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Simulation study of asphaltene deposition and solubility of CO_2 in the brine during cyclic CO_2 injection process in unconventional tight reservoirs

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The oil production from unconventional resources such as ultra-low permeability or porosity rocks were increased in the last decades due to advance in technologies that are horizontal drilling and multistage fracturing techniques provided a highly conductivity paths for the injected gas (CO_2) to diffuse and penetrate into the micro-permeable matrixes. The study of cyclic CO_2 injection and hydrocarbon recovery in ultra-low permeability reservoirs is mainly function of several parameters, initially the structural parameters such as fracture permeability, fracture conductivity, fracture half-length, fracture spacing and matrix porosity then the operational and fluid properties such as bottom-hole pressure, primary depletion time, CO_2 injection time and number of cycles. Permeability reduction induced by asphaltene precipitation is one of the serious issues in the oil industry especially when it causes plugging to the porous media and reduces oil productivity. On the other hand, the solubility of CO_2 in the brine is one of the safest and permanent trapping methods when considering CO_2 storage mechanisms in geological formations. Moreover, CO_2 dissolution in the aqueous phase is an important technique of CO_2 enhanced oil recovery as it increases oil displacement efficiency and improves the sweep efficiency. However, the effects of the above uncertain parameters on the process of CO_2 enhanced oil recovery have not been clearly understood systematically. Hence, it is absolutely important to study the most significant parameters dominating in this process. The main object of this work is to improve cyclic CO_2 injection process especially for tight reservoirs considering the effects of asphaltene deposition on the oil production and solubility of CO_2 in the brine. A suitable modeling process underlies effective simulation tools for quantitative studies of tight reservoir performance, in order to avoid asphaltene precipitation, minimize CO_2 emission, optimize cyclic CO_2 injection and maximize oil production.

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