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Aerobic Biodegradation Potential of Proteobacteria Mixed- Culture Consortium on Inhibitory Refinery Effluent

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EXTENDED ABSTRACT

The classical treatment approaches to recalcitrant and offensive petroleum refinery effluents is quite strenuous and defective, thus necessitated the modification of existing protocol for effective and conceivable degradation. The high COD content, presence of toxic substances such as phenol and hydrogen sulfide, coupled with the numerous refractory constituents has made its treatment strenuous using a simple axenic culture. Comparative biodegradation potential of two acclaimed bacteria in pure and mixed-culture form was evaluated. The degree of inhibition casted was assessed based on the effectiveness of each model to remove the targeted compounds within the assigned period. The mutual complementary effect of mixed-culture bacteria was reported to take care of much anticipated constraints by axenic culture and successively offer a perfect option for biodegradation of petroleum refinery wastewater. The performance of bacterial mixed culture (BMC) consortium, *Pseudomonas putida* (ATCC 49128) and *Bacillus cereus* (ATCC 14579) was found to agree well with the existing literatures regarding their application for biodegration of racalcitrant wastewaters. The composition of the investigated refinery wastewater was analysed with initial concentration of 8,155 mg/L COD, 100 mg/l phenol, and 500 mg/L sulfide, coupled with other refractory substances, respectively. The experiment was carried out in triplcate batch-wise under defined optimal conditions of 1.0 mg/L O_2, temperature of 35 ^oC, agitation of 170 rpm at 8 hour retention time. To ensure oxidizied sulfide is reduced to economically feasible product specie; DO was maitained at low level as explained previously. Aliqouts samples were withdrawn at interval for targeted pollutants estimation and were analysed using respective protocols as described elsewhere. Despite the expected toxicity and inhibitory effect of the medium, an overwhelming biodegradtion was achieved disproportionately in the three tested models, with BMC having the most effective performance trend**.** This was indicated by a reduction of 99.64% sulfide, 89.54% COD, 80 % phenol, respectively.

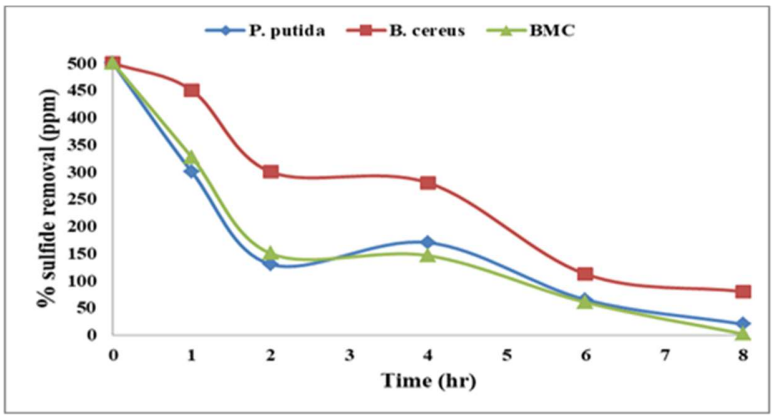

Fig. 1: Inhibitory effect of sulfide on the removal by pure and mixed-culture bacteria isolates

Keywords: Biodegradation, sulfide, refinery wastewater, bacteria, batch mode.

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References

[1]S. K. S. Patel, P. Kumar, and V. C. Kalia, "Enhancing biological hydrogen production through complementary microbial metabolisms," *Int. J. Hydrogen Energy*, vol. 37, no. 14, pp. 10590–10603, 2012.

[2] R. Vinothini, C., Sudhhakar, S. and Ravikumar, "Biodegradation of petroleum and crude oil by Pseudomonas putida and Bacillus cereus," *Int. J. Curr. Microbiol. Appl. Sci.*, vol. 4, no. 1, pp. 318–329, 2015.

[3] M. A.-M. Zytoon, A. A. AlZahrani, M. H. Noweir, and F. A. El-Marakby, "Bioconversion of high concentrations of hydrogen sulfide to elemental sulfur in airlift bioreactor.," *Hindawi Publ. Corp. Sci. World J.*, vol. 2014, p. 675673, 2014.