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STUDYING THE INFLUENCE OF REAGENTS COMPOSITIONS ON OIL RECOVERY AND OIL VISCOSITY

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Abstract. The effect of reagent compositions on the oil recovery coefficient and oil viscosity was investigated. Compositions of kerosene-alkaline waste from oil refinery were prepared. They consist of salts, reagent, sulfanol solution, polyacrylamide. The greatest interest in our study is the reagent, which has surface-active properties and a protective effect against hydrogen sulfide and bacterial corrosion. This is an alkaline additive composition based on waste from oil refining (KAW) and fat processing industries. Experimentally, on a model installation simulating a collector sample, were determined oil recovery coefficients using various compositions for waterflooding. Independently, the effect of A, CMC, KAW reagents on the oil viscosity there was studied. It was found that compositions containing reagent significantly increase
the oil recovery coefficient.

Keywords: heavy oil, oil recovery coefficient, viscosity, reagent, oil extraction and transportation, chemical effect.

Аннотация. Было исследовано влияние состава реагентов на коэффициент извлечения нефти и вязкость нефти. Были приготовлены составы керосиново-щелочных отходов нефтеперерабатывающего завода. Они состоят из солей, реагента, раствора сульфанола, полиакриламида. Наибольший интерес в нашем исследовании представляет реагент, обладающий поверхностно-активными свойствами и защитным действием против сероводорода и бактериальной коррозии. Это щелочная добавка на основе отходов нефтепереработки (КАВ) и жироперерабатывающей промышленности. Экспериментально, на модельной установке, имитирующей образец коллектора, были определены коэффициенты извлечения нефти при использовании различных составов для заводнения. Независимо изучалось влияние реагентов А, КМЦ, КАВ на вязкость нефти в этом случае. Было установлено, что составы, содержащие реагент, значительно увеличивают коэффициент извлечения нефти.

Ключевые слова: тяжелая нефть, коэффициент извлечения нефти, вязкость, реагент, добыча и транспортировка нефти, химическое воздействие.

Annotatsiya. Reagent tarkibining neftni qayta ishlash va yopishqoqlikka ta'siri o'rganildi. Kerosin-ishqoriy chiqindilar neftni qayta ishlash zavodlari tarkibi

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tayyorlandi. Ular tuzlar, reagent, sulfanol eritmasi va poliakrilamiddan iborat. Bizning tadqiqotimizda sirt faol xususiyatlarga ega va vodorod sulfidi va bakterial korroziyadan himoya qiluvchi reagent alohida qiziqish uyg'otadi. Ushbu ishqoriy qo'shimcha neftni qayta ishlash (WOR) va yog'ni qayta ishlash sanoati chiqindilariga asoslangan. Neftni qayta ishlash koeffitsientlari turli xil suv toshqini kompozitsiyalaridan foydalangan holda rezervuar namunasini simulyatsiya qiluvchi model o'rnatish yordamida eksperimental ravishda aniqlandi. Bu holda A, CMC va WOR reagentlarining neftning yopishqoqligiga ta'siri mustaqil ravishda o'rganildi. Reagent o'z ichiga olgan kompozitsiyalar neftni qayta ishlash koeffitsientini sezilarli darajada oshirishi aniqlandi.

Kalit so'zlar: og'ir neft, neftni qayta ishlash koeffitsienti, yopishqoqlik, reagent, neftni ishlab chiqarish va tashish, kimyoviy ta'sir.

INTRODUCTION.

It is known that one of the main methods of enhanced oil recovery (EOR) is waterflooding of oil reservoirs. Physicochemical methods are most widely used in the oil fields. One of these methods is based on the use of surfactants in oil reservoir flooding.

It is known that one of the main methods of enhanced oil recovery (EOR) is waterflooding of oil reservoirs. Physicochemical methods are most widely used in the oil fields. One of these methods is based on the use of surfactants in oil reservoir flooding.

The efficiency of oil recovery from oil reservoirs depends on many factors, one of which is the viscosity of the reagent injected into the injection well [1]. The use of surfactant solutions in conjunction with low-concentration polymer solutions makes it possible to simultaneously reduce interfacial tension at the phase boundary, increase oil mobility and improve its displacement by water, increase the viscosity of the aqueous solution of the displacing agent, and reduce its mobility. The use of reagents acting individually is not always effective, since the reagents may be incompatible with other reagents in the same technological process.

To increase the oil recovery factor (ORF) from flooded oil-bearing formations, it is necessary to select a compatible mixture of polymer and surfactant for well flooding with optimal viscosity. Polyacrylamide (PAA) can be used as a polymer, which has the ability to increase the viscosity of water even at low concentrations and reduce its mobility [2]. Polymer solutions, having increased viscosity, better displace not only oil but also bound formation water from a porous medium.

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METHODS. When developing a composition for the efficient extraction of residual oil reserves, research focused on the use of inexpensive reagents, such as large-tonnage industrial waste. Specifically, kerosene-alkaline waste from an oil refinery was tested. This waste represents salts obtained by treating kerosene with an aqueous alkali solution to neutralize the petroleum acids present in the kerosene. The remaining kerosene-alkaline waste contains 1.0-2.5% NaOH.

The compositions included the Az-5 reagent, a 40% aqueous solution of sulfanol, and the synthetic polymer PAA, added to improve oil displacement efficiency. The working polymer solution was prepared from a concentrated solution (40%), diluting it to the required concentration. To study the effect of the reagent and compositions on oil recovery and oil viscosity, naphthenic oil with a high resin-asphaltene content and a density of 941.1 kg/m³ was used.

The oil recovery factor was determined using a rig simulating a reservoir model. The rig used to determine the oil-displacing capacity of the developed compositions consisted of glass tubes 70 cm long and 30 mm in diameter, filled with sand (the packing's permeability corresponded to the reservoir of the oil field being studied). A filter consisting of one or two layers of metal mesh was installed at the lower end of the reservoir model. The reservoir model was then saturated with formation water collected from the well.

To saturate the sand with water, the unit was connected to a vacuum system and water was passed through the reservoir model. The reservoir pores were filled with water, and the excess was collected and measured in a cylinder. The prepared model was then saturated with oil. A certain volume of the prepared oil was passed through the reservoir model (the system operates under vacuum).

Oil partially displaces water from the reservoir pores, while some of the pores are filled with oil. As a result, the reservoir model has a certain oil and water saturation. The volumes of displaced water and oil were measured in beakers that collected the displaced fluid (water and oil), and the initial oil saturation of the reservoir was calculated as the difference between the oil injected into the reservoir and the oil measured in the beakers.

The residual water saturation of the reservoir model was calculated as the difference between the pore and water volumes in the beaker. The volume of oil displaced into the beaker was measured, and the oil recovery factor (ORF—the ratio of the volume of displaced oil to the volume of injected oil) was determined.

Methodology of work and processing of experimental results:

The possibility of creating multifunctional process fluids that simultaneously remove asphaltene, resin, and paraffin deposits from the bottomhole formation zone (BFZ) and alter the wettability of the formation pore surface has been

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experimentally confirmed. This results in increased well flow rates and a reduction in water content in the produced fluid. During oil field development, significant work is carried out to restore well productivity. The choice of treatment method for the near-wellbore zone (BWZ) depends primarily on the reservoir type, the composition and properties of the formation fluids, the cause of the formation's deterioration in porosity and permeability, and other factors.

In the presented work, new methods of processing the bottomhole formation zone (PZZ) based on the use of multifunctional compositions of chemical reagents (MCR) are developed and proposed, which make it possible to hydrophobize the rock surface, dissolve asphalt-resin-paraffin formations, and reduce the water cut of the liquid produced from wells.

Based on the results of theoretical and experimental studies, optimal RMD compositions were recommended and trial injections of selected compositions were carried out in terrigenous and carbonate rocks at Tatneft deposits. Preliminary observations showed a fairly high efficiency of FMD application, manifested in an increase in well flow rates and a decrease in the water content of the produced fluid. Translated from DeepL.com (free version)

Figure 1 shows the change in average oil displacement rate from the size of the composition rim. As can be seen from Figure 1, regardless of the viscosity of the oil, a decrease in the average oil displacement rate is observed with an increase in the size of the rim of the composition. However, the average rate of oil displacement with rims of all sizes for both oils is always higher than with continuous injection of the composition.

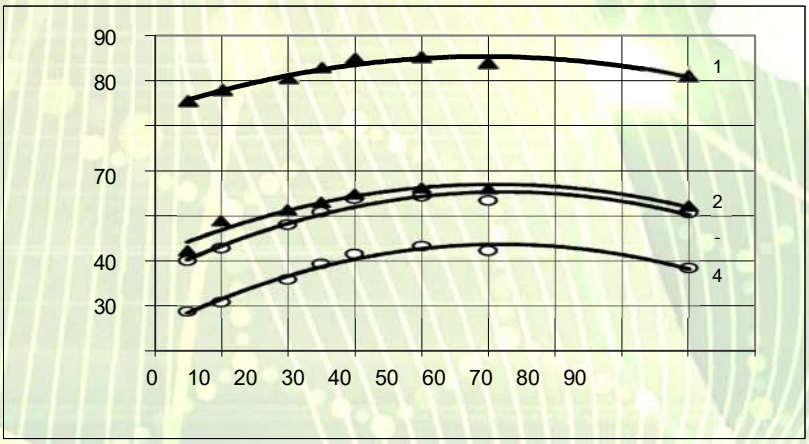


Figure. 1. Dependence of anhydrous and final oil recovery factors of viscosity on the size of the rim of the polymer-based composition.

RESULTS. From the analysis of the obtained experimental data, it follows: the oil recovery factor obtained when displacing oil with water under model installation conditions is low (28%). When using ¬ reagents (ABR and Az-5 reagent) in an individual, RFs are characterized by almost the same low values (13

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¬ 17%). The low oil displacement properties of these solutions are obviously due to ¬ chemical mismatch ¬ the stimulation of oil displacement agents with liquids. When CCO passes through sand saturated with formation water, sediment is formed, which complicates its filtration. After the use of CMC and KCO reagents, the density of the oil under study decreased slightly (to 936.8 kg/m3), and with the addition of the reagent, the Az-5 density of the oil became 929.3 kg/m3, which greatly facilitates the displacement of oil.

Thus, the reagent Az-5 exhibits protective eff ¬ fect against hydrogen sulfide and bacterial corrosion, but is also an effective component of compositions for ¬ the oil recovery factor, as well as reducing the viscosity and density ¬ of heavy oil, which method ¬ increases the processes of its field preparation and transportation

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