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Oil washing proficiency of bio surfactant produced by a novel bacillus tequilensis mk 729017 isolated from Assam reservoir soil

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Abstract

The present study describes elaborately the isolation of a potential biosurfactant producing and crude oil degrading (1-5%) strains isolated from the Assam oil reservoir field. The produced biosurfactant was chemically characterized for its applicability for the enhanced oil recovery applications in terms of wetting, interfacial tension (IFT) and oil washing. From the seven isolated strains, *Bacillus tequilensis* MK 729017 was chosen based on the better surface active properties as it reduced the surface tension to 30 ± 2 mN/m along with a moderate emulsification index of 66 ± 2 %. The produced biosurfactant was chemically identified to be lipopeptide, surfactin with a lower critical micelle concentration value of 90 mg/L. The carbon source and environmental parameters were optimized for the maximum concentration of the biosurfactant using RSM-CCD. The maximum biosurfactant concentration was measured to be 7.46 ± 0.39 g/L and Y_PS was determined as 0.45. The specific growth rate of the isolate was 0.15 ± 0.01 h-1 and Y_XS was estimated as 0.1. The produced biosurfactant was also found to be thermal and colloidal stable. The biosurfactant solutions altered wettability of hydrophobic rock surface from 90 ± 1° to 26 ± 1° indicating a better interfacial interaction. The IFT of the produced biosurfactant was found to be 0.32 ± 0.02 mN/m. The oil washing efficiency (80 ± 2 %) of the produced surfactin was comparable with chemical surfactants and the process involved two-steps: initial a faster (surface) washing followed by a slower (internal) washing. The first process was dependent on micelle sizes, while the later was dependent on water-oil emulsion size. The lower emulsion size of surfactin contributed to a greater internal washing as compared to chemical surfactants. These observations endorse the potential of the isolated strain towards biosurfactant production and its application in microbial enhanced oil recovery process.

Biography

Lalit Pandey is an Associate Professor of Biosciences and Bioengineering, IIT Guwahati. He has obtained his Ph.D. degree from Indian Institute of Technology Delhi and worked as Scientist at Central Pollution Control Board Delhi, Ministry of Environment & Forests, Govt. of India. Dr. Pandey is recipient of DST-UKEIRI Award 2018, IEI Young Engineers Award 2017, Outstanding Reviewers Awards (Elsevier) 2017/18, INSPIRE Faculty Award 2014, Early Career Research Award from DST and Erasmus Mundus fellowship 2010. He is a life member of the International Association of Engineers (IAENG), IIChE, NMS, BRSI and ACS and reviewer of several peer-reviewed journals. His research area includes Chemical and Biochemical engineering, Biointerfaces and Biomaterials, and Environmental Biotechnology. He has published 57+ journal papers/book chapters and 41+ conference papers. He is also co-editing one book to be published by Springer Nature in 2020. He is on the Editorial Board of five international journals.

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