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Biodegradation of heavy crude oil in wastewater by an efficient strain, ERCPPI-1

Parviz Darvishi[a], Dariush Mowla[b,*], Shahab Ayatollahi[c], Ali Niazi[d]

[a]*School of Chemical and Petroleum Engineering, Shiraz University, Shiraz, Iran*
[b]*Environmental Research Centre in Oil, Gas and Petrochemical Industries, Shiraz University, Shiraz, Iran*
Tel. +98 711 6133764; email: dmowla@shirazu.ac.ir
[c]*EOR Research Centre, Shiraz University, Shiraz, Iran*
[d]*Institute of Biotechnology, Shiraz University, Shiraz, Iran*

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ABSTRACT

The potential biodegradation of heavy crude oil from wastewater was assessed based on the development of a fermentative process with a new strain of *Enterobacter cloacea* (ERCPPI-1) which was isolated from heavy crude oil in south of Iran, when cultured in a basal mineral medium using heavy crude oil as the sole carbon source. The effects of heavy crude oil concentration, temperature, pressure, pH and salinity on the growth rate of ERCPPI-1 in the presence of heavy crude oil as the sole carbon source were investigated. The results showed that ERCPPI-1 has a good potential for biodegradation of heavy crude oil in the concentration ranges of 0.25–10%, temperatures up to 70 °C, pressures up to 6000 psia, pH ranges of 4–10, and salinity up to 15%. However, as the concentration of heavy crude oil is increased from 0.25% to 10%, the percentage of degradation by the strain is decreased from 76.3% to 19.1%. Temperature of 40 °C and pH of 7.0 were found to be the optimum conditions for maximum biodegradation rate. The experiments also showed that the strain ERCPPI-1 was able to produce a type of biosurfactant, using heavy crude oil as the sole carbon source, with high oil spreading and emulsification properties. The experiments performed in piston–cylinder systems demonstrated that the efficiencies of oil recovery and biodegradation of hydrocarbons are at a reasonable rate. These results suggest that strain ERCPPI-1 has the ability to degrade heavy crude oil under ex situ and in situ conditions.

Keywords: *Enterobacter cloacea*; Heavy crude oil; Biodegradation; Biosurfactant; Ex situ; In situ

*Corresponding author.

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