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Simulation of Single-Well Chemical Tracer Test (SWCTT) to Measure Residual Oil Saturation

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Determining residual oil saturation (Sor) in hydrocarbon reservoirs is crucial for reservoir evaluation and designing an enhanced oil recovery (EOR) method. Single-well chemical tracer test (SWCTT) is an efficient, economical, and accurate method for estimating Sor within approximately 20 to 30 meters around the well, providing valuable data for production optimization decisions. This technique utilizes the time difference between the production of ester and hydrolyzed alcohol, resulting from the chromatographic separation of the secondary tracer from the partitioning tracer. This study aims to simulate SWCTT for Sor measurement using the University of Texas Chemical Flooding Simulator (UTCHEM) in a glass bead pack flood system. Initially, SWCTT was conducted in this laboratory system by injecting ethyl acetate. Subsequently, an attempt was made to simulate the tracer behavior and experimental results using UTCHEM, a multi-dimensional, multi-phase, and multi-component flooding simulator capable of modeling a separable reactive tracer. The results demonstrated that Simulations by UTCHEM for SWCTT closely match the experimental data from glass bead flooding experiments for Sor estimation. Additionally, sensitivity analyses conducted on key parameters such as diffusion coefficient, injection rate, and tracer concentration revealed that simulation results are sensitive to these parameters. These findings highlight the capability of the SWCTT technique and UTCHEM simulator in accurately evaluating the oil-saturated zone around the well, providing valuable information for reservoir management decisions, including selecting the appropriate EOR fluid and process.

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