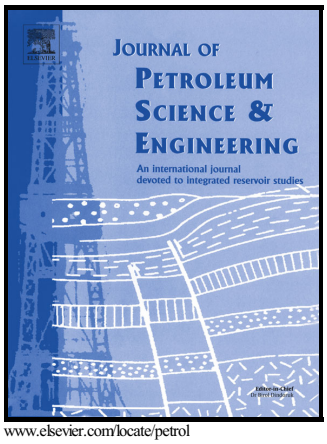

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Analytical Solution for Oil Displacement by Polymer Slugs Containing Salt in Porous Media

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Abstract

The displacement of oil by water containing dissolved chemical products in porous media is one of the most used Enhanced Oil Recovery (EOR) techniques. The continuous injection of these displacing fluids is very expensive; the alternative is the injection of finite volumes (slugs). Chemical methods of EOR involve mass transfer through adsorption and also changes transport properties. Mathematical modelling and experimental tests are important for the development of a project to increase oil recovery by EOR methods. This paper presents the analytical solution for the injection of a water slug containing dissolved polymer and salt followed by water drive. In this model the salt does not adsorb nor modifies the water fractional flow curve, but changes the adsorption isotherm. The solution is obtained by introducing a potential function based on the conservation of the aqueous phase volume which splits the original system into a thermodynamics auxiliary system and a transport equation. The thermodynamics auxiliary system depends only on the adsorption isotherm and allows predicting the distribution of components between the different phases. The transport equation, also called lifting equation, is a function of the relative permeabilities and viscosities of the phases. The solution of this problem is not self-similar, like the continuous injection of dissolved chemical components in water, and interactions among waves occur. A sensitivity analysis was performed to evaluate the effects of some parameters in the efficiency of the technique. The solution allows determining the slug behavior, and shows the development of the chromatographic cycle in porous media, illustrating the appearance and disappearance of the components injected into the reservoir rock.