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COMPUTER MODELING OF OIL DISPLACEMENT BY POLYMER INJECTION

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This research is a simulation study to improve oil recovery using waterflooding and polymer flooding techniques based on data obtained from the oilfields of Kazakhstan. There was no published report on polymer flooding project or polymer flooding simulation work that has been carried out for this oilfield. This simulation study have illustrated the feasibility of polymer flooding and provided the technical knowledge that can be used to study other techniques of improved oil recovery to be implemented in Kazakhstan oilfields. Use of polymer increases water viscosity which controls water mobility, thus, improving the sweep efficiency. The simulations were carried out using black oil model. In the simulation, factors such as polymer shear thinning effect, adsorption, concentration, permeability reduction, and fluid viscosity have been taken into account when constructing the mathematical model. The main points are to bring problems nonequilibrium filtration with free (unknown) boundaries, i.e. to Stefans and Verigins problems. The last statement is justified by the fact that having wells information, we can identify boundary of the area. It is known that the boundary or part of the boundary may change, either because of a temperature gradient, or because of the pressure gradient [1,2] .

The problem of nonequilibrium filtration is formulated as follows:

$$mH\frac{\partial s}{\partial t}+div\left(H\vec{u}_1\right)=0,\ -mH\frac{\partial s}{\partial t}+div\left(H\vec{u}_2\right)=0,$$

$$mH\frac{\partial}{\partial t}\left[c_1 s+(1-s)c_2\right]+H\frac{\partial a}{\partial t}+div\left(Hc_1\vec{u}_1\right)+div\left(Hc_2\vec{u}_2\right)=r,$$

$$\vec{u}_i=-\frac{K_0 f_i}{\mu_i}\nabla p(i=1,2),\ \ s+s_1=1,\ \ \frac{\partial a}{\partial t}=\frac{1}{\tau}\cdot\left(G(c)-a\right),$$

with initial and boundary conditions

$$s\big|_{t=0}=s_0(x),\ \ c\big|_{t=0}=c_0(x),\ \ a\big|_{t=0}=a_0(x),$$

$$(P,S,C)=(P_0,S_0,C_0),\ -D\cdot\frac{\partial c}{\partial n}+\vec{v}_{1n}\cdot c=q_n\cdot c^*,(x,t)\in\Sigma^1=\Gamma^1\times[0,\bar{t}],$$

where $G(c)$ is defined as

$$G(c)=\begin{cases}1, c>c^*\\ [0,1], c=c^*\\ 0, c<c^*\end{cases}$$

Main results of the research are computational algorithm, designed on the basis of presented model, and main technological parameters distribution analysis.

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