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Article



Annaguly Rejepovich Deryaev

Scientific Research Institute of Natural Gas of the State Concern „Turkmengas”
 Candidate of Technical Sciences, Senior Researcher,

Ashgabat, Turkmenistan

annagulyderyayew@gmail.com

THE RECIPE FOR THE PREPARATION OF DRILLING FLUIDS FOR DRILLING WELLS IN FIELDS WITH COMPLEX MINING AND GEOLOGICAL CONDITIONS

Abstract: The article describes the recipe for the preparation of an oil-emulsion humate-lignosulfonate solution, a complex-inhibited ALKAR-3M system, a solution of a hydrocarbon base of the "Versadril" type and a complex-inhibited CAIR-T system. The author suggests the procedure for replacing the oil-emulsion humate-lignosulfonate solution with the ALKAR-3M drilling fluid, as well as the replacement of the ALKAR-3M solution with a "Versadril" type hydrocarbon base solution. Such a view will be of interest to specialists for successful drilling operations in deep wells of deposits with difficult mining and geological conditions.

Key words: defoamer, viscosity, water output, chromepik, clay mixer, chisel, buffer, brine.

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Introduction

Preparation of oil-emulsion humate-lignosulfonate solution:

In a clay mixer with a volume of 4 m, water is poured to half the volume and 60 kg of caustic soda (NaOH) is filled in – mixing is carried out for 15-20 minutes, after that 600 kg of water is filled in with periodic scrolling of the blades of the clay mixer and water is added to the upper level. The mixture is mixed for 1-130 hours, after which the reagent is added to the drilling fluid during one circulation cycle. During the first treatment, it is necessary to add 2 clay mixers (8 m³) of the coal-alkali reagent (KAR) reagent to 100 m³ of drilling fluid.

In a clay mixer with a volume of 4 m³, water is poured to half the volume and 70-80 kg of caustic soda (NaOH) is filled in – mixing is carried out for 15-20 minutes, after that 700-800 kg of KSSB-2 is filled in with periodic scrolling of the blades of the clay mixer and topping up the water to the upper level. The mixture is mixed for 1 to 130 hours, after which the reagent is released into the drilling fluid during one circulation cycle. During the first treatment, 2 clay

mixers (8 m³) of the KSSB-2 reagent must be added to 100 m³ of drilling fluid.

For 100 m³ of drilling fluid, it is necessary to add 10 tons of oil and 500 – 700 kg of graphite. Surfactant HT-48 is used in drilling fluid as a defoamer. For 100 m³ of drilling fluid, it is necessary to add surfactant HT-48-200 – 400 kg. All these reagents are alternately added to the drilling fluid during one circulation cycle, depending on the volume of the drilling fluid being processed, further processing of the oil-emulsion humate-lignosulfonate solution is carried out in order to reduce the viscosity of the solution and water recovery to the set values of the parameters. If the pH of the solution falls below the value, the required amount of NaOH should be introduced into the solution. Preparation and addition of reagents in the future is carried out as needed.

Substitution of an oil-emulsion humate-lignosulfonate solution into a complex-inhibited ALKAR-3M system:

A complex-inhibited ALKAR-3M system is being prepared. 2-2.5 m³ of seawater is poured into a

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4 m³ clay mixer, 80-100 kg of chromium is loaded and mixed for 15-20 minutes, 200-250 kg of Portland cement is added, mixed for 1-2 hours, then 100-150 kg of alkali is added, mixed for 20-30 minutes, 500 kg of lignosulfonate is added and 70-100 liters of HT-48 are mixed for 1-2 hours. Sea water is added to the clay mixer to the level of. Everything is mixed for 1-130 hours. After preparation, the complex-inhibited ALKAR-3M system is released into the circulating drilling fluid during one cycle, injected into the drilling fluid in an amount of 10-15% by volume of the solution. The cooking time is 3-4 hours [1, 5, 6].

For 100 m³ of drilling fluid, it is necessary to add 10-15 tons of oil and 500 – 700 kg of graphite. All these reagents are alternately added to the drilling fluid during one circulation cycle, depending on the volume of the drilling mud being processed.

The need for further post-treatment of the "weakened" inhibited solution is expedient with an increase in structural and mechanical properties by 10-15%.

The procedure for replacing the inhibited solution of ALKAR-3M with a solution of the hydrocarbon base "Versadril".

To circulate the well with ALKAR-3M solution from the working tank to achieve the minimum acceptable parameters and static shear stress. Lower the chisel to the bottom as the new hydrocarbon solution approaches the chisel. Use large grids on the vibrating screen during replacement and after for 1-2 cycles. Pump a buffer of at least 60-150 m of the borehole. The buffer should be prepared from diesel and VG-69 clay to achieve viscosity or from a ready-made Versadril solution with a higher concentration of VG-69.

Preparation of a hydrocarbon-based solution formulation in field conditions for 1 m³ of solution:

The required amount of diesel fuel (0.5 m) is poured into one of the tanks, then, with intensive stirring, surfactant emulsifiers - Versamul and Versacoat are introduced through the funnel using a jet of centrifugal pumps and agitators, achieving their complete dissolution. In another container, mineralized water (containing CaCl₂) of the required activity is prepared. Mineralized water is slowly added to the container with the treated reagent with diesel fuel through the mixer funnel, mixing thoroughly (in addition, you can add dry powder CaCl₂). Then quicklime (CaO) is introduced, thoroughly mixed for 30-60 minutes and a filtration reducing reagent, Versatrol, is introduced, mixed for 30-60 minutes. In the resulting initial solution, barite is added to the required density and mixed for an hour. Technological parameters of the finished solution are determined.

The necessity is the sequence of reagent input and mechanical mixing of the system. In this regard, constant speed mixers (n = 2000 rpm) should be used

on drilling rigs. and more), and hydraulic and mechanical agitators should be used on the drilling rig.

Before mixing a hydrocarbon-based solution, all measuring tubes where a hydrocarbon-based solution will be prepared must be cleaned of an aqueous solution. After cleaning, it is necessary to start preparing the Versadril solution. It is recommended to have a spare capacity for preparing CaCl₂ brine, as well as to have diesel storage tanks. In order to avoid downtime of the drilling rig, it is necessary to provide the drilling rig with uninterrupted diesel and water [2, 7].

"CAIR-T" (Calcium-potassium-aluminate inhibited solution - thermostabilized) is a composition consisting of inhibitors, stabilizer, heat stabilizer, caustic soda, surfactant and water.

Lignosulfonates - salts of lignosulfonic acids (SSB, KSSB, FHLC), which also have an additional hydrophobic force, are used as a stabilizer and a viscosity reducing agent. However, lignosulfonates cause foaming in the drilling fluid and are not amenable to natural degassing.

Combined surfactants (HT-48) are nitrogenous surfactants in a mixture of polyoxyalkyl block copolymers - ethylene and propylene oxides, and is an active defoamer. The mechanism of defoaming is that HT-48 binds the hydrophobic part of lignosulfonate molecules. In addition, due to the adsorption of HT-48 on clay rocks, adsorbed HT-48 molecules shield the active areas on the surface of clays, preventing their interaction with water.

The role of the heat stabilizer is performed by salts of chromic acid - sodium bichromate (Na₂Cr₂O₇) or potassium (K₂Cr₂O₇).

The role of inhibitors is performed by potassium chloride and alkaline hydrolysates of Portland cement, forming acid-potassium chloride and acid-alkaline hydrolysates with sodium or potassium bichromates, which prevent hydration, swelling and disintegration of clay rocks in the zone of moderate and elevated temperatures. The increase in the level of inhibition occurs due to the transfer to a water-soluble state of potassium and calcium compounds present in potassium chloride and Portland cement - in the form of potassium and calcium monochromate.

Acid-base hydrolysates of Portland cement contain water-soluble and insoluble compounds, the mineralogical composition of which includes:

tricalcium silicate - 58,0-62,0%; - 3CaO-SiO₂+H₂O+K₂Cr₂O₇;

dicalcium silicate - 14,5-18,5%; - 2CaO-SiO₂+H₂O+K₂Cr₂O₇;

tricalcium aluminate - 4,0-6,0% - Ca₃Al₂O₆-SiO₂+H₂O+K₂Cr₂O₇;

tetracalcium aluminoferrite - 13,0-15,0%; - Ca₄(Al₂O₆)(Fe₂O₅) + H₂O+K₂Cr₂O₇.

These water-soluble acidic compounds are in dissociated form and are effective anionic clay inhibitors.

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Potassium acid chloride (KCl) enhances the inhibitory effect of the complex additive due to the unique property of the potassium ion. Potassium ion is not hydrated and, therefore, has a minimum size in an aqueous medium. This allows it to penetrate into the interplane space of clays, preventing their hydration and swelling.

The inhibited thermally stabilized complex additive "CAIR-T" can be treated with various types of drilling fluids, including clay ones.

A comparative analysis of the technical solution with the prototype shows that a significant difference between the claimed invention is an increase in the inhibitory effect in the zone of moderate (+61 °C to +100 °C) and elevated (+101 °C and more) temperatures, which affects the parameters of the solution - a decrease in viscosity (due to a decrease in the swelling of clay particles) and static shear stress in one and ten minutes.

When viewing other technical solutions known in this field, the proposed set of essential features that allows achieving a technical result is not found.

Preparation procedures for the inhibitory thermostabilized additive CAIR-T.

The implementation of the method is shown by the example of processing clay drilling fluid in field conditions. First, a complex inhibitory thermostabilized additive "CAIR-T" is prepared. To

do this, pour 2 - 2.5 m³ of seawater into a 4 m³ clay mixer, load 120 kg - 160 kg of chrome powder and mix for 15-20 minutes, add 400 kg - 500 kg of Portland cement - mix for 1-2 hours, then add 160 kg - 200 kg of caustic soda - mix for 20-30 minutes, add 400 kg - 600 kg of lignosulfonate and 40 liters - 80 liters of HT-48. After that, with continuous stirring, 400 kg - 600 kg of potassium chloride is loaded, mixed for 1-2 hours [3,10]. Sea water is added to the clay mixer to the full level. All this is mixed for 1-1.5 hours. After preparation, the complex inhibitory thermostabilized additive "CAIR-T" is released into a circulating clay drilling fluid for one cycle. Injected into clay drilling fluid in an amount of 8% - 15% by volume of the solution. The cooking time is 3-4 hours.

The effectiveness of the complex inhibitory thermostabilized additive "CAIR-T" has been proven by laboratory studies at room temperature (+24 °C) and under thermostatic conditions (+80 °C and +105 °C).

Inhibited system "CAIR-T" (calcium - potassium aluminate inhibited solution) this is a multilateral inhibited system, its application ensures a reduction in the consumption of chemicals and materials, increases the stability of the wall of the borehole zone of the borehole and increases the relief of the hole, bringing it closer to the nominal diameter [4, 8, 9].

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