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# STUDYING THE FEATURES OF OIL DISPLACEMENT BY ALKALINE WASTE SOLUTION IN A POLYMER COMPOSITION

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**Abstract:** In recent years, a number of new combined methods for enhancing oil recovery have been developed, which, when applied through the implementation of several oil recovery mechanisms in the reservoir, make it possible to influence both the reservoir coverage and the oil recovery factor from the reservoir, and thereby achieve a more complete oil recovery than with conventional flooding.

These methods include those based on various polymer applications combined with the injection of various chemical reagents that increase oil recovery. Moreover, key requirements when selecting chemical reagents should be their low cost, sufficiency, and relatively simple application technology. Typically, to conserve energy and resources, such combined physical and chemical methods are applied in the field as slugs.

**Keywords:** organic solvents, ionic associates, cation, tetraphenylarsonium, tetraphenylphosphonium, triphenyl lead, ionic association, benzene, toluene, xylene.

**Introduction:** The experiments were conducted on a linear model of a homogeneous reservoir, consisting of a 1-meter-long stainless steel pipe. Quartz sand with a fraction of less than 0.25 mm served as the porous medium. After filling the reservoir model with quartz sand, the permeability of the porous medium was 1.2 μm2, and the porosity was 0.26. In preparing the reservoir model for the experiments, it was evacuated, saturated with water, which was then displaced with oil from the fields. The experiment consisted of displacing oil from the reservoir model with a rim consisting of a polymer composition (in all experiments, polyacrylamide - PAA with a concentration of 0.05%) in a solution of alkaline waste with a concentration of 5%, which was then pushed through the reservoir with fresh water.

These polymer and alkaline waste concentrations in the composition were chosen because they resulted in minimal interfacial tension at the interface between the composition and the oil used in the experiments. The polymer- and alkaline waste-based slug was injected from the very beginning of the displacement process. The experiment was conducted until the water cut of the recovered product reached 98%. All experiments were conducted at a constant pressure drop of 0.15 MPa under isothermal conditions at a temperature of 20°C.

Before conducting experiments with various slug sizes, experiments were conducted with fresh water, a 5% alkaline solution, and a polymer-alkaline solution with continuous injection into the reservoir.

**Methods:** The experimental results are presented in the table. The results of the experiments showed that the use of the alkaline solution and the polymer-alkaline solution composite resulted in improved oil recovery from a homogeneous reservoir model compared to oil displacement with fresh water.

Results of oil extraction from a homogeneous porous medium using fresh water and a polymer-solution composition during continuous injection into the reservoir

| Рабочий агент | Вязкость нефти, мПа·с | Безводный КИН, % | Конечный КИН, % | Объем прокачки рабочего агента, ОП | |
|---|---|---|---|---|---|
| Пресная вода | 20,5 | 30,8 | 58,1 | 5,2 | |
| | 164 | 15,4 | 26,2 | 5,8 | |
| Раствор ДЩО | 20,5 | 40,2 | 73,3 | 2,5 | |
| | 164 | 25,5 | 38,7 | 3,6 | |
| Композиция полимера и раствора ДЩО | 20,5 | 5,2 | 80,4 | 1,35 | |
| | 164 | 37,4 | 49,5 | 2,1 | |

A series of experiments was then conducted to assess the effect of the polymer/SO solution slug size on the efficiency of oil recovery from the reservoir model. The experimental results are shown in Figs. 1 and 2

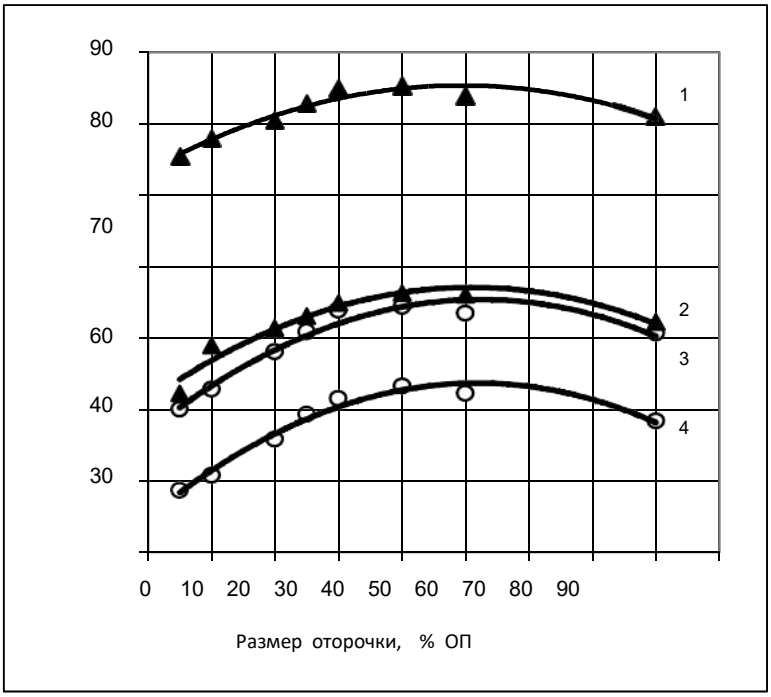


*Fig. 1. Dependence of the anhydrous and final recovery factors of oil with a viscosity of 20.5 mPa s and 164 mPa s on the size of the rim of the composition based on polymer and alkali metal.*

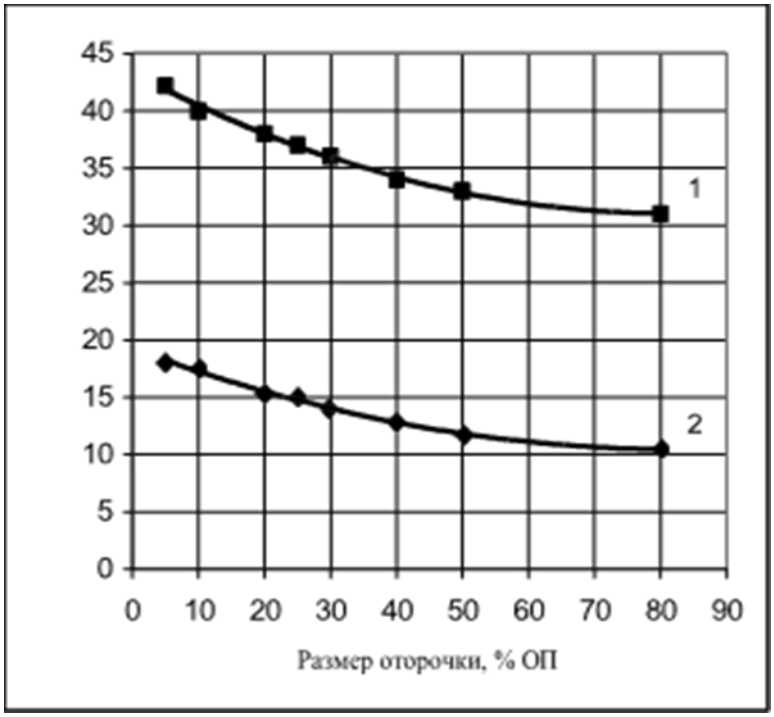


*Fig. 2. Dependence of the average displacement rate of oil with a viscosity of 20 and 164 mPa s on the size of the rim of the composition based on polymer and sho.*

**Methodology of work and processing of experimental results:** Comparison of experiments on continuous injection of the composition into the reservoir (table) with injection of slugs of the composition (Fig. 1 curves 1, 2, 3, 4) for both types of oil showed that if, with slug sizes of 5-20% of the reservoir pore volume, the anhydrous and final oil recovery factors are lower than or equal to the anhydrous and final oil recovery factors with continuous injection of the composition, then with slug sizes of 25-80% of the pore volume they are already higher than these values. The maximum increase in anhydrous (for oil with a viscosity of 20.5 mPa s is 4.7-5% and for oil with a viscosity of 164 mPa s is 4.8-5.8%) and final (respectively 3.5-3.9% and 3.9-4.8%)

**Results:** The experimental studies showed that, regardless of oil viscosity, its displacement by a composition of a DAO solution and a polymer is more effective than using waterflooding and DAO separately. Thus, under experimental conditions for oil with a viscosity of 20.5 and 164 mPa s, the increase in the final oil recovery factor during oil displacement by a composition of a DAO solution and a polymer compared to waterflooding was 22.3 and 23.3%, respectively, and compared to displacement by a DAO solution – 7.1 and 10.8%

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