LABORATORY STUDY OF ENZYME-BASED COMPLEXES FOR STIMULATION OF OIL RECOVERY

Background
In the world practice various methods are used to stimulate oil recovery, i.e., hydraulic fracturing, acid solutions to clean the bottom-hole zone and increase its permeability, solvents to wash out organic contaminants from the bottom-hole zone, surfactants to change rock wettability by fluids, etc. The effect of each method depends on the characteristics of the deposits and the specific causes of the lower flow rate. The use of enzyme-based complexes is a new efficient technology, acting due to changed rock wettability by oil.

Aims and Objectives
Study of enzyme-based complexes with the purpose to increase the permeability of the bottom-hole zone of producing wells by reducing the surface tension between liquids and solid rock.

Results
Laboratory study of enzyme-based complexes demonstrated that high viscosity oil may increase the binding of oil and rock, therefore, basing on the viscosity of oil, one may properly select additives to the enzyme complex for better cleaning of the bottom-hole zones by lowering oil viscosity. It was determined that in order to prevent reduction of enzyme activity in reservoir conditions due to high salinity and temperature, it was necessary to include chelate compounds to limit the influence of metal ions. The results of the experiment with EDTA – chelate compound showed that when the concentration of EDTA was from 2.0 % to 0.8 %, the turbidity of the enzyme solution became lower during the test, and this evidenced the positive effect of using EDTA with enzymes in salt water.

On the basis of experimental data the optimal concentrations of enzyme solutions and surfactants were determined for the minimum value of surface tension. The optimal effect with the minimum surface tension values of 1.735 mN/m was obtained at 0.477 : 0.3 enzyme – surfactant ratio. The analysis of the results of studying thermal stability of enzyme complexes showed that the interfacial tension between the solution of enzyme complex and kerosene is much lower than the interfacial tension between sea water and kerosene (21.75 mN/m), and this is the evidence of enzyme complex thermal stability at the reservoir temperature.
The results of testing solutions for salt resistance in situ allow a conclusion that the injection of enzyme complex will not promote salt formation and contamination of reservoir.

**Key words:** stimulation of oil recovery, enzyme solution, chelates, surface active tension, protein, bio technology, rock wettability, test plan

**References**


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