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Study on Comparison and Evaluation of Oil-Based Sand Made of Used/Heated Eating Oil for Digging Processes

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Abstract

Oil-based mud is made from used, heated edible oil that is obtained from a variety of places, including fast food establishments and restaurants. The oil should be collected, then it should be tested for yield point, gel strength, mud density, and filtering loss qualities. The result obtained will show whether the oil used will exhibit similar properties to that of OBM and be used more efficiently by reducing the cost for the drilling fluid.

Drillers and industrial operators have long desired the ability to drill a useable hole with little harm to the environment and with little financial impact. The drilling fluid, frequently referred to as "the blood of the drilling process," is one important part of the drilling process for oil wells. Numerous crucial functions are performed by the drilling fluid. These functions include moving drill cuttings from the bottom of the hole to the surface, lubricating and cooling the drilling bit to reduce wear, sealing off permeable formations by forming an impermeable, thin mud cake at the borehole wall to create a buoyancy force to partially support the weight of the drill string and casing string, and minimizing formation damage of different horizons penetrated.

Keywords: Oil-Based Sand, physiochemical properties, OBM

Introduction

Long-held aspirations of drillers and business owners have been to create a useful hole with little harm to the environment and with little financial burden. Drilling fluid, frequently referred to as "the lifeblood of the drilling process," is one important part of the drilling process for oil wells. The "architect" is what determines if a drilling operation will be possible or not. The fluid serves a variety of essential functions, which explains this. These functions include, but are not limited to, transporting drill cuttings from the bottom of the hole to the surface, lubricating and cooling the drill bit to reduce wear, sealing off permeable formations by forming an impermeable, relatively thin mud cake at the borehole wall, holding drill cuttings in suspension when circulation is interrupted, and producing a buoyancy force to support some of the weight of the drill cuttings.

Objective

The main goal of using soybean oil in OBM is to offer an environmentally benign substitute for traditional mineral oil-based drilling fluids, which can be detrimental to both the environment and human health.

Using soybean oil as an OBM also aims to achieve the following

i). **Lubrication:** Soybean oil's superior lubricating qualities assist minimize heat and friction during drilling operations. This characteristic lessens the chance that the wellbore will sustain damage and increases the lifespan of the drilling machinery.

ii). The capacity to tolerate high temperatures and resist deterioration over time is a result of soybean oil's exceptional thermal and oxidative stability. During the drilling operation, this stability aids in maintaining the characteristics of the drilling fluid.

iii). Biodegradability: Because soybean oil degrades naturally in the environment without harming ecosystems, it is considered to be biodegradable. This characteristic makes it a more environmentally friendly drilling fluid than mineral oil-based ones.

Literature Review

Rheological characteristics, yield point, gel strength, filtration characteristics, fluid loss, and mud density are all being studied because of their relation to the total drilling mud performance.

The drilling of wells in the oil and gas sector frequently makes use of oil-based muds (OBMs). A continuous oil phase, a solid phase, and numerous additives make up OBMs. Over the usage of water-based muds, OBMs offer benefits such enhanced borehole stability, better lubrication, and higher penetration rates. We will examine some of the most current OBM investigations in this literature review.

Oil-based muds (OBMs) are frequently employed in the oil and gas drilling sector to manage wellbore pressure, cool the

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drill string, and lubricate the drill bit. Due to their potential for cost savings and environmental friendliness, edible oils have been looked at as a possible replacement for conventional mineral oil-based muds. In this review of the literature, we will look at the studies done on the usage of edible oils as OBMs.

Resources

Preparation of Samples: The establishments on the surrounding streets of Peddapuram are where the used cooking oil is gathered. This used oil will contain wastes, which will lead to a high level of pollutants.

So, we need to sanitize. We suggest the filtration method for that, which enables us to distinguish between the oil and trash or pollutants. Following that, the gasoline needed to create mud must be collected, and the oil must be maintained in a container.

Characteristics of Oil-Based Fluids: Physical and Chemical: The basic fluids employed in the formulation of the OBM were studied for their physiochemical properties. These variables can be utilized to forecast an early description of mud behavior and composition.

a) The weight of base fluid is indicated by the specific gravity. This will show how densely the muck has formed.
b) The pour point, or lowest temperature at which the base fluid will flow, is shown in
c) The flash point displays the temperature at which a liquid starts to ignite.
d) **Kinematic viscosity:** This metric illustrates how resistant a base fluid is to flowing when gravity is at play.
e) At this temperature, dissolved solids are no longer entirely soluble and begin to precipitate as a second phase, giving the fluid a hazy appearance.

Stability of Chemicals in Diesel and Soybean Oil

Understanding both the physiochemical properties of soybean oil as well as its chemical stability at wellbore conditions (high temperature) is crucial for its usage as the base fluid in OBM formulation. If a chemical is not particularly reactive in the environment or during chemical processes, it is referred to as being "stable". In particular, the usefulness survives in air, moisture, or heat as well as in the conditions of the planned application. The indicator of a substance's longevity in the environment, the biodegradability in this direction serves as the yardstick for judging how environmentally friendly a substance is.

Regarding the biodegradability of soybean oil and other vegetable oils in comparison to diesel oil, research publications are unanimous in their conclusions. For example, Howell, Erhan, and Perez all agree that soybean oil and other vegetable oils are environmentally friendly, renewable, and biodegradable. From the standpoint of chemical stability, Table 2 displays some of the benefits of soybean oil as a workable replacement for the use of diesel oil in OBM formulation.

Estimation of Mud Residuals

Estimations of the Rheological Properties

To ascertain the rheological characteristics of the mud samples, the Fann V-G viscometer was employed. The equipment was turned on and given time to stabilize before being tested for reliability using the viscosity of distilled water. Mud sample was added to the viscometer's cup, which was then set on the viscometer stand. The platform was set in place and adjusted as the rotor sleeve was precisely submerged to the fill line in the muck. The power was turned on after setting the speed selector knob to 600 revolutions per minute.

The dial reading for 600 RPM was noted when it reached a stable state. For rpms of 300, 200, 100, 6, and 3, the method described above was repeated. The readings' rheogram (shear stress-shear rate profile) is shown in the figure below. Since the viscometer (Fann V-G) dial readings for the mud samples were reported in Table 4, the apparent viscosity (AV), plastic viscosity (PV), and yield point (YP) of the mud samples were computed using a two data point technique. where AV stands for apparent viscosity, PV for plastic viscosity, 600 represents a dial reading at 600 revolutions per minute, 300 represents a dial reading at 300 revolutions per minute, and YP represents the yield point.

Using a Fann V-G viscometer, the rheological properties of the mud samples were determined. The apparatus's integrity was checked after being turned on and allowed some time to stabilize by determining the viscosity of distilled water.

Discussion of Results

Rheological Characteristics

The fundamental reason for choosing to base the comparison on these properties of the two oils' rheological, plastic viscosity, yield point, gel strength, filtration, fluid loss, and filter cake is their significance. A mud's ability to raise cuttings from the annulus is gauged by its yield point (YP). Cuttings will be carried more successfully by a fluid with a high YP because it is not Newtonian and has a higher YP than a fluid with a lower YP but similar density. Note that excessive YP results in large pressure losses when the drilling mud is cycled. From the dial readings and viscometer speeds, respectively, shear rate and shear stress were computed.

The Fann V-G viscometer was used to assess the gel strength of the mud samples. After stirring the mud sample for ten seconds at 3 rpm using the speed selector knob, the power was abruptly cut off. After 10 seconds and 10 minutes, respectively, of the sleeve not rotating, the power was turned on at 3 rpm. The mud samples' gel strength at 10 seconds and 10 minutes was recorded for each occasion using the highest dial.

Based on the findings, Figure 1 displays the shear stress-shear rate curve (rheogram) for the formed mud. In this figure, the rheological models of the two mud samples are displayed. According to the image, the rheology of both mud samples is comparable. As a result, it is possible that the rheological behavior of the soil samples is similar. It is evident that the two created OBMs exhibit a rheological model that is essentially equivalent to the Bingham plastic model in this regard. A Bingham plastic fluid won't flow until the shear stress surpasses a particular minimum value known as the yield point, or YP. The plastic constant serves as the constant of proportionality, and changes in shear rate after the yield point (YP) are proportionate to changes in shear stress.

Mud Density

Since the pressure on the wellbore is affected by the mud density, well stability, wellbore collapse, and other drilling issues can be affected. This makes the mud density an essential parameter to monitor throughout drilling operations. Adding weighing agents, like barite, to raise the density or lighter weight elements, like calcium carbonate, to decrease the density is the usual method of adjusting the density of the mud. The precise formulation and the drilling circumstances can have an impact on the mud density of an oil-based mud. An OBM's mud density typically falls between 8.5 and 20 ppg (1.02 and 2.4 kg/L).

Filtration Loss

The most important drilling fluid property is typically its rate of filtration, especially when drilling permeable strata where the hydrostatic pressure is greater than the building force. In some circumstances, filtering helps the stability of the borehole and can help prevent or lessen wall adhering and drag. The amount of filtrate that was recovered from the formed OBMs after 30 minutes. The results demonstrate that the water volume from diesel mud (15 mL) was higher than the water volume from soybean mud (13 mL). This could be explained by the idea that just a portion of the water was emulsified with the diesel sludge, resulting in an unstable emulsion. However, 12 mL and 10 mL of oil, respectively, were extracted from the two samples. similar to soybean mud and gasoline. Figure also displays the estimated filtrate loss volumes for time intervals of 1.0, 5.0, 7.5, 10.0, 15.0, and 30.0 minutes. The figure shows that the filter loss values grew over time because the diesel OBM has a higher capacity for filter loss than the soybean OBM. Figure shows the filtrate volumes against the square root of the time in minutes. The reduction in the OBMs' spurt was measured by taking this action. As a result, the spurt loss measurements for the two mud samples were identical and had a spurt loss volume of roughly 0.01 mL.

Comparison Methods

Comparing Edible (Soybean) Oil Mud to Other Oil Base Fluids

Soybean oil mud has a number of benefits over conventional oil-based drilling fluids. First of all, because it is non-toxic and biodegradable, it is more environmentally friendly. This indicates that it is easier to dispose of and has a smaller negative environmental impact. Second, soybean oil mud is a renewable resource, allowing for sustainable production without using up precious resources. Third, the superior lubricating qualities of soybean oil mud can aid to lower friction during drilling and guard against damage to the drilling machinery. Because soybean oil mud is less expensive than other oil-based drilling fluids, it may be possible to lower the cost of drilling.

Particularly in locations where the ecology is a concern, soybean oil mud provides a practical substitute for conventional oil-based drilling fluids. For businesses aiming to lessen their drilling expenses and environmental effect, it is a desirable alternative because to its benefits in both those areas. However, while choosing a drilling fluid for a certain well, it should be taken into account that it has limitations in high-temperature conditions and is viscous.

There have been few, if any, direct comparisons in the literature between the rheological properties of soybean oil and those of other vegetable oils as the primary fluid in oil-based drilling mud.

Conclusion

The effectiveness of drilling fluid during drilling operations is known to be influenced by a number of variables, including mud viscosity, density, pH, and filtration loss, among others. In this investigation's oil-based mud (OBM), soybean oil served as the primary fluid. We looked at the properties of formulations made with soybean and diesel OBM. Even though the formulated soybean OBM has significantly more potential as an oil-based drilling mud than diesel OBM, the study's findings allow for the following conclusions to be drawn.

For effective hole cleaning, the soybean OBM formulation's low yield point, low gel strength, and optimum mud qualities for turbulent flow at low pump pressure. A Bingham plastic rheological model is also included.

Using densifiers, the density of the soybean OBM can be raised to appropriate levels during equivalent circulating density (ECD) predictions in order to have a successful drilling operation.

The filtering loss property of the soybean OBM contrasted favorably with the properties of the thin and soft filter cake sought during drilling operations.

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