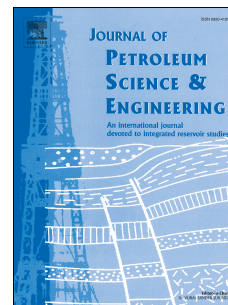


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## Integrated Microbial Enhanced Oil Recovery (MEOR) Simulation: Main Influencing Parameters and Uncertainty Assessment

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### Abstract

The present study investigated the ability of a thermophilic anaerobic microbe (herein coded as AR80) for MEOR with the further objective to quantify the uncertainty of production forecast in terms of the cumulative probability distribution. A series of core flood experiments conducted in water-flooded Berea sandstone showed that up to 51% of initial oil-in-place was recovered when the plugs were treated with AR80 and shut-in for 14 days. Mainly, the oil recovery mechanisms were attributed to viscosity enhancement, wettability changes, permeability and flow effects. Matching the laboratory data using artificial intelligence: the optimized cumulative oil recovery could be achieved at an enthalpy of 894.2 J/gmol, Arrhenius frequency of 8.3, residual oil saturation of 20%, log of capillary number at microbe flooding stage of -1.26, and also depicted a history match error less than 3%. Therefrom, a sensitivity analysis conducted on reservoir shut-in period effect on oil recovery revealed that a relatively shorter shut-in period is recommended to warrant early incremental oil recovery effect for economical purposes. In addition, MEOR could enhance the oil recovery significantly if a larger capillary number (between  $10^{-5}$  and  $10^{-3.5}$ ) is attained. Per probabilistic estimation, MEOR could sustain already water-flooded well for a set period of time. This study showed that there is a 20% frequency of increasing the oil recovery by above 20% when a mature water-flooded reservoir is further flooded with AR80 for 2 additional years. Lastly, it was demonstrated herein that increasing the nutrient (yeast extract) concentration (from 0.1-1% weight) had less or no significant effect on the oil viscosity and subsequent recovery.

### Keywords:

Artificial Intelligence; Capillary Number; Enthalpy; Microbial Enhanced Oil Recovery; Monte Carlo Simulation; Response Surface Methodology

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