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Implementation of new retention model for the simulation of polymer flood in heterogeneous reservoirs

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The polymer retention has been regarded as one of the major problems in the polymer injection process, which leads to the formation damage as well as the poor efficiency. It has been characterized as mainly mechanical entrapment and adsorption. Even though there are a number of experimental studies verifying the individual mechanisms, the modeling of polymer retention has been made as only the Langmuir's type isotherm; this model is able to depict only the mechanism occurring in the pore wall surface. Since the mechanical trapping takes place in the narrow pore throats, the behavior of the polymer retention exhibited the different results in the heterogeneous porous media.

One approach to modeling the polymer retention is to use a population balance method. In the present work, a non-equilibrium mass transfer method was used to model the mechanical entrapment occurring in the pore throats that depends sensitively on the permeability. The trapping rate in the non-equilibrium mass transfer was determined from the ratio between pore radius and polymer gyration ratio. At the narrow pore throats, the trapped amounts was increased while it was reduced in the wide pore throats. The verification of the new model was performed by comparing with the conventional model at various permeability with different level of heterogeneity. Compared with results from the conventional Langmuir's model, different results were obtained by using modified reservoir simulator employing this approach. The polymer loss and permeability reduction across the 1-D core is believed to be more realistic than that of the previous one. Also, the results in the field-scale reservoir show that the proposed model is much more sensitive to the heterogeneity while exhibiting almost same behaviors in the homogeneous reservoir. This new approach can be used as a more accurate model for evaluating polymer retention process in the real heterogeneous reservoirs.

Keywords: polymer retention; population balance method; mechanical entrapment; adsorption

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