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## **THE INFLUENCE OF SURFACE-ACTIVE SUBSTANCES ON THE LUBRICATING PROPERTIES OF DRILLING MUD**

Lubricating additives are added to drilling mud to improve their lubricating properties. The importance of using lubricating additives lies in the reduction of friction due to the adsorption layer on the surface of the phase interface. The use of lubricating additives helps to increase the penetration of the bit and the mechanical speed of drilling. Lubricating additives also reduce friction between drill pipes and well walls. Drilling mud treated with surface-active substances (surfactants) are also known to have lubricating properties. [1].

The results of industrial tests of a number of well-known products during the construction of wells showed that in most cases they are maximally effective only in systems of drilling flushing fluids of a certain component composition and depend on specific geological and technical conditions, that is, they are not universal. Surface-active components in the composition of lubricating additives affect their polarization and structure, improve the adsorption-insulating effect, etc [2].

The presence of multifunctional properties of surface-active lubricating additives, in addition to reducing the coefficient of friction, can be evidenced by ease of dispersion in drilling mud, compatibility with chemical reagents - ingredients of drilling muds, the ability to limit the hydration of clay minerals being drilled, emulsifying, anti-corrosion properties, resistance to the aggressive effects of salts polyvalent metals [3].

This work shows the results of research and determination of the optimal concentrations of surface-active substances (surfactants) and surface-active reagents - defoamers added to the drilling mud with a lubricating additive. Surface-active substances are widely used in drilling mud on fresh and salt water, and in solutions with a chloride-potassium and chloride-sodium basis, in gypsum and lime systems for drilling rocks composed of clay shale at various stages of lithogenesis. To prevent particles of clay mud from sticking to the drilling tool, bit and elements of the elements of the drill pipe column, and to each other. Separate types of surfactants prevent the formation of oil seals, contribute to an increase in the mechanical speed of drilling, and improve the lubricating properties of the drilling mud. Surface-active substances are economical, environmentally safe and effective in small concentrations, even a small percent of additives improves the anti-sealing and lubricating properties of the drilling mud and does not lead to mud dispersion.

Defoamers are surfactants. They consist of two components - the surfactant itself and an organic carrier with high mobility and in which the surfactant is dissolved. The basic principle of the foam extinguishing mechanism is that the surfactant has a high adsorption capacity. The phase separation boundary at which the defoamer is adsorbed is the surface of the bubble forming the foam and the surface of the colloidal particle. The defoamer displaces the foaming agent. If the foam is on the surface, it itself quickly collapses; if it is inside the liquid, only the largest bubbles are able to float away, overcoming the strength of the structure. But with stirring, the bubbles meet in depth and the weak surface film, from which the surfactant has displaced the foaming agent, cannot resist the coalescence of the bubbles. They grow in size, float and burst. The foamed solution has high values of structural and mechanical characteristics. Pump performance deteriorates.

According to the results of preliminary studies, certain concentrations of natural oils were selected as the main component of the lubricant additive, even in small quantities

(already 0.5%) they significantly improve the lubricating properties of the solution and the friction coefficient of the cake thickness (CTC). The lubricating properties of castor, hemp, rapeseed, soybean, mustard, sunflower and corn oils were studied. Separately, each type of oil in concentrations of 0.5%, 1% and 3% was added to samples of fresh, mineralized and salt-saturated solutions.

Analyzing the results of the tests, it was established that, in terms of technological efficiency and price policy, the most acceptable for our conditions are the lubricating additive of sunflower and rapeseed oils. Given that sunflower oil additives showed satisfactory test results only for fresh and mineralized solutions, rapeseed oil was chosen for further research. During the processing of drilling mud, depending on their composition and initial characteristics, the concentration of the additive can be optimal from 1% to 3%.

Further research is aimed at determining the most acceptable concentration of surfactants and a defoaming agent, which, together with the selected concentration of rapeseed oil, were added to samples of fresh, mineralized and salt-saturated solutions and their effect on the lubricating properties of the solution and the coefficient of friction of the cake thickness (CTC). After analyzing the main types of these reagents, they selected the surfactants-1 reagent and the «PENTOSIL plus» defoamer reagent. Surface-active substances were added to the samples in concentrations of 0.1%, 0.25% and 0.5%.

The results of the tests showed that the most acceptable concentration of surfactant and reagent - defoamer - 0.25% each, and the lubricating additive in the form of rapeseed oil - 1 or 3% when added to a fresh solution, 3% - to mineralized and 1% - to salt-saturated solutions. Additions of 1% of rapeseed oil and 0.25% of surfactant and defoamer reagent improve the lubricating properties, which decrease from 0.065 to 0.035, the coefficient of friction of the cake thickness does not change and is 0.07, filtration decreases from 15 to 14 cm<sup>3</sup> in 30 min, and the viscosity decreases from 60 to 46 s for fresh solution. For a fresh solution, the addition of 3% rapeseed oil and 0.25% surfactant and defoamer reagent also improve the lubricating properties, which decrease from 0.061 to 0.030, the coefficient of friction of the cake thickness decreases from 0.09 to 0.06, filtration does not change, and in viscosity decreases from 66 to 34 s. Additions of 3% rapeseed oil and 0.25% each of surfactant and reagent - defoamer to the mineralized solution do not change the lubricating properties of the mineralized solution. The lubrication coefficient is 0.054, the coefficient of friction of the cake thickness is 0.18. Filtration does not change, and the viscosity decreases slightly. For a salt-saturated solution, the most acceptable results were obtained with the addition of 1% rapeseed oil and 0.25% each of surfactant and defoamer reagent. While the lubrication factor changed from 0.056 to 0.082, the coefficient of friction of the cake thickness decreased from 0.23 to 0.18. Therefore, given concentrations of surfactant, defoamer and rapeseed oil have the best influence on the lubricating properties of fresh and mineralized drilling mud.

### **References**

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