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Biosurfactant-producing *Bacillus subtilis* strains isolated from crude oil samples enhance oil recovery at lab scale

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Microbial Enhanced Oil Recovery (MEOR) is potentially useful to increment oil recovery from reservoirs beyond primary and secondary recovery operations using microorganisms and their metabolites. Stimulation of bacterial growth and biosurfactant production by indigenous microorganisms can reduce the capillary forces that retain the oil into the reservoir. MEOR offers major advantages over conventional EOR, namely low amounts of energy consumption and independence of the price of crude oil [1]. In this work, a sand pack column model was designed to simulate the oil recovery operations in oil reservoirs and evaluate the mobilization of residual oil. Three *Bacillus subtilis* strains, previously isolated from crude oil samples [2], were used. Those strains grow and produce extracellular biosurfactants at 40ºC under anaerobic conditions in medium supplemented with hydrocarbons. Biosurfactants produced reduce the surface tension of water from 72 to 30 mN/m, exhibit emulsifying activity and are not affected by exposure to high temperatures (121ºC) which makes them good candidates for application in biosurfactant mediated MEOR. Sand pack column assays were performed using paraffin and crude oil. Additional oil recovery using paraffin ranged from 19 to 35% with the different isolates. When crude oil was used as hydrocarbon, the isolates recovered between 19 and 21% of the entrapped oil. The results obtained suggest that stimulation of biosurfactant production by these strains *in situ* can contribute to mobilize entrapped oil and improve the oil fluidity.

References

[1] Sen R, “Biotechnology in petroleum recovery: The microbial EOR”, *Progress in Energy and Combustion Science* (2008) 34: 714-724.

[2] Gudiña EJ, Pereira JFB, Rodrigues LR, Coutinho JAP, Teixeira JA, “Isolation and study of microorganisms from oil samples for application in Microbial Enhanced Oil Recovery”, *International Biodeterioration and Biodegradation* (2012) 68: 56-64.