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Project Title: Using Biosurfactants Produced from Agriculture Process Waste Streams to Improve Oil Recovery in Fractured Carbonate Reservoirs

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PUBLIC ABSTRACT

The US domestic oil production has been in a steady decline for the past 30 years. Significant effort has been devoted to improving oil recovery by using various secondary and tertiary recovery methods. Although these efforts have resulted in a significant increase in recovery efficiency, almost 2/3 (~350 billion barrels) of the US oil reserve still remains stranded and unproduced. Previous research has demonstrated that the injection of surfactants into oil reservoirs can be very effective in mobilizing stranded oil. However, the economics of surfactant injection have rarely been favorable in actual field applications because of the cost associated with high-concentration chemical surfactants. This proposed three-year research project will evaluate the use of low-cost biosurfactants produced from high-starch agriculture process waste streams (e.g., potato or rice process effluents) to improve oil recovery in fractured carbonate reservoirs. Specifically, the proposed project will examine the ability of the biosurfactants to mediate wettability changes that positively affects oil recovery in fractured carbonate rock by accelerating the spontaneous imbibition process during waterflooding. The successful completion of this project will not only significantly increase the domestic oil production by recovering the previously unrecoverable stranded oil but also benefit the environment by promoting the beneficial reuse of agriculture process waste products.

The hypothesis of the proposed research is that dilute solutions of biosurfactants produced from agriculture process waste streams can compete favorably both in performance and process economics with dilute chemical surfactants in mediating changes in wettability that positively impacts oil recovery in fractured carbonate reservoirs. To test the hypothesis, the performance of the biosurfactants will be evaluated using the key variables that affect process economics. These key variables include incremental oil recovery, surfactant loss due to adsorption and retention, surfactant cost, and surfactant injection cost. A commercial chemical surfactant will be selected as the benchmark for performance and process economics comparisons.

The proposed research will be a joint effort between the Tertiary Oil Recovery Project (TORP) at the University of Kansas (KU) and the Idaho National Engineering and Environmental Laboratory (INEEL).