УДК 541.182.02

БЫСТРОСХВАТЫВАЮЩАЯ КОМПОЗИЦИЯ ДЛЯ ПРЕДОТВРАЩЕНИЯ ПОГЛОЩЕНИЯ ПРОМЫВОЧНЫХ РАСТВОРОВ ПРИ БУРЕНИИ СКВАЖИН

QUICK-SETTING COMPOSITION FOR PREVENTING THE ABSORPTION OF WASHING SOLUTIONS DURING WELL DRILLING

Кадыров Абдусамик Абдувасикович
доктор технических наук,
профессор,
профессор кафедры технология бурения скважин,
филиал РГУ Нефти и газа имени И.М. Губкина, г. Ташкент
abdusamig@rambler.ru

Алиханов Борий Ботирович
PhD технических наук,
докторант,
Ташкентский государственный технический университет

Кадиров Нодир Абдусамикович
доктор технических наук,
доцент кафедры экология и охрана окружающей среды,
Ташкентский государственный технический университет

Эшмухамедов Мурод Азимович
кандидат химический наук,
профессор кафедры технология
нефтегазохимической промышленности,
Ташкентский государственный технический университет

Аннотация. Данная статья посвящена разработке способа и технологии предотвращения катастрофического поглощения промывочных растворов при бурении глубоких скважин.

Ключевые слова: поглощения, буровой раствор, скважина, композиция, отход переработки дистиллированных жирных кислот хлопкового масло.

Kadyrov Abdusamik Abduvasikovich
Doctor of Technical Sciences,
Professor,
Professor of the Department
of Well Drilling Technology,
branch of the Russian State University
of Oil and Gas named after I.M. Gubkin,
Tashkent
abdusamig@rambler.ru

Alikhanov Boriy Botirovich
PhD Technical Sciences,
Doctoral Candidate,
Tashkent State Technical University

Kadirov Nodir Abdusamikovich
Doctor of Technical Sciences,
Associate Professor of the Department
of Ecology and Environmental Protection,
Tashkent State Technical University

Eshmukhamedov Murod Azimovich
Candidate of Chemical Sciences,
Professor of the Department of Technology
of the Oil and Gas Chemical Industry,
Tashkent State Technical University

Annotation. This article is devoted to the development of a method and technology for preventing catastrophic absorption of washing solutions during deep well drilling.

Keywords: absorption, drilling mud, well, composition, waste from processing distilled fatty acids of cottonseed oil.

The main problems of increasing the speed of drilling wells in Uzbekistan are the presence of accidents and complications arising from the catastrophic absorption of drilling fluids during well construction.

Drilling fluid loss is a wellbore complication characterized by a complete or partial loss of drilling fluid circulation during the drilling process [1, 2].

Work to eliminate drilling mud absorption is associated not only with significant material losses, but also with significant losses in the extraction of minerals that cannot be accounted for. In this regard, improving technological methods for eliminating absorption, using new technologies and materials that provide the maximum economic result are of exceptional importance [3, 4].

Catastrophic absorption is typical for rocks with karst voids, caverns and large tectonic or non-tectonic faults. Elimination of catastrophic absorption of drilling fluid is very difficult in this case, since the use of widely used materials in the form of clays and cements does not lead to the desired results [4, 5].

Known methods for eliminating zones of complete (catastrophic) absorption can be conditionally divided into two main groups [6, 7]:

– filling with fill□rs;
– pumping in cement mixtures.

In this case, an emulsion-suspension solution containing diesel fuel or oil, an emulsifier, silicon dioxide, microparticles of ilmenite or trimanganese tetroxide, and an aqueous solution of calcium chloride is used as a tamponade blocking pack. The technical result is the elimination of drilling mud absorption in highly permeable formations or formations with abnormally low formation pressure, simplification of the preparation of a blocking composition in field conditions, and the possibility of regulating the rheological parameters of the compositions.

This development relates to a quick-setting composition (QSC) against the absorption of drilling fluids and can be used in the construction of deep wells in the oil and gas industry, geological exploration and mining.

The aim of the study is to develop a formula for a fast-setting composition for eliminating the absorption of drilling fluids, including the bottom waste of the distillation process of fatty acids of cotton soapstocks (BD PFA CS), hydrocarbon solvent and used motor oil, while as a hardener BSK contains a mixture consisting of quicklime, water and phosphogypsum, taken in certain ratios of components.

The optimum composition of the QSC, the ratio of the initial components, the temperature and time of the reaction were selected in laboratory conditions. The technological properties of the developed QSC composition were studied: conditional viscosity according to SPV-5, static shear stress, the curing time of the composition, the hydrogen ion index (pH) (Table 1).

Table 1.

№	Various tamponade compositions				Physico-chemical parameters				
	PAA + $Al_2(SO_4)_3$	Starch and cement solution	Cem tampon solution	QSC (various compositions,	Conditional viscosity T500 sec.	SNS, mg/cm^2		Curing time (min)	pH of the environment
						1 мин	10 мин		
1	Initial clay solution				25	15	35		9,0
2	1	–	–	–	60	8	12	25	9,0
3	–	1	–	–	45	18	25	24	9,5
4	–	–	1	–	45	28	45	26	9,5
5	–	–	–	compound 1	38	15	25	30	9,5
6	–	–	–	compound 2	35	14	26	45	9,0
7				compound 3	40	10	25	60	9,5

The peculiarity of the proposed composition is that as a hardener the composition contains an aqueous solution of quicklime, which when dissolved in water releases heat (exothermic process) due to which, when interacting with the BD PFA CS solution, a rubber-like quick-setting composition is formed. Phosphogypsum in this QSC composition serves as a regulator of the fluidity of the lime mortar.Used motor oil serves as a plasticizing additive for the hydrocarbon solution BD PFA CS.

The set task is achieved by the described composition of the quick-setting composition (QSC) consisting of:

– wasted from the process of distillation of fatty acids □f □□tt□n s□□□st□□ks;
– h□dr□□□rb□n s□lv□nt;
– used motor oil
– phosphogypsum
– lime (quicklime)+water.

The preparation of the quick-setting composition is carried out in the following order: BD PFA CS and a hydrocarbon solvent taken in a certain ratio with a plasticizer are loaded into the reactor, and at the same time an aqueous solution of quicklime (CaO) with phosphogypsum additives is added.

BD PFA CS taken in a certain amount from the total mass of QSC is heated to 50–600 C and dissolved in a hydrocarbon solvent containing used motor oil. The process lasts 15–20 minutes with stirring. After complete dissolution of BD PFA CS, a dark brown liquid is obtained. To this liquid, we add the calculated quantities of the hardener solution consisting of quicklime, phosphogypsum and water. The degree of hardening of the resulting composition is checked with a Vicat needle.

For comparison, the following compositions of plugging solutions were used:

– polyacrylamide and aluminum sulfate.
– starch and cement mortar
– cement mortar
– QSC of various compositions: 1, 2, 3 (differing in the ratio of components).

Comparative tests of BSK against drilling fluid absorption

The technique for eliminating the absorption of drilling fluid is as follows. Through the "bare end" of the drill pipe (through special holes at a distance of 2-3 m), which is located opposite the absorption zone, a solution of the oligomer (BD PFA CS) in a hydrocarbon solvent with used automobile oil is fed, and a solution of the hardener (all under pressure) consisting of lime, phosphogypsum and water is pumped into the “annulus”.

The two solutions meet opposite the absorption zone and form a rubber-like, fast-setting mixture that closes the absorption zone (Fig. 1). The presence of temperature and the absence of oxygen in the well depth in the absorption zone do not affect the plugging process. The oligomer and hardener solution have good fluidity and are pumped by a pump.

Scheme
Technological scheme of absorption of drilling mud of a geotechnical well

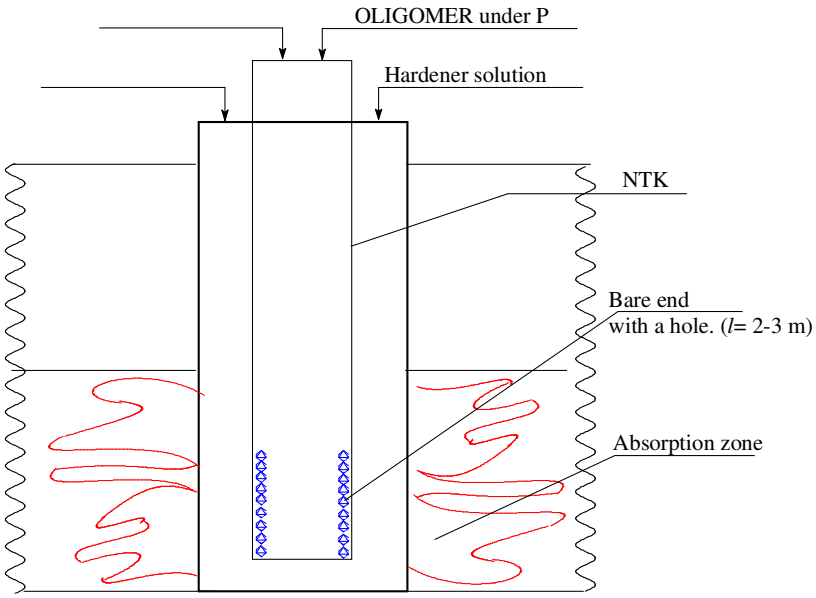

Fig. 1. Scheme of elimination of drilling mud absorption: *NKT – pump and compressor pipe

Due to the selected composition and ratio of components, cross-linking and formation of a rubber-like oligomer occurs directly in the absorption zone.

As a result of the experimental work, it was revealed that the parameters of the composition of the quick-setting composition (QSC) given in example No. 1 are the most optimal.

Conclusions

A quick-setting composition (QSC) against the absorption of drilling fluids during drilling of geotechnical wells in the complicated conditions of South-West Uzbekistan has been developed based on local materials.

A pilot industrial test of a fast-setting composition was successfully conducted in the zone of catastrophic absorption of drilling fluid during drilling of a geotechnical well in the Tuvaktau area in the Zirabulak geological exploration expedition of the Navoi-Uran State Enterprise of Uzbekistan.

Список литературы:

1. Роджерс В.Ф. Состав и свойства промывочных жидкостей. – М. : Недра, 1967. – 345 с.
2. Кистер Э.Г. Химическая обработка буровых растворов. – М. : Недра, 1971. – 366 с.
3. Шералиева О.А. Бинарные эмульсионно-полимерные системы для бурения скважин / О.А. Шералиева, Ж.К. Артыкова // Сборник материалов XXIV Международной НПК «Инновация-2019». – 2019. – С. 213–215.
4. Рязанов Я.А. Энциклопедия буровых растворов. – Оренбург : Летопись, 2005. – 625 с.
5. Мантрова С.В. Превентивные меры в борьбе с поглощениями при бурении скважин в условиях аномально низких пластовых давлений / С.В. Мантрова, М.А. Аманов, Г.А. Ишангулыев // Молодой ученый. – 2015. – № 3(83). – С. 326–331. – URL : https://moluch.ru/archive/83/15220
6. Изоляция зон поглощения с применением наполнителей / В.И. Крылов [и др.] // Обзорная информация. – М. : ВНИИОЭНГ, серия Бурение, 1981. – С. 62–70.
7. Мойса Н. Оценка закупоривающих свойств наполнителей для ликвидации поглощений бурового раствора / Н. Мойса, Н. Сухенко // Бурение. Нефть. – 2006. – № 6. – С. 38–42.
8. Курочкин Б. Профилактические мероприятия с применением наполнителей-кольматантов при вскрытии потенциально поглощающих пластов / Б. Курочкин, С. Самыкин // Технология ТЭК. – М., 2006. – № 4. – С. 34–40.
9. Горонович С. Ликвидация поглощений буровых растворов с использованием наполнителей / С. Горонович, В. Степанов, А. Ефимов // Бурение. Нефть. – 2005. – № 6. – С. 48–52.
10. Кадыров Н.А. Мицеллярные растворы на основе предельных и непредельных жирных кислот хлопковых соапстоков / Н.А. Кадыров, М.М. Пазилов, А.А. Кадыров // Научно-практическая конференция ТНИИХТ. – Ташкент, 2021. – С. 58–60.

List of references:

1. Rogers V.F. Composition and properties of washing fluids. – M. : Nedra, 1967. – 345 p.
2. Kister E.G. Chemical Processing of Drilling Fluids. – M. : Nedra, 1971. – 366 p.
3. Sheralieva O.A. Binary emulsion-polymer systems for well drilling / O.A. Sheralieva, J.K. Artykova // Proceedings of the XXIV International Scientific-Production Complex «Innovation-2019». – 2019. – P. 213–215.
4. Ryazanov Y.A. Encyclopedia of drilling muds. – Orenburg : Letopis, 2005. – 625 p.
5. Mantrova S.V. Preventive measures in the fight against absorption during well drilling in conditions of abnormally low formation pressures / S.V. Mantrova, M.A. Amanov, G.A. Ishangulyev // Young Scientist. – 2015. – № 3(83). – P. 326–331. – URL : https://moluch.ru/archive/83/15220
6. Isolation of absorption zones using fillers / V.I. Krylov [et al.] // Review information. – M. : VNIIOENG, Drilling Series, 1981. – P. 62–70.
7. Moisa N. Evaluation of plugging properties of fillers for liquidation of drilling fluid absorption / N. Moisa, N. Suhenko // Drilling. Oil. – 2006. – № 6. – P. 38–42.
8. Kurochkin B. Preventive measures with application of filler-colmatants at opening of potentially absorbing formations / B. Kurochkin, S. Samykin // Tekhnologiya TEK. – M., 2006. – № 4. – P. 34–40.
9. Goronovich S. Liquidation of drilling mud absorption using fillers / S. Goronovich, V. Stepanov, A. Efimov // Drilling. Oil. – 2005. – № 6. – P. 48–52.
10. Kadyrov N.A. Micellar solutions based on marginal and unsaturated fatty acids of cotton soapstocks / N.A. Kadyrov, M.M. Pazilov, A.A. Kadyrov // Scientific and Practical Conference TNIICHT. – Tashkent, 2021. – P. 58–60.