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MODERN STATE OF LUBRICANTS FOR DRILLING OIL AND GAS WELLS

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Abstract

The article presents the modern state of lubricants for drilling oil and gas wells. Purpose of using lubricants and main physical chemical and technological properties of lubricants are given. Types and advantages of using lubricants in oil and gas well drilling are given too.

Keyword: *Lubricant, drilling, fluid, property, friction*

Introduction

Lubricating agents for drilling fluids are special additives such as fatty acids, polyglycols, resin substances and petroleum oils that reduce friction between the drilling tool and the borehole walls, as well as between the tool itself and the rock, which prevents sticking, increases the drilling speed and service life of the equipment (Kobilov et al., 2020). Examples of such reagents include additives “BURLAK”, ECOLUBE, “Lubrex”, BURMUD, StabVisco-LDF and Silange. Lubricating additive for drilling fluids Lubriminol is used to reduce the friction coefficient of drilling fluids, increase the mechanical drilling speed and reduce the risk of sticking. The product is used for all types of water-based drilling fluids. Additionally, it performs the function of inhibiting clays and shales. During drilling, there is strong friction of the tool against the borehole walls and high torques. To reduce them, lubricating additives for drilling fluids are used. They have increased surface-active properties and therefore increase the efficiency of drilling operations and improve wear resistance and lubricating properties of solutions. Polymer lubricating additives for drilling fluids increase the rate of penetration and reduce abrasive wear, i.e. increase the service life of drilling equipment and pumping equipment. Drilling lubricant type MBR is developed by us and implemented in oil and gas well drilling.

Materials and methods

Drilling fluid testing procedures and other documents related to oilfield standards are

published by the American Petroleum Institute (API) (Kobilov, 2024). The composition of the lubricant for drilling fluids. Ecolube includes petroleum oils, additives, as well as modified resin and fatty acids. This lubricant:

- reduces friction;
- increases the rate of penetration;
- protects drilling rods and tools from rust and breakage;
- increases the potential of the equipment and extends its service life.

Lubricant additive for drilling fluid stabvisco-ldf StabVisco-LDF is designed to ensure highly efficient drilling in difficult geological and technical conditions. It is intended for the treatment of water- and hydrocarbon-based drilling fluids in order to reduce downhole friction forces, as well as to reduce and prevent sticking situations when drilling vertical and directional wells in difficult geological and technical conditions.

StabVisco-LDF is an effective lubricating additive for use in drilling

Lubriminol lubricating additive is a solution of fatty acid derivatives with surfactants in a solvent.

Application

- Drilling vertical, directional and horizontal wells, including slide drilling;
- Preparation of drilling fluid packs with an increased concentration of lubricating additive for running casing strings.

Table 1. *Main physical and chemical properties*

Appearance at 20 °C	*Viscous liquid from dark brown to black*
Density at 20 °C, g/cm³, within	*–0.8 – 1.00*
Freezing point, °C, not higher than	*Minus 8*
Mass fraction of organochlorine compounds (OCC), mcg/g (ppm), not more than	*Absence*

Properties and advantages of use lubricants.

- The components of the lubricating additive are adsorbed on metal surfaces and on the walls of the well, creating a lubricating cushion along which the drilling tool or casing string slides freely;
- The Lubriminol additive is dispersed throughout the entire volume of the solution and does not migrate to the dome zone of the horizontal wellbore, thus preventing the creation of conditions for sticking;
- The lubricant additive does not separate into phases and does not accumulate at the wellhead during shutdowns, quickly and effectively reduces torque and torque amplitude fluctuations, improves tool movement and reduces hook weight, facilitates applying the load to the bit and facilitates slide drilling, increases the mechanical and commercial drilling speed, can be used to prepare concentrated packs before lowering the casing, does not foam or salt out and is thermally stable and is environmentally safe.

Table 2. *Technological properties of the lubricant*

Reduction in the coefficient of friction of a 1% aqueous solution of a lubricating additive on a friction machine, %	*> 90*
Coefficient of friction of a clay cake on FSK-4E on KTK-2, rel. units	*< 0.1*
Foaming activity of 1% aqueous solution of lubricant additive, cm³	*< 5*
Foaming activity of 0.5% solution of lubricant additive in clay solution, %	*< 0.2*
Relative decrease in friction coefficient after thermal aging (16 hours at 150 °C), %, not less than	*> 90*

(48 hours at minus 40 °C), %, not less than	*> 90*
*Relative decrease in friction coefficient after exposure to negative temperatures Salt resistance***	*Formation of uniform emulsion*

** Tested in an accredited laboratory.*

*** Brine containing CaCl2–36.44 g/l, KCl – 40.64 g/l, NaCl- 201.75 g/l. Density 1.17 g/cm³, pH = 5–6.*

Results and Discussion

The reagent is recommended to be introduced either into the circulating drilling fluid through a hydraulic funnel, or directly into a container with the solution, or into a trough. Depending on the composition and type of the solution, as well as on the geometry of the well, the consumption of the lubricating additive Lubriminol is from 10 to 30 kg per 1 m³ of finished drilling fluid. If necessary, the concentration can be increased to 50 kg per 1 m³.

Table 3. *StabVisco-LDF is an effective lubricating additive for use in drilling fluids under difficult geological and technical conditions.*

Appearance at 20 °C:	*dark brown liquid.*
Density at 20 °C, kg/m³:	*870-920*
Pour point, °C, not higer than:	*–15*
Kinematic viscosity at 50 °C, mm/s:	*15-70*
Acid number, mg KOH/g:	*25-55*

Storage: in a well-ventilated, dry room. The use of open fire is prohibited in storage areas. Lubricant additive for drilling fluid SMEG

Liquid lubricating additives SMEG are compositions of vegetable and mineral oils modified with various additives. They are intended for use as additives in drilling process fluids in a wide range of clay phase content, weighting agents and mineralization. Lubricating additives SMEG provide effective reduction of the friction coefficient and do not have a negative effect on the properties of drilling fluids. The series of lubricating additives SMEG is represented by the following brands, differing in composition, properties and area of application: – SMEG-3 is intended for low-clay, weighted drilling fluids and solutions with a low degree of mineralization. – SMEG-5 is intended for low-clay, mineralized and weighted drilling fluids with a low freezing point.

Application of the lubricant. SMEG

SMEG lubricant additives provide an effective reduction in the friction coefficient over a wide temperature range. Adding 0.5% SMEG lubricant additive to the drilling fluid reduces the friction coefficient by at least 50%.

Processing

For optimal results, SMEG is added to the drilling fluid directly in the cycle. The consumption of the lubricant additive to achieve the desired effect is 0.5–2%. The SMEG reagent is compatible with all drilling fluid formulations.

When drilling wells, high friction forces of the tool against the borehole walls and high torques occur. To reduce them, special additives for drilling fluids are used. They have improved surface-active and anti-stick properties.

Additives for drilling fluids are divided into two types depending on the purpose and process parameters:

- electrolytes;
- protective, containing high-molecular substances.

The use of polymer additives for drilling fluids from various manufacturers allows you to increase the rate of penetration, as well as the service life of pumping equipment and drilling equipment due to reduced abrasive wear.

When working with aerated compositions, individual additives increase foaming. This reduces unproductive losses of drilling fluid when it is absorbed in faults between rock layers. The products are your benefits.

- Prompt deliveries of a full range of reagents and additives: production downtime due to the lack of necessary components is eliminated;
- Chemistry from the best manufacturer in Russia, the quality of chemical raw materials will ensure the efficiency of oil and gas production and processing.

Assortment expansion: we monitor the development of the industry and promptly offer raw materials for the implementation of the latest technologies. Lubricating additive for drilling fluids RC–LUBE

- lubricant additive for drilling fluid RC-lube;
- general description;
- RC–Lube reagent is a lubricating additive for drilling fluids, does not have a negative effect on the rheology of the drilling fluid or has a minimal effect.
- Main advantages;
- reduces friction between drill rods and the wellbore wall;
- has a beneficial effect on the parameters of solutions: viscosity, static shear stress, filterability;
- easily dispersed even in cold water;
- does not create problems during disposal, biodegradable, harmless to the environment;
- can be used in land and sea drilling conditions;
- compatible with all drilling fluid additives.
- Application information
- Recommended for water-based drilling fluids at a dosage of 0.5–1%. Added directly to the drilling fluid system.

Characteristics	
Appearance:	*dark liquid*
pH of 1% solution	*8-11*
Density at 20°C, kg/m³:	*900-950*

Conclusion

Main physical chemical and tribological properties of lubricants are given, as appearance, acidity, viscosity, density, salt resistance, foaming property and coefficient friction.

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