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Mineralization of Petroleum Contaminated Wastewater by Co-Culture of Petroleum-Degrading Bacterial Community and Biosurfactant-Producing Bacterium

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ABSTRACT

Activity of a crude biosurfactant extracted from the culture fluid of *Serratia* sp. that was isolated from riverbed soil was shown to increase in proportion to the cultivation time, and was higher at pH 8 than at pH 7. *Serratia* sp. grew in the mineral-based medium with soybean oil but was not with kerosene-diesel. The petroleum-degrading bacteria—*Acinetobacter* sp., *Pseudomonas* sp., *Paracoccus* sp., and *Cupriavidus* sp.—were isolated from a specially designed enrichment culture. The efficiency of mineralization of wastewater contaminated with kerosene and diesel (WKD) by the petroleum-degrading bacterial community (PDBC) was enhanced significantly by addition of the crude biosurfactant. The efficiency of mineralization of the WKD was also about 2 times boosted by co-culture of *Serratia* sp. and PDBC. Bacterial community of *Serratia* sp. and PDBC co-cultivated in the WKD was maintained for at least 8 days according to the TGGE pattern of 16S rDNA obtained from the bacterial culture. In conclusion, the co-culture of *Serratia* sp. and PDBC is an applicable technique for the mineralization of wastewater contaminated with petroleum, which may substitute for chemical or biological surfactant.

KEYWORDS

Biosurfactant, *Serratia* Sp. Petroleum-Degrading Bacteria, Mixed Culture, TGGE

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References

- [1] J. P. Allen, E. A. Atekwana, J. W. Duris, D. D. Werkema and S. Rossbach, " The Microbial Community Structure in Petroleum-Contaminated Sediments Corresponds to Geophysical Signatures," *Applied Environmental Microbiology*, Vol. 73, No. 9, 2007, pp. 2860-2870. doi:10.1128/AEM.01752-06
- [2] S. K. Haack and B. A. Bekins, " Microbial Populations in Contaminant Plumes," *Hydrogeology Journal*, Vol. 8, No. 1, 2000, pp. 63-76. doi:10.1007/s100400050008
- [3] J. Y. Lee, J. Y. Cheon, K. K. Lee, S. Y. Lee and M. H. Lee, " Factors Affecting The Distribution Of Hydrocarbon Contaminants And Hydrogeochemical Parameters In A Shallow Sand Aquifer," *Journal of Contaminant Hydrology*, Vol. 50, No. 1-2, 2001, pp. 139-158. doi:10.1016/S0169-7722(01)00101-2
- [4] W. A. Sauck, E. A. Atekwana and M. S. Hash, " High Conductivities Associated with an LNAPL Plume Imaged by Integrated Geophysical Techniques," *Journal of Environmental & Engineering Geophysics*, Vol. 2, No. 3, 1998, pp. 203-212.
- [5] I. M. Banat, R. S. Makkar and S. S. Cameotra, " Potential Commercial Applications of Microbial Surfactants," *Applied Microbiology and Biotechnology*, Vol. 53, No. 5, 2000, pp. 495-508. doi:10.1007/s002530051648
- [6] J. D. Desai and I. M. Banat, " Microbial Production of Surfactants and Their Commercial Potential,"

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- [7] C. N. Mulligan, R. N. Yong and B. F. Gibbs, " On the Use of Biosurfactant for the Removal of Heavy Metals from Oil-Contaminated Soil," *Environmental Progress*, Vol. 18, No. 1, 1999, pp. 50-54. doi:10.1002/ep.670180120
- [8] S. C. Lin, M. A. Minton, M. M. Sharma and G. Georgiou, " Structural and Immunological Characterization of a Biosurfactant Produced by *Bacillus licheniformis* JF-2," *Applied Environmental Microbiology*, Vol. 60, No. 1, 1994, pp. 31-38.
- [9] M. J. McInerney, S. Maudgalya, D. P. Nagle and R. M. Knapp, " Properties of the Biosurfactant Produced by *Bacillus licheniformis* Strain JF-2," *Journal Industrial Microbiology*, Vol. 5, No. 2-3, 1990, pp. 95-102. doi:10.1007/BF01573858
- [10] M. E. Davey, N. C. Caiazza and G. A. O' Toole, " Rhamnolipid Surfactant Production Affects Biofilm Architecture in *Pseudomonas aeruginosa* PAO1," *Journal of Bacteriology*, Vol. 185, No. 3, 2003, pp. 1027-1036. doi:10.1128/JB.185.3.1027-1036.2003
- [11] S. S. Branda, J. E. Gonzalez-Pastor, S. Ben-Yehuda, R. Losick and R. Kolter, " Fruiting Body Formation by *Bacillus subtilis*," *Proceeding National Academy of Science USA*, Vol. 98, No. 20, 2001, pp. 11621-11626. doi:10.1073/pnas.191384198
- [12] J. C. Fountain, A. Klimek, M. G. Beikirch and T. M. Middleton, " The Use of Surfactant for in Situ Extraction of Organic Pollutants from a Contaminated Aquifer," *Journal of Hazardous Materials*, Vol. 28, No. 3, 1991, pp. 295-311. doi:10.1016/0304-3894(91)87081-C
- [13] J. W. Mercer and R. M. Cohen, " A Review of Immiscible Fluids in the Subsurface: Properties, Models, Characterization and Remediation," *Journal of Contaminant Hydrology*, Vol. 6, No. 2, 1990, pp. 107-163. doi:10.1016/0169-7722(90)90043-G
- [14] S. A. Churchill, R. A. Griffin, P. P. Jones and P. F. Churchill, " Biodegradation Rate Enhancement of Hydrocarbons by an Oleophilic Fertilizer and a Rhamnolipid Biosurfactant," *Journal of Environmental Quality*, Vol. 24, No. 1, 1995, pp. 19-28. doi:10.2134/jeq1995.00472425002400010003x
- [15] D. K. Jain, H. Lee and J. T. Trevors, " Effect of Addition of *Pseudomonas aeruginosa* UG2 Inocula or Biosurfactants on Biodegradation of Selected Hydrocarbons in Soil," *Journal of Industrial Microbiology*, Vol. 10, No. 2, 1992, pp. 87-93. doi:10.1007/BF01583840
- [16] Y. Zhang and R. M. Miller, " Enhanced Octadecane Dispersion and Biodegradation by a *Pseudomonas* rhamnolipid Surfactant (Biosurfactant)," *Applied Environmental Microbiology*, Vol. 58, No. 10, 1992, pp. 3276-3282.
- [17] H. S. Kang, B. K. Na and D. H. Park, " Oxidation of Butane to Butanol Coupled to Electrochemical Redox Reaction of NAD⁺/NADH," *Biotechnology Letters*, Vol. 29, No. 4, 2007, pp. 1277-1280. doi:10.1007/s10529-007-9385-7
- [18] W. J. Lee, J. K. Lee, J. Chung, Y. J. Cho and D. H. Park, " Effects of Electrochemical Reduction Reactions on the Biodegradation of Recalcitrant Organic Compounds (ROCs) and Bacterial Community Diversity," *Journal of Microbiology and Biotechnology*, Vol. 20, No. 8, 2010, pp. 1230-1239. doi:10.4014/jmb.0910.10016
- [19] S. J. Lee, Y. W. Lee, J. Chung, J. K. Lee, J. Y. Lee, D. Jahng, Y. Cha and Y. Yu, " Reuse of Low Concentrated Electronic Wastewater Using Selected Microbe Immobilized Cell System," *Water Science and Technology*, Vol. 57, No. 8, 2008, pp. 1191-1197. doi:10.2166/wst.2008.246
- [20] K. McClay, B. G. Fox and R. J. Steffan, " Toluene Monooxygenase-Catalyzed Exoxidation of Alkenes," *Applied Environmental Microbiology*, Vol. 66, No. 5, 2000, pp.1877-1882. doi:10.1128/AEM.66.5.1877-1882.2000
- [21] C. E. Cerniglia, " Biodegradation of Polycyclic Aromatic Hydrocarbons," *Current Opinion in Biotechnology*, Vol. 4, No. 3, 1993, pp. 331-338. doi:10.1016/0958-1669(93)90104-5
- [22] B. N. Aronstein and M. Alexander, " Effect of a Non-Ionic Surfactant Added to the Soil Surface on the Biodegradation of Aromatic Hydrocarbons within the Soil," *Applied Microbiology and Biotechnology*, Vol. 39, No. 1, 1993, pp. 386-390.
- [23] E. Rosenberg, " Microbial Surfactants," *Critical Review in Biotechnology*, Vol. 3, No. 2, 1986, pp. 109-132. doi:10.3109/07388558509150781
- [24] T. Barkay, S. Navon-Venezia, E. Z. Ron and E. Rosenberg, " Enhancement of Solubilization and

