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## **Analysis of oil-bearing complexes of the North Tatar arch in connection with the forecast of bituminosity on the upper section part of sedimentary cover**

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**Abstract.** The article considers the structural features of the oil-bearing complexes of the North Tatar arch according to GIS data, core testing studies. The estimation of oil content by tectonic elements of the third order is presented. As a result of the work, data has been collected that can be used to assess the prospects of the oil and bitumen bearing capacity of the studied object according to an integrated approach in data analysis. The criteria for predicting the bituminosity of the upper part of the section of the sedimentary cover of the territory of the North Tatar arch are considered.

**Key words:** *oil-bearing complex, North Tatar arch, forecast, sedimentary cover, oil content of Tatarstan, prospects of bituminous activity*

**For citation:** B.V. Uspensky, E.E. Andreeva, A.G. Baranova, A.V. Valeeva, G.M. Ionov Analiz neftenosnykh kompleksov Severo-Tatarskogo svoda v svyazi s prognozom bituminoznosti verkhney chasti razreza osadochnogo chekhla [Analysis of oil-bearing complexes of the North Tatar arch in connection with the forecast of bituminosity on the upper section part of sedimentary cover]. Neftyanaya Provintsiya, No. 2(38), 2024. pp. 1-8. DOI <https://doi.org/10.25689/NP.2024.2.1-8>. EDN LVIBGP (in Russian)

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EDN GCPHSG

УДК 551.3.051+550.8.072

**The use of magnitomineralogical methods to develop a model  
for the formation of non-marine microbial limestone  
of the red-coloured kazan stage (middle permian)  
of the lower Kama (east-european platform)**

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**Abstract.** The article contains the results of modelling of possible conditions of formation and delineation of limestone lithotypes of the red-colored formation of the Kazan Stage (Middle Permian) the Lower Kama.

In the process of research, data of magnetomineralogical analysis methods were used along with biostratigraphic approach to study samples of the Sentiak geological section near Elabuga. Magnetomineralogical analysis is considered as a tool for obtaining more reliable information to construct a sedimentological model of the geological object under study.

**Key words:** *depositional model, Kazanian stage, lithotypes, nonmarine microbial limestones, magnetic-mineralogical method, biostratigraphic method*

**For citation:** M.F. Latifullina, A.Kh. Kabirova Privlecheniye metodov magnitominerologicheskogo analiza dlya sozdaniya kontseptual'noy modeli osadkonakopleniya nemorskikh mikrobial'nykh izvestnyakov krasnotsvetnoy formatsii kazanskogo yarusa na territorii nizhney Kamy [The use of magnitomineralogical methods to develop a model for the formation of non-marine microbial limestone of the red-coloured kazan stage (middle permian) of the lower Kama (east-european platform)]. Neftyanaya Provintsiya, No. 2(38), 2024. pp. 9-15. DOI <https://doi.org/10.25689/NP.2024.2.9-15>. EDN GCPHSG (in Russian)

DOI: <https://doi.org/10.25689/NP.2024.2.16-30>

EDN CCQAUV

УДК 553.98(574)

## **The reasons for the uneven areal distribution of oil and gas fields within the Buzachinsky peninsula and some practical consequences**

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**Abstract.** The conducted studies have shown that local uplifts of the platform cover, containing in some cases large accumulations of hydrocarbons, were formed in an environment of periodically manifested tangential compression. In terms of plan, they coincide with the frontal parts of tectonic scales and gentle thrusts in the Triassic-Paleozoic rock complex, which underwent intensive folding in the Pre-Jurassic period. The established patterns in the structure and areal distribution of dislocations made it possible to solve practical problems related to the conditions of formation of oil and gas accumulations, migration directions and probable zones of hydrocarbon generation. The results obtained can be used to determine further directions of exploration in the region.

**Key words:** *anticlines, thrusts, tangential compression, oil and gas traps*

**For citation:** Popkov V.I., Popkov I.V. Priciny neravnomernogo ploshchadnogo razmeshcheniya mestorozhdeny nefti yi gaza vie predelach buzachinskogo poluoostrova yi necotora prakticheskiye sledstviya [The reasons for the uneven areal distribution of oil and gas fields within the Buzachinsky Peninsula and some practical consequences]. Neftyanaya Provintsiya, No. 2(38), 2024. pp. 16-30. DOI <https://doi.org/10.25689/NP.2024.2.16-30>. EDN CCQAUV (in Russian)

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EDN GNBLES

УДК 550.8.072

## **Experience in constructing a structural framework for a geological model of strata of the Pokur Formation in the north of Western Siberia**

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**Abstract.** The work analyzes one of the most important and complex stages of constructing geological models of the Kharampur field, which directly affects the process of calculating hydrocarbon reserves, planning the process of developing oil and gas deposits, as well as assessing promising zones - the creation of a structural framework. Seismic and geological correlation of layers affects, first the geometrization of known deposits and the distribution of promising oil and gas zones.

The complexity of modeling the structure of the Pokur deposits is associated with the predominantly continental genesis of the deposits of the Pokur strata, which determines their high geological heterogeneity and lateral variability of the section, which is reflected in seismic sections. The article describes the process of correlation of productive strata of the Pokur formation of continental origin, the methodology of seismic calculations, as well as an algorithm for modeling the structural basis of the pokur deposits.

**Materials and methods.** Results of geophysical surveys of wells, as well as data on geological layer-by-layer correlation of the field. Analysis of structural structures through linear dependence, through multidimensional dependence. Construction of two-dimensional maps. Geological modeling.

**Key words:** *geological section, Western Siberia, Pokurskaya suite, reflecting horizon, roof, structural frame*

**For citation:** K.B. Kuziv, D.A. Leikom Opyt postroyeniya strukturnogo karkasa geologicheskoy modeli plastov pokurskoy svity na severe Zapadnoy Sibiri [Experience in constructing a structural framework for a geological model of strata of the Pokur Formation in the north of Western Siberia]. Neftyanaya Provintsiya, No. 2(38), 2024. pp. 31-43. DOI <https://doi.org/10.25689/NP.2024.2.31-43>. EDN GNBLES (in Russian)

DOI: <https://doi.org/10.25689/NP.2024.2.44-72>

EDN DMLMSS

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## Hydrogeochemical features of groundwater in the mesozoic sediments of the Bukharo-Khiva oil and gas region

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**Abstract.** The article examines the current state of hydrogeochemical zoning of Mesozoic deposits of the Bukhara-Khiva oil and gas region. Groundwater plays an important role in the formation and preservation of oil and gas deposits; under certain conditions, they can contribute to their accumulation or destruction; therefore, the purpose of the study is to establish the role of groundwater in the formation and placement of hydrocarbons in the Mesozoic water system of the Bukhara-Khiva region. The work used an integrated approach to solving problems, including scientific generalizations of factual data in the context of Jurassic and Cretaceous deposits of the study area with the use of materials characterizing the hydrogeochemical parameters of formation waters.

From a general geological point of view, consideration of the hydrogeological features of groundwater, the unity of the dynamics and chemistry of formation fluids are an important oil exploration criterion and deserves attention when choosing a rational direction for geological exploration. Based on the hydrogeological analysis of the Jurassic and Cretaceous deposits of the BKHNGR, the hydrogeochemical zones and the location of individual promising areas with respect to oil and gas potential were clarified. The discovery of such local areas of the study area significantly expands the range of search objects, which in the future will improve the efficiency of prospecting and exploration work. Conclusions are presented with an assessment of the oil and gas potential of the study area based on hydrogeochemical criteria. The hydrogeochemical studies proposed in the work have an undeniable advantage, since the hydrogeological aspect under consideration is based on the analysis of data from previous structural-tectonic, lithological-facial, geochemical, geophysical studies and acts as the final generalizing result.

**Key words:** *hydrogeochemical zone, sediments, formation water, aquifer complex, mineralization, horizon, fluid, deposit, migration, Jurassic, Cretaceous, Mesozoic*

**For citation:** T.Kh. Shoimurotov, I.N. Khakimzyanov, J.Sh. Ziyaev *Gidrogeokhimicheskiye osobennosti podzemnykh vod mezozoyskikh otlozheniy Bukharo-Khivinskogo neftegazo-nosnogo regiona* [Hydrogeochemical features of groundwater in the mesozoic sediments of the Bukharo-Khiva oil and gas region]. *Neftyanaya Provintsiya*, No. 2(38), 2024. pp. 44-72. DOI <https://doi.org/10.25689/NP.2024.2.44-72>. EDN DMLMSS (in Russian)

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EDN VXJBKD

УДК 622.276.342.003

## **Approaches to assessment of technological and economic efficiency of infill drilling in carbonate sediments - A case study of Berket-Klyuchevskoye oil field in the Republic of Tatarstan**

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**Abstract.** Traditional approaches to oil field development at late stages result in localization of a substantial portion of oil reserves in the inter-well space. Today, a number of effective technological solutions aimed at recovery of residual oil reserves in producing fields are available. One of the approaches to addressing the problem of recovery of residual oil reserves locked in poorly drained and stagnant zones provides for infill drilling. The paper presents an example of infill drilling operations conducted in carbonate reservoirs of Berket-Klyuchevskoye oil field in the Republic of Tatarstan. Various options for further development of the field using geological and reservoir simulation modeling are considered. Forecast production data due to application of proposed technological solutions aimed at enhancing oil recovery in the inter-well space and increasing the ultimate oil recovery factor are presented.

**Keywords:** *field, reserves, carbonate reservoir, geological structure, infill drilling, well, relative permeability, oil recovery factor, economic efficiency*

**For citation:** V.N. Petrov, A.Kh. Kabirova, R.N. Khusnutdinov, M.A. Sayfitdinov, N.Kh. Gadrakhmanov, A.F. Yartiev Podkhody po otsenke tekhnologicheskoy i ekonomicheskoy effektivnosti uplotneniya setki skvazhin na karbonatnykh otlozheniyakh na primere Berket-Klyuchevskogo neftyanogo mestorozhdeniya respubliky Tatarstan [Approaches to assessment of technological and economic efficiency of infill drilling in carbonate sediments - A case study of Berket-Klyuchevskoye oil field in the Republic of Tatarstan]. Neftyanaya Provintsiya, No. 2(38), 2024. pp. 73-89. DOI <https://doi.org/10.25689/NP.2024.2.73-89>. EDN VXJBKD (in Russian)

DOI: <https://doi.org/10.25689/NP.2024.2.90-128>

EDN NVRPPU

УДК 622.279.7+661.185

## **Methods of combating watering in gas condensate wells, possibilities of using surfactants and rationale for its selection**

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**Abstract.** The article discusses methods of domestic and foreign technologies for operating gas condensate wells. The most probable reasons for watering of gas condensate wells are given, methods of combating watering, existing types and modern types of surfactants, methods for selecting surfactants, equipment for laboratory research, as well as methods for delivering surfactants to the bottom of a gas condensate well with horizontal end for the purpose of removing fluid from the bottom

**Key words:** *gas, gas condensate, well, watering, surfactant, types of surfactants, methods for researching surfactants, laboratory testing of surfactants, equipment for laboratory research*

**For citation:** E.B. Guseynov, A.T. Zaripov, R.R. Sultanbekov, A.F. Shaikhutdinova Sposoby bor'by s obvodneniyem gazokondensatnykh skvazhin, vozmozhnosti primeneniya poverkhnostno-aktivnykh veshchestv i obosnovaniye yego podbora [Methods of combating watering in gas condensate wells, possibilities of using surfactants and rationale for its selection]. Neftyanaya Provintsiya, No. 2(38), 2024. pp. 90-128. DOI <https://doi.org/10.25689/NP.2024.2.90-128>. EDN NVRPPU (in Russian)

DOI: <https://doi.org/10.25689/NP.2024.2.129-141>

EDN DHRILZ

УДК 622.276.65-97

## **Approbation of technology for regulating the coverage of reservoirs by flooding using a thermotropic composition based on aluminum chloride and urea**

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**Abstract.** Thermotropic compositions used in physico-chemical methods of increasing oil recovery technologies are a separate group of reagents, the effectiveness of which depends on the parameters of the reservoir temperature. This condition is due to the fact that the qualitative formation of a water-insulating barrier can be ensured only at the expense of the thermal energy of the layer, since thermotropic compositions belong to thixotropic pseudoplastic systems of the coagulation structure. In most cases, compositions based on aluminum chloride and urea (urea) are used as thermotropic formulations. When such a thermotropic composition is injected into the formation under the influence of temperature, a volumetric inorganic aluminum hydroxide gel is formed, which cools the treated reservoir intervals away from the bottom of the treated well, which contributes to the intra-reservoir redistribution of filtration flows and connection to the development of new oil-saturated intervals [1].

Experimental work performed in conditions of low-permeable high-temperature formations of a number of fields in Western Siberia showed fairly high results in increasing oil recovery. The technology is recommended for industrial implementation.

**Key words:** *methods of oil recovery enhancement, flow diverting technologies, injection of low-volume rims of gel-forming compounds oil cleaning agents, thermotropic compositions, integrated EOR technologies*

**For citation:** S.F. Mambetov, A.M. Ignatiev, A.M. Farrakhov Aprobatsiya tekhnologii po regulirovaniyu okhvata plastov zavodneniyem s primeneniym termotropnoy kompozitsii na osnove khlorida alyuminiya i karbamida [Approbation of technology for regulating the coverage of reservoirs by flooding using a thermotropic composition based on aluminum chloride and urea]. Neftyanaya Provintsiya, No. 2(38), 2024. pp. 129-141. DOI <https://doi.org/10.25689/NP.2024.2.129-141>. EDN DHRILZ (in Russian)



DOI: <https://doi.org/10.25689/NP.2024.2.142-155>

EDN EQMQCX

УДК 622.276.66.001

## **Studying impact of a relative permeability modifier on capillary imbibition process and evaluation of its adverse effect on physical and chemical properties of fracking fluid**

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**Abstract.** One of the ways to intensify oil production and simultaneously control the water content of products during hydraulic fracturing (fracking) is the use of relative permeability modifiers. Since this modifier is resistant to high shear rates, it can be pumped under high pressure and at a high feed rate. A characteristic feature of the relative permeability modifiers is that it is compatible with almost any water-based hydraulic fracturing fluids that are used in hydraulic fracturing on terrigenous reservoirs. The use of relative permeability modifiers makes it possible to increase the efficiency of hydraulic fracturing by effectively reducing water permeability and maintaining oil and gas permeability. The article shows the results of experimental studies to study the effect of the relative permeability modifiers on rheological characteristics, sand-holding capacity of hydraulic fracturing fluid. The dependence of the filtration time of the hydraulic fracturing fluid through the proppant pack on the concentration of the relative permeability modifiers is shown. As a result of the research, the most effective concentration of permeability modifier for rocks with a clay content of 1.5 – 5.5%.

**Key words:** *hydraulic fracturing, permeability modifier, compatibility, hydrophilicity, hydrophobicity, rheology, filtration, proppant pack, clayiness*

**For citation:** R.L. Budkevich, I.A. Alenkin, T.T. Belova, R.R. Zakirov, A.Kh. Kabirova Issledovaniye vozdeystviya modifikatora odnositel'noy pronitsayemosti na protsess kapillyarnoy pro-pitki i opredeleniye yego negativnogo vliyaniya na fiziko-khimicheskiye svoystva zhidkosti dlya gidravli-cheskogo razryva plasta [Studying impact of a relative permeability modifier on capillary imbibition process and evaluation of its adverse effect on physical and chemical properties of fracking fluid]. Neftyanaya Provintsiya, No. 2(38), 2024. pp. 142-155. DOI <https://doi.org/10.25689/NP.2024.2.142-155>. EDN EQMQCX (in Russian)

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EDN KKBVSU

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## Assessment of the effect of process fluids injected into injection wells on the possibility of changing the rheological parameters of hydraulic fracturing fluids after destruction

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**Abstract.** The efficiency of the fracturing process depends on many factors, including the compatibility of the fracturing fluid with the reservoir system. After hydraulic fracturing and well flushing, part of the destroyed gel may remain in the reservoir formation and react with process fluids during geological and technical measures. As a result of the reactions, the processes of so-called repeated or "secondary crosslinking" of the destroyed gel can occur, and, as a result, the colmatation of the pore space of the reservoir reservoir by "crosslinking" systems. To establish the fact of "secondary crosslinking", rheological studies are carried out to analyze changes in the dynamic viscosity of samples of the destroyed gel with the addition of process fluids. As a result of the work, the risks of repeated "crosslinking" for a system based on a xanthan biopolymer were assessed.

**Key words:** *hydraulic fracturing, crosslinked system, rheology, compatibility, process fluids, destroyed gel, hydrogen index, crosslinking, geological and technical measures*

**For citation:** I.A. Alenkin, T.T. Belova, R.R. Zakirov, A.Kh. Kabirova Otsenka vliyaniya tekhnologicheskikh zhidkostey, zakachivayemykh v nagnetatel'nyye skvazhiny, na vozmozhnost' izmeneniya reologicheskikh parametrov zhidkostey GRP posle destruktzii [Assessment of the effect of process fluids injected into injection wells on the possibility of changing the rheological parameters of hydraulic fracturing fluids after destruction]. Neftyanaya Provintsiya, No. 2(38), 2024. pp. 156-176. DOI <https://doi.org/10.25689/NP.2024.2.156-176>. EDN KKBVSU (in Russian)

DOI: <https://doi.org/10.25689/NP.2024.2.177-192>

EDN WHRSSV

УДК 622.276.63

## Controlling the kinetics and rheology of acid systems to improve acid well treatments

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**Abstract.** According to various estimates, the world hydrocarbon reserves in carbonate reservoirs range from 38% to 60%. A characteristic feature of carbonate reservoirs field development is the complexity of controlling filtration processes caused by the structure of the void space of the carbonate matrix of reservoir rocks.

According to geometrical criteria, the following can be distinguished in the void space: porosity (intergranular porosity), cavernousness (intergranular porosity), fracturing. Moreover, in carbonate rocks, various combinations of void space types can occur: pore-cavernous, pore-cracked, pore-cavernous-cracked, pore-cavernous-cracked and other reservoirs [1].

The strong differentiation of reservoir properties creates certain difficulties in performing conventional acid stimulation techniques for carbonate reservoir development. Carbonate minerals actively interact with most inorganic and organic acids. Traditionally, 10-15% hydrochloric acid solutions are used for acid treatments due to its high solubility and low cost. In order to carry out acid treatments of productive formations, complex compositions based on hydrochloric acid with various components allowing to regulate the properties are used. In this case, the characteristic features describing the dissolution process are the reaction rate and the reaction constant. One of the solutions to obtain physical values of solubility rate and kinetics is the use of volumetric estimation method. The use of this method involves the study of the rate of carbon dioxide release during the reaction process with subsequent data processing. In the work was used one of the versions of equipment for automated data acquisition reflecting the rate of carbon dioxide release during the chemical reaction installation “PIK-OSG” JSC “Geologika”.

**Key words:** *carbonate reservoir, porosity, filtration, hydrochloric acid, reservoir, reaction rate, kinetics, carbon dioxide*

**For citation:** I.I. Mannanov, G.R. Ganieva, A.R. Faizov, A.R. Gimaeva Upravlenie kinetikoj i reologiej kislotnyh sistem dlya sovershenstvovaniya kislotnyh obrabotok skvazhin [Controlling the kinetics and rheology of acid systems to improve acid well treatments]. Neftyanaya Provintsiya, No. 2(38), 2024. pp. 177-192. DOI <https://doi.org/10.25689/NP.2024.2.177-192>. EDN WHRSSV (in Russian)

DOI: <https://doi.org/10.25689/NP.2024.2.193-203>

EDN BVNYLR

УДК 622.276.654.001

## **Determination of conditions for combustion front development near injection well following air injection into oil reservoir using fluid flow modeling**

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**Abstract.** The paper contains studies performed for the purpose of determination of combustion front creation conditions near injection well following air injection into oil reservoir. The plotted line separating spontaneous combustion zone and zone free of spontaneous combustion following air injection is presented with corresponding differential values between air injection pressure and initial formation pressure that can lead to creation of combustion front near injection well following air injection into oil reservoir. Using Brea-Olinda oil field as an example via calculation it is possible to demonstrate relationship between time of combustion front creation near injection well following air injection into oil reservoir and injection pressure values on digital fluid flow model. It was noted, that during air injection having lower injection pressure values, combustion front creation time increases, and in case of increased overbalance, combustion front creation time decreases.

**Keywords:** *high-viscosity oil, super-viscous oil, thermal recovery methods, in-situ combustion, in-situ combustion front, spontaneous combustion*

**For citation:** G.V. Aleksandrov, R.Kh. Nizaev, A.Kh. Kabirova Opredeleniye usloviy vozniknoveniya fronta gorenii v okrestnosti nagnetatel'noy skvazhiny s nachalom zakachki vozdukha v neftenosnuyu zalez' s ispol'zovaniyem fil'tratsionnogo modelirovaniya [Determination of conditions for combustion front development near injection well following air injection into oil reservoir using fluid flow modeling]. Neftyanaya Provintsiya, No. 2(38), 2024. pp. 193-203. DOI <https://doi.org/10.25689/NP.2024.2.193-203>. EDN BVNYLR (in Russian)

DOI: <https://doi.org/10.25689/NP.2024.2.204-219>

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## Testing of industrial hyperbranched polymers for pipeline pumping of hydrocarbons

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**Abstract.** The article describes a laboratory evaluation of Boltorn industrial hyperbranched polymers for the possibility of application in pipeline transportation of unconventional reserves (TRIZ) using the example of a high-viscosity waxy emulsion. Industrial additives differ in their chemical structure and molecular weight. The maximum efficiency for pipeline pumping for Boltorn W3000 was 13.6% at a concentration of 200 ppm, for the Boltorn H311 composition - 12.7% at a concentration of 150 ppm. Additionally, the effect of the hyperbranched polymer Boltorn W300 on the viscosity values of oil at various concentrations and in the temperature range from 5 to 25°C in increments of 5°C was studied. The most effective additive concentration in this study was 100 g/t. At this concentration and at 00C, the maximum efficiency in reducing the dynamic viscosity index is 40%.

**Key words:** *oil, transportation, dynamic viscosity, concentration, additive, hyperbranched*

**For citation:** E.V. Kharitonov, A.V. Sharifullin, L.R. Baybekova, G.G. Pesternikova, N.R. Gafurov, Y.A. Yurchenko, F.F. Minnakhmetov, G.I. Dusmetova Issledovaniya promyshlennykh giperrazvetvlennykh polime-rov dlya truboprovodnoy perekachki vyazkikh neftyanykh sred [Testing of industrial hyperbranched polymers for pipeline pumping of hydrocarbons]. Neftyanaya Provintsiya, No. 2(38), 2024. pp. 204-219. DOI <https://doi.org/10.25689/NP.2024.2.204-219>. EDN CMJSJA (in Russian)

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EDN XCMRYX

УДК 622.276.72

## Comparative analysis of the effectiveness of inhibitors preventing the formation of high molecular hydrocarbon deposits

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**Abstract.** The processes of asphaltene precipitation are specific due to the heterogeneity of the oil reservoir system and the non-stationary nature of the ongoing processes. Therefore, to design technologies for injecting solvents into an oil reservoir in order to increase oil recovery, detailed and comprehensive studies of the colloidal stability of petroleum dispersed systems are required. An important task is the selection of the optimal formulation and composition of inhibitors, the use of which would ensure a reduction in asphaltene precipitation and an increase in the stability of the dispersed oil system of each individual well planned for the implementation of the technology.

The work provides a review of the asphaltene inhibitors used. It has been established that despite the large number of works devoted to the selection of inhibitors that prevent the process of deposition of high molecular weight hydrocarbon deposits, there is no methodology for selecting inhibitors for each potential object of implementation, and therefore this is a promising area for research. The use of spectrophotometry makes it possible to accurately assess the ability of inhibitors to keep asphaltene clusters or aggregates in suspension and not precipitate from solution. This method can be used to select the type of inhibitors.

**Key words:** *asphaltene precipitation, inhibitor effectiveness, high molecular weight hydrocarbon deposits, spectrophotometry, concentration, efficiency, petroleum dispersed system, light absorption coefficient*

**For citation:** D.T. Akhmetshina, A.A. Rybakov, R.R. Zakirov, M.P. Mironov Sravnitel'nyy analiz effektivnosti ingibitorov, predotvrashchayushchikh formirovaniya vysokomolekulyarnykh uglevodorodnykh otlozheniy [Comparative analysis of the effectiveness of inhibitors preventing the formation of high molecular hydrocarbon deposits]. Neftyanaya Provintsiya, No. 2(38), 2024. pp. 220-232. DOI <https://doi.org/10.25689/NP.2024.2.220-232>. EDN XCMRYX (in Russian)

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EDN HJWWJK

УДК 628.16.067.1

## Results of research of ultrafiltrated quality water production using sorption-filtration method

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**Abstract.** The research is aimed at determination of the potential for production of ultrafiltrated quality water during preliminary treatment via sorption-filtration method to optimize the performance of produced water ultrafiltration units at extra-viscous oil fields.

The paper presents the results of field tests and approaches to improve the quality of produced water treatment using granular filter materials.

Research findings are very useful for practical applications and enable production of high-quality water, free of residual oil and suspended solids, to result in substantial reduction of the costs on chemical cleaning of ultrafiltration units and improved service life of expensive ultrafiltration membranes.

**Keywords:** *produced water, wastewater treatment, filter material, sorption-filtration unit*

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EDN XBUUDM

УДК 622.276.8

## Oxygen-assisted catalytic oxidation of hydrogen sulfide in crude oil

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**Abstract.** Removal of hydrogen sulfide from crude oil is required for delivery of commercial-quality oil to main pipeline system as per GOST R 51858-2002 "Crude petroleum. General specifications". Nowadays several technologies for reduction of hydrogen sulfide content to the required level are applied. These are technologies based on application of hydrogen sulfide chemical scavengers, technology of liquid-phase oxidation of hydrogen sulfide in presence of air and hydrogen sulfide desorption in stripping columns.

Direct oxidation of hydrogen sulfide in crude oil with atmospheric oxygen in presence of catalyst complex has an indisputable economic advantage over application of chemical scavengers, and also compared to stripping method in case the first group of oil quality is required. However, substantial capital investments required for construction of such facilities encouraged the search for new approaches to reduce process costs. Oxygen-assisted catalytic process for removal of hydrogen sulfide combined with oil transport was developed and optimal concentration of oxygen in oxygen-air mixture was determined. Research for substantiation of fire and explosion safety of the technology during mixing of crude oil and process oxygen was conducted.

**Keywords:** *oil, hydrogen sulfide, oxygen, pressure, temperature, concentration, consumption, optimal, fire and explosion safety, ignition*

**For citation:** V.V. Solovyev, A.N. Shatalov, R.Z. Sakhabutdinov, A.A. Korzhavin, V.V. Zamashchikov, Ya.V. Kozlov Kislородno-kataliticheskoye okisleniye serovodoroda v nefi [Oxygen-assisted catalytic oxidation of hydrogen sulfide in crude oil]. Neftyanaya Provintsiya, No. 2(38), 2024. pp. 242-253. DOI <https://doi.org/10.25689/NP.2024.2.242-253>. EDN XBUUDM (in Russian)



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EDN LHMEJG

УДК 622.245.1

## **Analysis of multi-function guide shoes for running casing strings and profile liners into horizontal and multilateral wells**

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**Abstract.** The trend toward drilling more horizontal wells and horizontal sidetracks has revealed that the existing technologies for running casing strings with conventional shoes do not fully meet new requirements and in most cases cannot ensure trouble-free casing run to target depth. This necessitates pulling the casing strings out of hole, multiple reaming and flushing operations in horizontal hole sections and rerunning of casing strings or perforated sections in hole. The technology is more challenging in horizontal sidetracks because drilling equipment has to pass through casing window and also due to small hole diameters, high probability of technogenic impacts within drilling targets (reservoir pressure maintenance, production operations, extensive production enhancement and well intervention activities, etc.), high degree of data uncertainty in pressure-versus-depth plots, which results in operational problems, such as unexpected severe circulation losses, gas and oil shows, hole sloughing, differential sticking and so on. Vast experience of Russian and foreign service companies has shown that construction of horizontal sidetracks and multilateral wells in intensively developed fields at the late stage of development is inevitably associated with big challenges and high accident risks, which necessitates development of more efficient process equipment and technological solutions.

**Key words:** *horizontal well, horizontal sidetrack, multilateral well, casing string, liner, setting head, retrievable guide shoe*

**For citation:** A.A. Mukhametshin, A.L. Nasyrov, I.N. Tarasov, A.Z. Khakimov Analiz mnogofunktional'nykh bashmakov dlya spuska obsadnykh kolonn i profil'nykh perekryvateley v gorizontal'nyye skvazhiny i dopolnitel'nyye stvoly mnogozaobnykh skvazhin [Analysis of multi-function guide shoes for running casing strings and profile liners into horizontal and multilateral wells]. Neftyanaya Provintsiya, No. 2(38), 2024. pp. 254-271. DOI <https://doi.org/10.25689/NP.2024.2.254-271>. EDN LHMEJG (in Russian)

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EDN IXLOHJ

УДК 665.61.035.6

## **Application of rheological relationships in studying oil phase transition processes**

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**Abstract.** The paper discusses application of heavy oil rheological relationships at various temperatures to define the temperature of structural phase transition. Oil phase transitions are attributed to abnormal viscous properties of oil from Tatarstan fields. Oil viscosity mainly depends on its composition and pressure-and-temperature conditions. Decrease in oil temperature can cause paraffin crystallization and asphaltene coagulation. Oil behavior is characterized as one of a non-Newtonian fluid. Rheological relationships, such as flow curves, indicate the point where phase transition starts, as significant change in rheological properties is observed in this point. Bingham model considering viscoplastic properties of oil was used to analyze rheology data and to determine phase transition temperature. A reservoir in the Bobrikovian horizon (Republic of Tatarstan) was selected as a target for research.

**Key words:** *rheology, oil viscosity, asphaltenes, resins, paraffins, phase transition, development, temperature, flow curves*

**For citation:** V.M. Khusainov, O.S. Sotnikov, A.Kh. Kabirova, A.A. Pimenov *Primeneniye reologicheskikh zavisimostey v issledovanii protsessov fazovykh perekhodov nefi* [Application of rheological relationships in studying oil phase transition processes]. *Neftyanaya Provintsiya*, No. 2(38), 2024. pp. 272-282. DOI <https://doi.org/10.25689/NP.2024.2.272-282>. EDN IXLOHJ (in Russian)