

## **Experimental Investigation of Enhancing Oil Recovery in Simulated Fractured Carbonate Rocks by Selective Plugging of Microbial biomass**

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### **Abstract**

Microbial biomass selective plugging is one of the proposed mechanisms for improving reservoir sweep efficiency in highly fractured reservoirs. In this work, the potential of *Bacillus* strains isolated from oil contaminated soil from the Sultanate of Oman was tested for their ability to grow in induced fractures in carbonate rocks and to divert subsequent injection water to the upswept matrix zones.

Four *Bacillus* strains were tested with name codes; B17, B29, W16 and W19. Their growth behavior under different nitrogen sources using yeast extract, peptone and urea was investigated. Glucose and sucrose were tested as carbon sources. Carbon/nitrogen ratios were optimized where it was found that sucrose was the carbon source that maximized bacterial growth with concentration of 2% and yeast extract was the selected nitrogen source with concentration of 0.1%. The combination of *B. licheniformis* strain W16 in a minimal medium containing sucrose incubated for 10 to 11 hours was the optimum condition for maximum cell growth. Indiana limestone core plugs were used for coreflooding experiments. A fracture was simulated by slicing the cores vertically into two sections using a thin blade. The bacterial cells were injected into the cores and the ability of the microbes to grow and plug the fracture was examined. Scanning electron microscopy was used to prove the growth of the microbial cells in the fracture after the experiment.

Coreflooding experiments showed promising results where enhancement of oil recovery was observed after bacterial injection. A total of 27-30% of the residual oil was produced after 11 hours of incubation. This shows the high potential of using microbial biomass for selective plugging in fractured reservoirs.