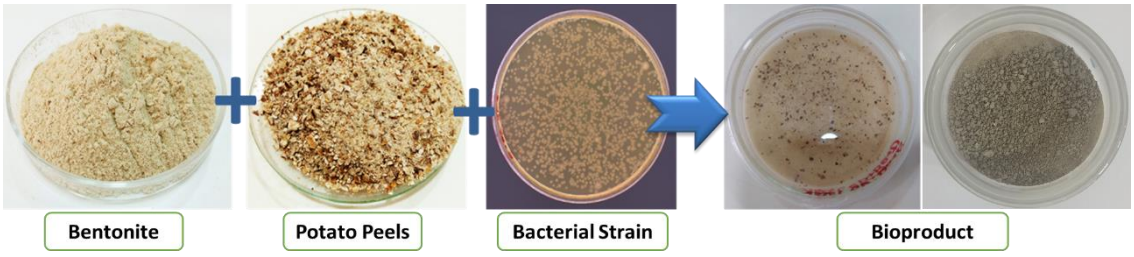

Figure1: Preparation of the bioproduct

The viability of a bacterial population was assessed before and after storage, with and without reactivation. Initially, the bacterial count was 1.26×10^{13} CFU/ml. After two days, reactivated bacteria increased to 1.40×10^19 CFU/ml, while non-reactivated ones reached 1.19×1015 CFU/ml. After 60 days, reactivated bacteria decreased to 5.03×10^{16} CFU/ml, whereas non-reactivated ones increased to 2.55×10^{16} CFU/ml. The drying process and storage conditions did not affect bacterial viability; they remained preserved with organic and mineral additives. These additives not only preserve bacteria effectively for up to two months but also serve as nutrient sources, enhancing bacterial growth [10]. A biodegradation test was performed by inoculating BH medium and petroleum into Erlenmeyer flasks with a reactivated culture of the bioproduct. After 7 days of agitation, residual petroleum was extracted using hexane and acetone, and

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solvents were evaporated. Control flasks underwent the same extraction process [4; 5].
The obtained results have been summarized in this diagram:

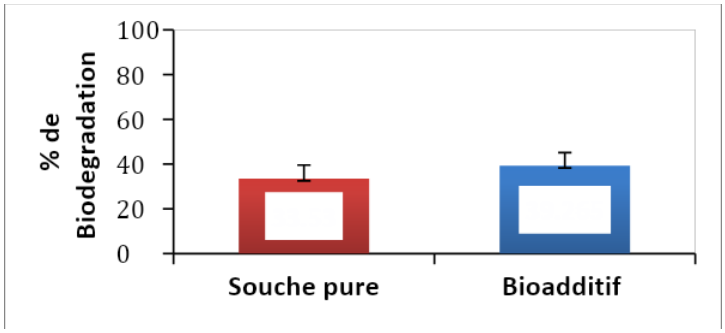

Figure2: Crude oil biodegradation.

3 Conclusion

These results suggest that the bioproduct is a promising solution for hydrocarbon depollution, offering an effective and sustainable alternative for bioremediation. The conducted tests have confirmed its ability to enhance hydrocarbon degradation, thereby presenting compelling prospects for its potential use across various environmental and industrial contexts. Further studies could delve deeper into understanding the underlying mechanisms and explore additional practical applications of this promising bioproduct.

References

[1] Karamalidis A.K.; Evangelou A.C.; Karabika E.; Koukkou A.I.; Drainas C.; Voudrias E.A. (2010). Laboratory scale bioremediation of petroleum-contaminated soil by indigenous microorganisms and added *Pseudomonas aeruginosa* strain Spet. 101(16), 6545–6552.

[2] Benchouk A., Ighilahriz K., Khellouf M. and Khodja M. (2023). Biostimulation of oily sludge - contaminated soil using organic and inorganic additives. *International Journal of Environment and Waste Management.* 1 (1).

[3] Liu Wuxing., Wang Xiaobing., Wu Longhua., Chen Mengfang., Chen Tu, Luo Yongming.et Christie Peter. (2012). Isolation, identification and characterization of Bacillus amyloliquefaciens BZ-6, a bacterial isolate

[4] Oudot J., Ambels A., Bourgeois, S., Gatellier C., et Sebyera N. (1989) Hydrocarbon infiltration and biodegradation in a landfarming experiment. Environmental Pollution, 59, pp. 17-40.

[5] Deborah D.R., Moody J. et Cerniglia C.E. (2002). Utilization of mixtures of polycyclic aromatic hydrocarbons by bacteria isolated from contaminated sediment. FEMS Microbiology Ecology. 41: 1-7 for enhancing oil recovery from oily sludge, Chemosphere. 87: 1105-1110.

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