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Х А Б А Р Л А Р Ы

ИЗВЕСТИЯ

РОО «НАЦИОНАЛЬНОЙ
АКАДЕМИИ НАУК РЕСПУБЛИКИ
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ЧФ «Халық»

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В 2016 году для развития и улучшения качества жизни казахстанцев был создан частный Благотворительный фонд «Халык». За годы своей деятельности на реализацию благотворительных проектов в областях образования и науки, социальной защиты, культуры, здравоохранения и спорта, Фонд выделил более 45 миллиардов тенге.

Особое внимание Благотворительный фонд «Халык» уделяет образовательным программам, считая это направление одним из ключевых в своей деятельности. Оказывая поддержку отечественному образованию, Фонд вносит свой посильный вклад в развитие качественного образования в Казахстане. Тем самым способствуя росту числа людей, способных менять жизнь в стране к лучшему – профессионалов в различных сферах, потенциальных лидеров и «великих умов». Одной из значимых инициатив фонда «Халык» в образовательной сфере стал проект Ozgeris powered by Halyk Fund – первый в стране бизнес-инкубатор для учащихся 9-11 классов, который помогает развивать необходимые в современном мире предпринимательские навыки. Так, на содействие малому бизнесу школьников было выделено более 200 грантов. Для поддержки талантливых и мотивированных детей Фонд неоднократно выделял гранты на обучение в Международной школе «Мирас» и в Astana IT University, а также помог казахстанским школьникам принять участие в престижном конкурсе «USTEM Robotics» в США. Авторские работы в рамках проекта «Тәлімгер», которому Фонд оказал поддержку, легли в основу учебной программы, учебников и учебно-методических книг по предмету «Основы предпринимательства и бизнеса», преподаваемого в 10-11 классах казахстанских школ и колледжей.

Помимо помощи школьникам, учащимся колледжей и студентам Фонд считает важным внести свой вклад в повышение квалификации педагогов, совершенствование их знаний и навыков, поскольку именно они являются проводниками знаний будущих поколений казахстанцев. При поддержке Фонда «Халык» в южной столице был организован ежегодный городской конкурс педагогов «Almaty Digital Ustaz.

Важной инициативой стал реализуемый проект по обучению основам финансовой грамотности преподавателей из восьми областей Казахстана, что должно оказать существенное влияние на воспитание финансовой грамотности и предпринимательского мышления у нового поколения граждан страны.

Необходимую помощь Фонд «Халык» оказывает и тем, кто особенно остро в ней нуждается. В рамках социальной защиты населения активно проводится работа по поддержке детей, оставшихся без родителей, детей и взрослых из социально уязвимых слоев населения, людей с ограниченными

возможностями, а также обеспечению нуждающихся социальным жильем, строительству социально важных объектов, таких как детские сады, детские площадки и физкультурно-оздоровительные комплексы.

В копилку добрых дел Фонда «Халык» можно добавить оказание помощи детскому спорту, куда относится поддержка в развитии детского футбола и карате в нашей стране. Жизненно важную помощь Благотворительный фонд «Халык» оказал нашим соотечественникам во время недавней пандемии COVID-19. Тогда, в разгар тяжелой борьбы с коронавирусной инфекцией Фонд выделил свыше 11 миллиардов тенге на приобретение необходимого медицинского оборудования и дорогостоящих медицинских препаратов, автомобилей скорой медицинской помощи и средств защиты, адресную материальную помощь социально уязвимым слоям населения и денежные выплаты медицинским работникам.

В 2023 году наряду с другими проектами, нацеленными на повышение благосостояния казахстанских граждан Фонд решил уделить особое внимание науке, поскольку она является частью общественной культуры, а уровень ее развития определяет уровень развития государства.

Поддержка Фондом выпуска журналов Национальной Академии наук Республики Казахстан, которые входят в международные фонды Scopus и Wos и в которых публикуются статьи отечественных ученых, докторантов и магистрантов, а также научных сотрудников высших учебных заведений и научно-исследовательских институтов нашей страны является не менее значимым вкладом Фонда в развитие казахстанского общества.

С уважением, Благотворительный Фонд «Халык»!

NAS RK is pleased to announce that News of NAS RK. Series of geology and technical sciences scientific journal has been accepted for indexing in the Emerging Sources Citation Index, a new edition of Web of Science. Content in this index is under consideration by Clarivate Analytics to be accepted in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. The quality and depth of content Web of Science offers to researchers, authors, publishers, and institutions sets it apart from other research databases. The inclusion of News of NAS RK. Series of geology and technical sciences in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential content of geology and engineering sciences to our community.

Қазақстан Республикасы Ұлттық ғылым академиясы «ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы» ғылыми журналының Web of Science-тің жаңаланған нұсқасы Emerging Sources Citation Index-те индекстелуге қабылданғанын хабарлайды. Бұл индекстелу барысында Clarivate Analytics компаниясы журналды одан әрі the Science Citation Index Expanded, the Social Sciences Citation Index және the Arts & Humanities Citation Index-ке қабылдау мәселесін қарастыруда. Webof Science зерттеушілер, авторлар, баспашылар мен мекемелерге контент тереңдігі мен сапасын ұсынады. ҚР ҰҒА Хабарлары. Геология және техникалық ғылымдар сериясы Emerging Sources Citation Index-ке енуі біздің қоғамдастық үшін ең өзекті және беделді геология және техникалық ғылымдар бойынша контентке адалдығымызды білдіреді.

НАН РК сообщает, что научный журнал «Известия НАН РК. Серия геологии и технических наук» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Известия НАН РК. Серия геологии и технических наук в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному контенту по геологии и техническим наукам для нашего сообщества.

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DIGITAL MODELING OF INCREASING THE EFFICIENCY OF WATER INSULATION IN THE BOTTOM-HOLE ZONE OF A WELL WITH VARIOUS INJECTION AGENTS

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Abstract. Currently, the degree of depletion of oil reserves of the industrial category of various regions has increased significantly and amounts to more than 70 %. Since there is a high water content in them, scientific and technical solutions for blocking permeable sections of the reservoir become important. In this regard, ways of using effective waterproofing compounds are being sought. A significant number of formulations are known and a huge experience of their implementation has been accumulated, but their technological efficiency is low and does not exceed 40–50 %. This article reveals the physical and technological essence of the phenomena associated with water flows into the well on the basis of theoretical and experimental studies. The results of the analytical studies carried out using a 3D digital hydrodynamic model are presented. The essence of the technology proposed for implementation is as follows. As a result of plugging of the most permeable layers of the productive section, water consumption decreases along the washed highly permeable layers with an abnormally high rate of reserves production

and an increase in depressions on the formation in producing wells. As a result, due to an increase in the pressure gradient between the injection zone and the sampling zone and a change in the direction of filtration flows in the reservoir, oil-saturated layers of reduced permeability and waterlogging, previously not covered or poorly covered by flooding, are involved in the process of active production of reserves. The technology in question can be used in terrigenous and carbonate reservoirs. The following parameters should be noted as geological and physical criteria for selecting an operational facility for the implementation of flow-deflecting technologies (FDT): excess of water content over the degree of production of recoverable oil reserves, a high proportion of residual oil reserves for the development element, water content of the production of producing wells of at least 40%, sufficiently high liquid sampling, lack of oil degassing in the reservoir.

Keywords: water inflow, modeling, improvement of development efficiency, uniform production of layers, polymer, gel-forming compositions

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ӘР ТҮРЛІ АЙДАУ АГЕНТТЕРІ БАР ҰҢҒЫМАНЫҢ ТӨМЕНГІ АЙМАҒЫНДА СУ ОҚШАУЛАУ ТИІМДІЛІГІН АРТТЫРУДЫҢ ЦИФРЛЫҚ МОДЕЛЬДЕУІ

Аннотация. Қазіргі уақытта әртүрлі өңірлердің өнеркәсіптік санаттағы мұнай қорларын өндіру деңгейі айтарлықтай өсті және 70 % – дан астамды құрайды. Олардағы жоғары сулану болғандықтан, қабаттың өткізгіш учаскелерін бұғаттау бойынша ғылыми-техникалық шешімдер мұрағатқа айналады. Осыған байланысты тиімді су оқшаулағыш құрамдарды қолдану жолдарын іздестіру жүргізілуде. Композициялардың едәуір саны белгілі және оларды енгізудің үлкен тәжірибесі жинақталған, бірақ олардың технологиялық тиімділігі төмен және 40–50 % – дан аспайды. Бұл мақалада теориялық және эксперименттік зерттеулер негізінде ұңғымаға су ағынымен байланысты құбылыстардың физикалық және технологиялық мәні ашылады. 3D цифрлық гидродинамикалық модельдің көмегімен жүргізілген аналитикалық зерттеулердің нәтижелері ұсынылған. Іске

асыру үшін ұсынылған технологияның мәні келесідей. Өнімді кесудің ең өткізгіш пропласттарын тампондау нәтижесінде Қор өндірудің қалыптан тыс жоғары қарқыны бар жуылған жоғары өткізгіш қабаттар арқылы су ағынының төмендеуі және өндіруші ұңғымалардағы қабатқа депрессияның жоғарылауы байқалады. Нәтижесінде, айдау аймағы мен іріктеу аймағы арасындағы қысым градиентін ұлғайту және қабаттағы сұзу ағындарының бағытын өзгерту есебінен қорларды белсенді өндіру процесіне бұрын су басумен қамтылмаған немесе әлсіз қамтылған өткізгіштігі мен суланuы төмендеген мұнаймен қаныққан пропластиктер тартылады. Қарастырылып отырған технологияны терригендік және карбонатты коллекторларда қолдануға болады. Ағынды ауытқу технологияларын (тер) іске асыру үшін пайдалану объектісін таңдаудың геологиялық-физикалық критерийлері ретінде мынадай параметрлерді атап өту қажет: алынатын мұнай қорларын өндіру дәрежесінен суланудың асып кетуі, игеру элементі бойынша мұнай қалдықтарының жоғары үлесі, өндіруші ұңғымалар өнімінің суланuы кемінде 40%, сұйықтық бойынша жеткілікті жоғары іріктеу, қабатта мұнайды газсыздандырудың болмауы.

Түйін сөздер: су ағыны, модельдеу, даму тиімділігін арттыру, қабаттардың біркелкі өндірісі, полимер, гель түзетін қосылыстар

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ЦИФРОВОЕ МОДЕЛИРОВАНИЕ ПОВЫШЕНИЯ ЭФФЕКТИВНОСТИ ВОДОИЗОЛЯЦИИ В ПРИЗАБОЙНОЙ ЗОНЕ СКВАЖИНЫ С РАЗЛИЧНЫМИ АГЕНТАМИ ЗАКАЧКИ

Аннотация. В настоящее время степень выработанности запасов нефти промышленной категории различных регионов существенно выросла и составляет более 70%. Поскольку имеет место высокая обводненность в них становится архиважным научно-технические решения по блокированию проницаемых участков пласта. В связи с этим проводится изыскание путей применения эффективных водоизоляционных составов. Известно значительное количество составов и накоплен колоссальный опыт их внедрения, однако технологическая эффективность их невысока и не превышает 40–50 %. В данной статье раскрыты физическая и технологическая сущности явлений, связанных с водопритоками в скважину на основе теоретических и экспериментальных исследований.

Представлены результаты проведенных аналитических исследований с помощью 3D цифровой гидродинамической модели. Сущность предлагаемой для реализации технологии сводится к следующему. В результате тампонирования наиболее проницаемых пропластков продуктивного разреза происходит снижение расхода воды по промытым высокопроницаемым слоям с аномально высоким темпом выработки запасов и повышение депрессий на пласт в добывающих скважинах. В результате, за счет увеличения градиента давления между зоной нагнетания и зоной отбора и изменения направления фильтрационных потоков в пласте в процесс активной выработки запасов вовлекаются нефтенасыщенные пропластки пониженной проницаемости и обводненности ранее не охваченные или слабо охваченные заводнением. Рассматриваемая технология может применяться в терригенных и в карбонатных коллекторах. В качестве геолого-физических критериев выбора эксплуатационного объекта для реализации потокоотклоняющих технологии (ПОТ) необходимо отметить следующие параметры: превышение обводненности над степенью выработки извлекаемых запасов нефти, высокая доля остаточных запасов нефти по элементу разработки, обводненность продукции добывающих скважин не менее 40 %, достаточно высокие отборы по жидкости, отсутствие разгазирования нефти в пласте.

Ключевые слова: водоприток, моделирование, повышение эффективности разработки, равномерная выработка пластов, полимер, гелеобразующие составы

Introduction

Currently, the degree of depletion of oil reserves of the industrial category of various regions has increased significantly and amounts to more than 70 %. Since there is a high water content in them, scientific and technical solutions for blocking permeable sections of the reservoir become important. In this regard, ways of using effective waterproofing compounds are being sought. A significant number of formulations are known and a huge experience of their implementation has been accumulated, but their technological efficiency is low and does not exceed 40–50 %. (Knobloch et al., 2018).

This article reveals the physical and technological essence of the phenomena associated with water flows into the well on the basis of theoretical and experimental studies. The results of the analytical studies carried out using a 3D digital hydrodynamic model are presented. (Manichand et al., 2014; Peter Mora et al., 2021).

The essence of the technology proposed for implementation is as follows. As a result of plugging of the most permeable layers of the productive section, water consumption decreases along the washed highly permeable layers with an abnormally high rate of reserves production and an increase in depressions on the formation in producing wells. As a result, due to an increase in the pressure gradient between the injection zone and the sampling zone and a change in the direction of filtration flows in the reservoir, oil-saturated layers of reduced permeability and waterlogging, previously not covered or poorly covered by flooding, are involved in the process of active production of reserves. (Castro-Garcia et al., 2016).

The technology in question can be used in terrigenous and carbonate reservoirs. The following parameters should be noted as geological and physical criteria for selecting

an operational facility for the implementation of flow-deflecting technologies (POT): excess of water content over the degree of production of recoverable oil reserves, a high proportion of residual oil reserves for the development element, water content of the production of producing wells of at least 40 %, sufficiently high liquid sampling, lack of oil degassing in the reservoir. (AL-Obaidi et al., 2021).

Materials and basic methods

To date, several points can be attributed to the basic issues of water manifestation. These are water breakthrough through leakages in the casing, backwater flows, water breakthrough through a highly permeable channel without intra-reservoir flows, two-dimensional cone formation after hydraulic fracturing, individual cracks forming channels between injection and production wells, a system of cracks passing through the aquifer, cracks or faults crossing inclined or horizontal wells, etc.

The use of sedimentary gel-forming compounds has two undeniable advantages over cement treatments.

Firstly, gels can penetrate into the pores of rocks, while cement and other similar blocking agents will be filtered out on their surface. Cements (including "fine-dispersed cement") cannot penetrate for considerable distances into a porous medium or sandstones with a rock permeability of less than 10 mD, except in cases where cracks are present in the rock, there is dissection or high depression on the formation. The shielded area will not be sufficiently insulated if the cement does not adhere well to the rock (due to chemical incompatibility or mechanical influences).

Secondly, the gel can penetrate and clog the narrow back channels.

When conducting experiments and experiments on displacement with a polymer solution, it is necessary that the viscosity of the oil be as close as possible to those reservoir conditions where all this will be realized in the future. Also with modeling of polymer flooding. The modeling stage can be called preparation for further analytical studies after receiving the results of case calculations.

As an example, let's consider the results of the analysis of the effectiveness of polymer flooding using hydrodynamic modeling.

The 3D hydrodynamic model under consideration was prepared specifically to obtain a forecast of technological development indicators, such as oil, gas, water production, expected water availability, etc. It is assumed that the flow of the polymer solution through porous rocks does not affect the flow of hydrocarbon phases. Therefore, standard equations for heavy oil are used to describe hydrocarbon phases in the model.

Digital polymer injection was carried out at two injection wells A and B, injection was started in 2014. The analysis was carried out on an adapted model as of November 1, 2014. and it was calculated until March 1, 2017. The results on the adaptation of polymer injection from 2014 to 2017 are presented. Calculations were carried out on the Eclipse 100, Black Oil simulator using the Polymer, Brine, Non Newton flow options.

The experimental model project is called "StudySimMod2022" with a historical calculation from 1989 to 2017, and at a certain stage (2014) the polymer injection parameter was introduced. The model "StudySimMod2022" has a dimension of 96 x 88 x 55, respectively, in X x Y x Z. The size of the model is 464,640 cells (Fig. 1).

The main file in the model has the extension *.DATA and contains all the necessary information and links to the inclusions to run the model. The options "POLYMER", "BRINE", "NNEWTF", "SALTVD" are necessarily included.

In the "Schedule" section, the keywords WPOLYRED and WPOLYMER are necessarily entered, which are responsible for starting the polymer in wells.

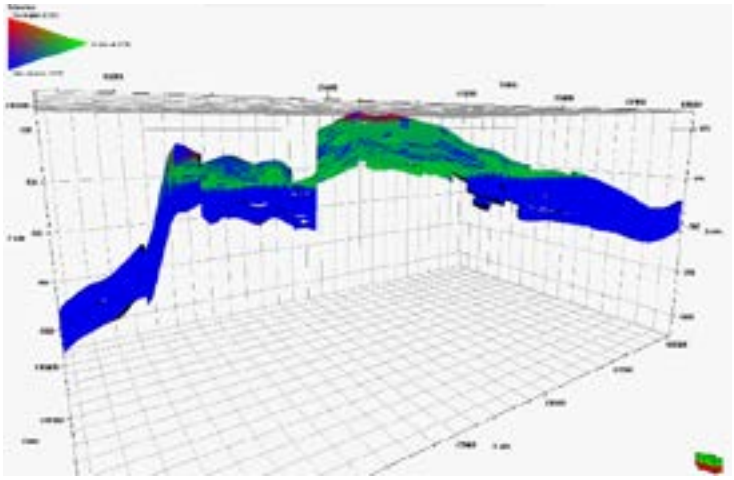

Fig. 1 - Experimental 3D hydrodynamic model of the «U» oil and gas field

Due to the fact that the model is small and the convergence of the full-scale model and the sectors show an acceptable convergence, up to 98 %, it was decided to work with a full-scale model. In addition, the good hydro-coupling of the Neokomsky II formation, confirmed by tracer studies and modeling, showed that the polymer injected into the experimental wells goes far beyond the experimental site. (Abhijit Chaudhuri et al., 2022).

The polymer has its own rheology, and requires laboratory studies to determine the dependence of viscosity on the concentration of the mixture, shear rate, mineralization and temperature.

The first and important dependence of the polymer is the viscosity and concentration. As is known, the polymer is added to the injected agent to weigh down the agent and increase the viscosity. This reduces the mobility or mobility of water and increases the efficiency of flooding. The effect occurs due to high coverage by volume and lower oil saturation in the washed zone.

To select the modeling of the polymer rheology process by the viscosity-concentration parameter, laboratory tests were used as a basis to determine the viscosity of polymer mixtures at different temperatures (20 °C and 39 °C). The obtained graphs of the viscosity-polymer concentration dependence were taken for analysis, as a result of which one dependence was selected for input into the hydrodynamic model (Fig.2). However, it was also modified or calibrated for the fact during the model setup.

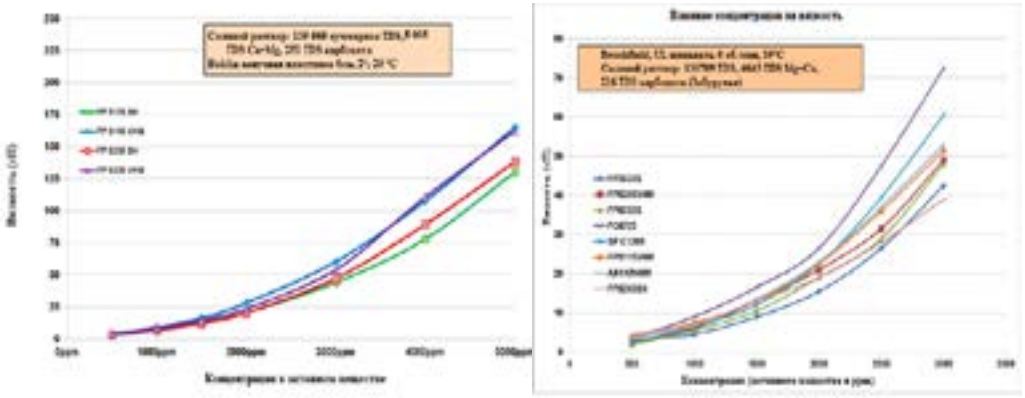

Fig. 2 - Effect of polymer concentration on viscosity

Another important parameter in the study of polymer rheology is the identification of the dependence of viscosity on the shear rate. (Jiaming Li et al., 2022). The polymer mixture is a non-Newtonian liquid, since its viscosity depends on the velocity gradient. Newton's law of viscous flow states that the internal friction force that appears when one layer of liquid moves relative to another is directly proportional to the gradient of the relative velocity of this movement and the surface of the layers.

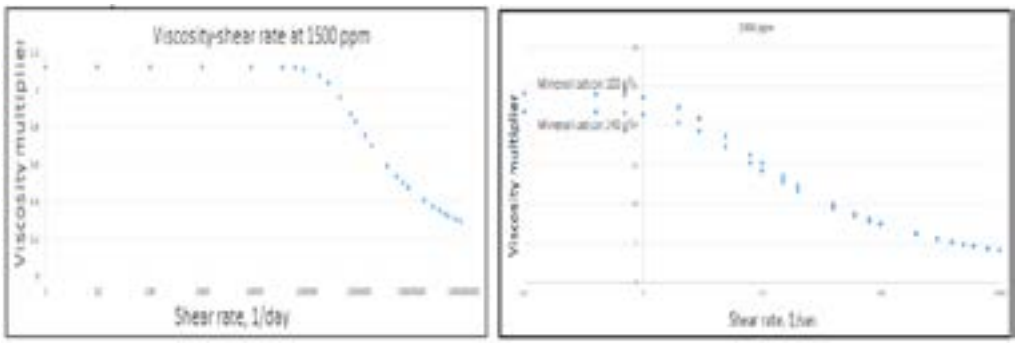

Fig. 3 – Viscosity – shear rate at 1500 ppm, 2000 ppm

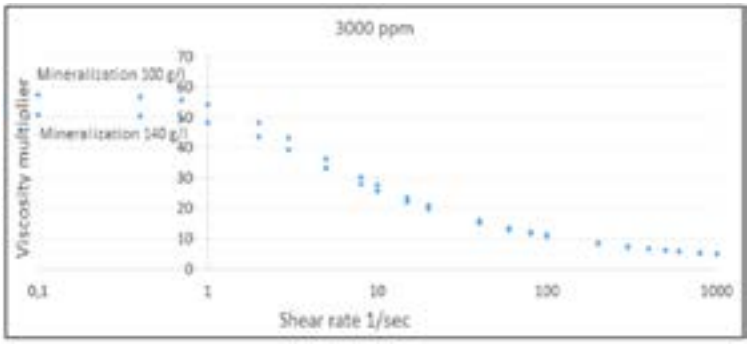

Fig. 4 - Viscosity – shear rate at 3000 ppm

That is, internal friction reduces the viscosity of the polymer mixture.

It should be noted that the non-Newtonian fluid effect was taken into account in the model using the NonNewton option. This was accepted because the actual results of the viscosity dependence on the shear rate were not verified. We applied data from an analog deposit.

The rheology of the polymer is influenced by mineralization. According to the modified data of the analog deposit, with mineralization in the range of 100–140 g/l, the viscosity changes at a low shear rate from 1 to 10 sec-1. With an increase in the polymer concentration from 1000 ppm to 3000 ppm, the viscosity decreases to 10 sP (Fig.3). In the digital 3D hydrodynamic model, mineralization is taken into account using the option.

Another significant parameter in polymer rheology is the effect of temperature. According to laboratory results, with an increase in the polymer concentration from 1500 ppm to 3000 ppm, the viscosity can decrease to 5 Cps under temperature conditions (39 °C ± 10) (Fig.4).

At the simulated field, the reservoir temperature averages 38 °C, respectively, the injected agent has no effect on temperature change. In this connection, there is no need to apply the viscosity dependence on temperature, and not to "weigh down" the model with a thermal option.

One of the uncertainties in the simulation is the adsorption of the polymer, or how the injected polymer partially settles in the pores of the collector. In this regard, this parameter was determined using the implementation of more than 100 iterations. As a result, the most optimal rheology was selected for this parameter (Table 1).

The coefficient of absolute permeability reduction is taken as a single constant in the Eclipse simulator, despite the fact that some simulators accept this coefficient as a function of permeability. (Liu et al., 2022).

Table 1 - Concentration - adsorbed polymer

Concentration (kg/cm3)	Adsorbed polymer kg/kg
0,00	0,00000035
0,03	0,00000066
0,50	0,00000081
0,75	0,00000091
1,00	0,00000109
1,25	0,00000112
1,50	0,00000122
1,75	0,00000132
2,00	0,00000140
2,25	0,00000150
2,50	0,00000160
2,75	0,00000171
3,00	0,00000180

After entering all the necessary initial data into the digital model, the model was configured for real data. During the calculations, along with determining the optimal parameters of the rheological properties of the polymer, attention was paid to the

adaptation of data such as pick-up, especially for wells A and B, into which the polymer is injected and production from individual wells (Fig.5–6).

The task is not just to conduct an experiment on a model for injecting an agent with a polymer, but at the same time an important component is not to lower the very pick-up through wells, due to the weighting of the agent with a polymer. (Leng et al., 2022). And this means that the parameters of the polymer should be selected most optimally without loss in implementation.

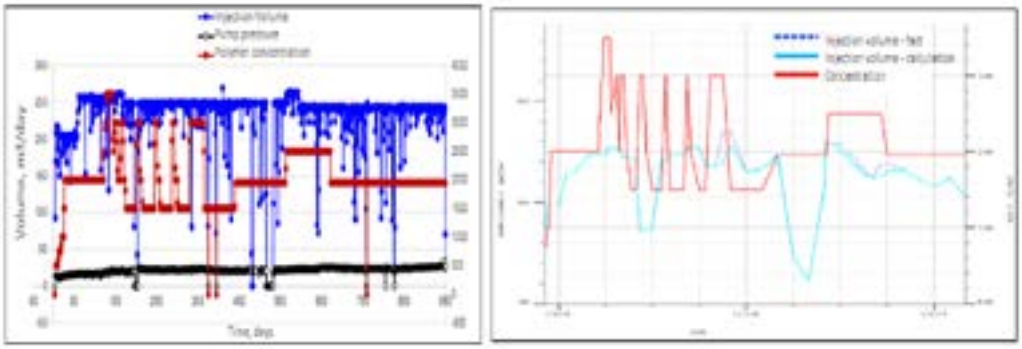

Fig. 5 - Well A (actual injection dynamics; results of model calculation of injection dynamics)

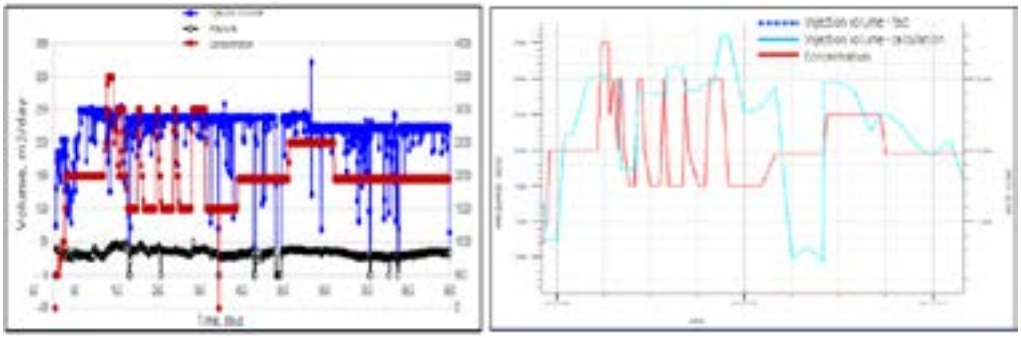

Fig.6 - Well B (actual injection dynamics, model injection dynamics)

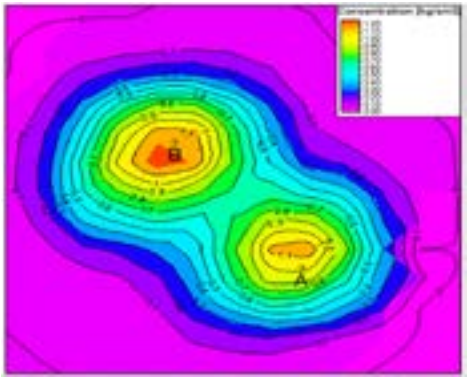

Fig. 7 – Distribution map of polymer concentration, kg/m3

Results

As a result, comparing calculations with polymer injection and without polymer injection, the effect of polymer injection is obvious. As of March 1, 2017, with the injection of 403 tons of dry polymer, 27,440 tons of additional oil were extracted. The water cut has been reduced from 86 % to 85 % in the field as a whole. (Wang et al., 2022). Below are graphs of the polymer effect and maps of polymer propagation (Fig.7–9).

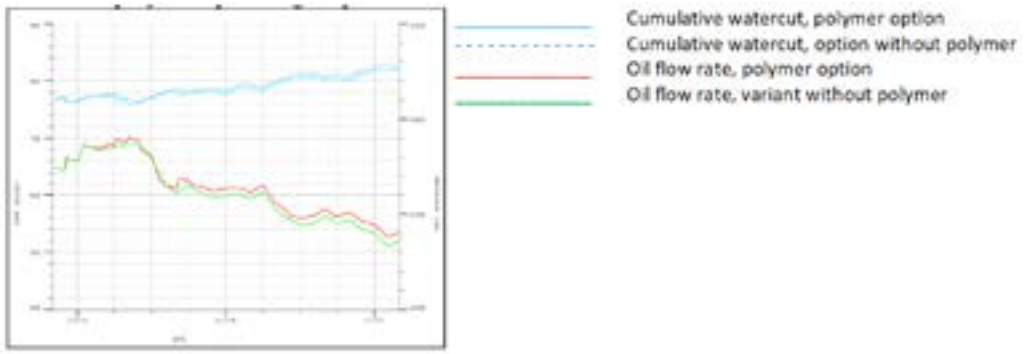

Fig. 8 - Dynamics of oil flow rate and water content

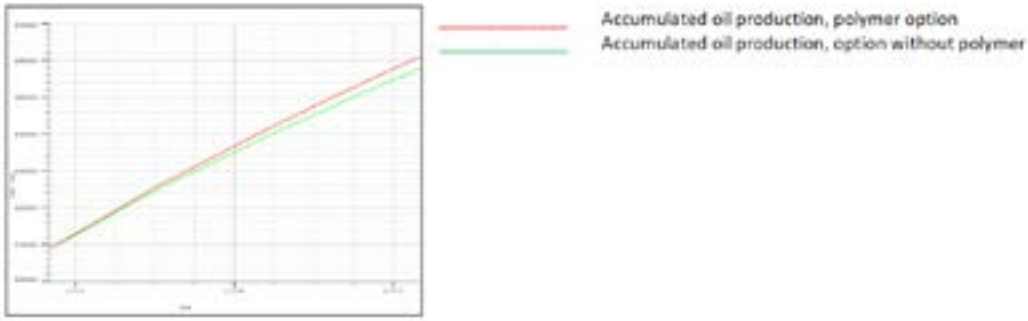

Fig. 9 - Accumulated oil production

Conclusion

In the work performed, studies of technologies that allow to increase the efficiency of oil displacement due to SWEAT and changes in the displacement front of the injected agent into the reservoir were analyzed. To date, the global volume of oil production with the help of POT is about 15-20 million tons.

Currently, it is possible to conduct a preliminary assessment of the applicability of the selected technologies using digital technologies, namely 3D hydrodynamic modeling, which was done in this work. For example, several modeling stages were carried out, where the concept of leveling the pick-up and water insulation profile with clogging of channels and with flow through a highly permeable layer of injected water was applied.

Previously, by studying the thermal stability of the composition of flow-bending technologies, various patterns are established that help to evaluate:

1) the mechanism of sediment formation in the bottom-hole zone of the formation;

2) applicability of formulations as FDT.

The influence of geological and filtration characteristics of the formation on sedimentary compositions and on the formation of a water-insulating screen was determined.

The established patterns of viscosity-polymer concentration, viscosity-shear rates, the effect of mineralization and temperature were introduced into an experimental 3D model, which was calculated. The calculations performed on the digital model of the reservoir indicate that the use of FDT with an average water content leads to an increase in the coverage of the simulated reservoir with flooding compared to the basic version.

As a result, it is possible to recommend FDT as one of their effective methods of increasing oil recovery. With the help of this technology, gel-forming compositions are injected into the bottom-hole zone of the formation in order to align the pickup profile of injection wells and, as a result, the flooding coverage coefficient increases.

The technology is neutral in relation to the intensity of corrosion, the rate of salt deposition, the development of sulfate-reducing bacteria in oilfield equipment, and also does not affect the preparation process and the quality of commercial oil. (Wang et al., 2020).

The selected and analyzed technology can be applied to mature fields in Kazakhstan.

With the help of digital 3D modeling, it is possible to identify the establishment of the variability of the residual resistance factor when pumping sedimentary rock-forming compounds into the bottom-hole zone of the formation. And also to continue the study to establish the effectiveness of the use of sedimentary rock-forming compounds when creating a blocking screen in the bottom-hole zone of the formation.

The geological and hydrodynamic model of the deposit is constructed taking into account all available geological and field and laboratory studies. The analyzed field is densely drilled with wells, respectively, uncertainties in the lateral distribution of reservoirs and the properties of FES are minimized, which is confirmed as a result of adaptations of the hydrodynamic model to history. The geological and hydrodynamic model is ready for use in making decisions on further field development, optimization of the development system, planning of new GTM, and sealing drilling.

Within the framework of this digital simulation, an assessment of the effectiveness of polymer flooding in the Neocom II formation was carried out. The evaluation showed a positive effect of polymer injection. As of March 1, 2017, when pumping 403 tons of dry polymer, 27440 tons of additional oil were extracted, and the water content of the field was also reduced.

In general, along with the expansion of polymer flooding, it is recommended to carry out repair and insulation work, leveling the inflow profile to isolate the watered intervals of producing wells and isolate highly permeable intervals in injection wells.

Summing up the analytical studies carried out, it can be concluded that all this makes it possible to regulate filtration flows with water-insulating technologies during the development of oil fields.

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