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Effects of Polymer Adsorption and Desorption on Polymer Flooding in Waterflooded Reservoir

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Abstract : Polymer Flooding is one of the most well-known methods in Enhanced Oil Recovery (EOR) technology which can be implemented after either primary or secondary recovery, resulting in favorable conditions for the displacement mechanism in order to lower the residual oil in the reservoir. Polymer substances can lower the mobility ratio of the whole process by increasing the viscosity of injected water. Therefore, polymer flooding can increase volumetric sweep efficiency, which leads to a better recovery factor. Moreover, polymer adsorption onto rock surface can help decrease reservoir permeability contrast with high heterogeneity. Due to the reduction of the absolute permeability, effective permeability to water, representing flow ability of the injected fluid, is also reduced. Once polymer is adsorbed onto rock surface, polymer molecule can be desorbed when different fluids are injected. This study is performed to evaluate the effects of the adsorption and desorption process of polymer solutions to yield benefits on the oil recovery mechanism. A reservoir model is constructed by reservoir simulation program called STAR® commercialized by the Computer Modeling Group (CMG). Various polymer concentrations, starting times of polymer flooding process and polymer injection rates were evaluated with selected values of polymer desorption degrees including 0, 25, 50, 75 and 100%. The higher the value, the more adsorbed polymer molecules to return back to flowing fluid. According to the results, polymer desorption lowers polymer consumption, especially at low concentrations. Furthermore, starting time of polymer flooding and injection rate affect the oil production. The results show that waterflooding followed by earlier polymer flooding can increase the oil recovery factor while the higher injection rate also enhances the recovery. Polymer concentration is related to polymer consumption due to the two main benefits of polymer flooding control described above. Therefore, polymer slug size should be optimized based on polymer concentration. Polymer desorption causes polymer re-employment that is previously adsorbed onto rock surface, resulting in an increase of sweep efficiency in the further period of polymer flooding process. Even though waterflooding supports polymer injectivity, water cut at the producer can prematurely terminate the oil production. The injection rate decreases polymer adsorption due to decreased retention time of polymer flooding process.

Keywords : enhanced oil recovery technology, polymer adsorption and desorption, polymer flooding, reservoir simulation
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