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# Enhanced heavy oil recovery and CO2 storage in a reservoir with high-water-cut: laboratory to field

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In this study, in order to enhance heavy oil recovery in the heavy oil reservoir with a high-water-cut after water flooding process, experimental and numerical simulation studies are conducted. In the experimental studies, firstly, the properties of the heavy oil-CO2 system were measured under different saturation pressures at the reservoir temperature. Secondly, to mimic the high-water-cut condition in the real reservoir, water flooding process was conducted for each core; then four long core experiments insist of one CO2 huff `n` puff process and three CO2 flooding processes were implemented. The CO2 huff `n` puff process is conducted to compare the production performance with that in the CO2 flooding process to optimize the method. Regarding the CO2 flooding process, different gas (pure CO2, flue gas) and different production categories (constant production pressure, pressure depletion) were applied to study the heavy oil production performance in the heavy oil reservoir with high-water-cut. The experimental results indicate that, the CO2 flooding coupling with pressure depletion process is the best choice to reduce the water-cut and enhance the heavy oil recovery, which is 41.84% of the original oil in place and the water-cut reduced to lower than 70%. In the numerical simulation studies, the WinProp module in CMG is applied to simulate the properties of the heavy oil-CO2 system, which is generated by recombining CO2 into heavy oil, and high agreement simulation results were obtained. Then the results of the optimized experiment were history matched using GEM module. Finally, the upscaling studied was conducted. The CO2 flooding processes are carried out in the studied reservoir to maximum the heavy oil recovery factor. Moreover, the CO2 storage ratio is studied using GEM model.