TITLE: THE POTENTIAL USE THE *Bacillus velezensis* H2O-1 SURFACTIN IN MICROBIAL ENHANCED OIL RECOVERY (MEOR)

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ABSTRACT:

Biosurfactants are molecules with tensoactive properties produced by several microorganisms. They are more efficient and effective with respect to surface and interfacial activities than conventional surfactants. Some biosurfactants have high thermal, pH and ionic strength stabilities, and can be used in environments under adverse conditions. These molecules can be used in various sectors of the oil industry, e.g., Enhanced Oil Recovery (EOR). Currently, chemical surfactants are used for this purpose. However, these surfactants can cause serious damages, especially toxicity in aquatic organisms. One of the most studied and efficient biosurfactants is surfactin, a lipopeptide produced by several species of *Bacillus*. The aim of this study was to evaluate the stability of surfactin produced by *B. velezensis* H2O-1 and to compare the toxicity and potential of this molecule in Microbial Enhanced Oil Recovery (MEOR) against the commercial surfactant Ultrasperse (US). The stability of H2O-1 surfactin was evaluated by changes in the surface tension (ST) after thermal treatment at 100 °C, altered pH, and variations in ionic strength. Toxicity was assessed through the lethal dose (LD_{50}) of *Artemia salina*. The potential of application of surfactin to MEOR was evaluated by the ability to reverse the wettability of calcite impregnated with cyclohexanopentanoic acid. In the thermal stability test, it was observed that the surfactin was stable to the heat treatment at 100 °C in the evaluated time intervals, with ST remaining the same as the control (24.8 mN/m). In relation to the ionic strength, it was observed that with up to 6 % of NaCl, surfactin maintained a ST equal to that of the control and in higher concentrations of NaCl there was an increase of TS. Regarding to the pH variation, the ST of the surfactin remained stable in the range of pH 6 to 12. Acid pH increased ST. The acute toxicity test showed that both surfactants are safe for the environment, showing LD_{50} of 634 mg/L and 1439 mg/L for surfactin and US, respectively. Moreover, the results of wettability reversal test showing that both *B. velezensis* H2O-1 surfactin and US are suitable for use in EOR. Surfactin and US were able to reverse wettability of the calcite by 80% and 100%, respectively, for the highest concentration studied (100 ppm). These results indicate the excellent potential for MEOR application of this surfactin, mainly due to its stability, wettability alteration and reduced toxicity.

Keywords: *Bacillus velezensis* H2O-1, surfactin, stability, toxicity, reverse wettability

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