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THE EFFECT OF UTILIZATION OF AMBON BANANA PEEL POWDER ON PLASTIC VISCOSITY, YIELD POINT AND GELL STRENGHT OF FRESHWATER DRILLING MUD AT VARIOUS TEMPERATURES

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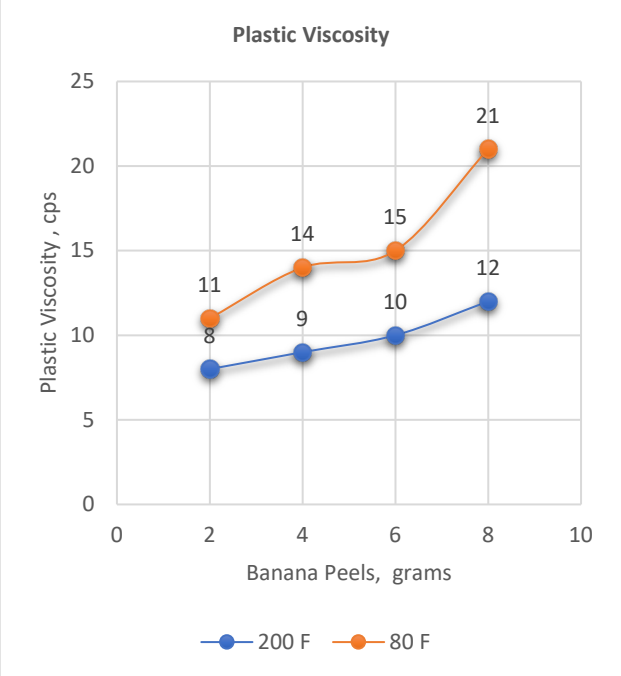

Abstract

Drilling is part of exploration activities, where this activity aims to prove whether the zone exists or not. In the drilling process, drilling mud is needed to expedite the process, and the content contained in the drilling fluid consists of various additives. In this study, the ambon banana peel powder additive was tested to utilize household waste and minimize environmental impacts due to additives from raw materials. The use of banana peel powder in this study started with concentrations of 2 grams, 4 grams, 6 grams, and 8 grams, and seeing the concentration with the most optimal ability. Banana peel powder was used as a substitute for polymer in the mud system, which aims to maintain the rheology of the mud. Drilling, in this study, the parameter that is seen is the Plastic Viscosity, Yield Point and Gell Strength, where there is a change in the Plastic Viscosity, Yield Point and Gell Strength value from each addition of the concentration of Ambon banana peel powder. Temperature is also used to compare and see the effect of mud viscosity on temperature changes, the temperature used in this study is room temperature, which is 80°F, and the temperature at the roller oven is 200°F, where each temperature has a different value.

Keywords: Drilling Fluid, Plastic Viscosity, Yield Point, Gell Strenght Temperature, Ambon Banana Peel Powder

1.0 INTRODUCTION

Waste materials are the unwanted or useless substances which are disposed of after essential use. Waste material is an inevitable result of human actions.[1] The waste material can be in the form of waste or liquid waste. Examples of liquid waste that can be found are Lucian wastewater from households or liquid waste from companies. Solid waste has examples in the form of food waste, furniture, used tires, plastic bottles, etc.[1], [2]. Based on the type of waste, there is also a lot of waste that has been managed properly every day. But there are also those who have not used it or managed it properly so that it can damage the natural surroundings. The starting points of waste are ample and can be delivered from assorted sources; they include waste made from nourishment, family households, risky waste, build trash, radioactive waste, wastewater, and various others as typified underneath.[3] The unappetizing pieces of the nourishment or any piece of the nourishment that is generally disposed of by individuals can be considered as food waste. For example, green and yellow lemon peels, date seeds, green and

black olive pits, watermelon peels, potato peels, grass, hemp, mandarin peels, pomegranate peels, date seeds, sunflower shells, avocado peels, orange peels, and so forth. [4]–[9]Waste materials are causing regular issues in present-day society as they can rise numerous unwanted impacts, which can impact the earth and the wellbeing of the general population. To minimize these troubles, it is essential to advance substitutional goals to break these dilemmas. These waste materials can be used in the oil business by exploiting them for various targets instead of tossing the troublesome waste. For example, unappetizing food waste can be used for different uses, for example, adjusting the drilling fluid properties[4]–[9]

Drilling Mud is a fluid used in drilling operations to assist the drilling process. The composition and physical properties of the mud greatly affect drilling operation. These are the success factor of the drilling process. Drilling speed, efficiency, safety, and drilling cost are highly depending on the fluid used. [10]–[13]

The composition and physical properties of the drilling mud are very influential during the drilling process, casing planning, drilling rate and completion can be affected by the mud used at that time. There are four physical properties of drilling mud, namely density (specific gravity), viscosity, gel strength, and sieve rate. Therefore, it can be said that the geological characteristics of an area are also influential in determining the type of mud that must be used.[14]–[16]

Mud rheology can be interpreted as a study of the flow of material in liquid conditions, rheology is used to find out about changes in the shape and flow of a type of fluid which can be related to shear stress, in rheology mud usually consists of plastic viscosity (PV) defined as flow resistance due to interaction mechanical properties of the solids in the sludge system and controlled by dilution or mechanical devices such as centrifuge, apparent viscosity (AP), and yield point (YP) are defined as the electrochemical force between molecules in a static state and gels strength is the attractive force between molecules in a static state, unit (lbs/100sq.ft)[15], [16]

Based on the Environmental Protection Agencies (EPA), the drilling process produces the second largest volume of waste to the environment. [17]The selection of drilling mud additives can have an impact on environmental pollution. With the development of science, innovations have been made in the field of drilling mud using environmentally friendly natural materials. The advantage of using natural materials besides utilizing household waste is that they can prevent pollution during the drilling process, besides that they are also easy to obtain in the surrounding environment. The material used in the drilling mud is Banana Peel Powder and the content contained in the banana peel is based on research [18] such as Phosphorus, Magnesium, Sodium, Iron, Calcium, Copper, Potassium, Manganese, Zinc. [6], [19]–[21] Meanwhile, the content of organic compounds found in unripe banana peels (% dry weight) are 37.52% hemicellulose, 12.06% cellulose, and 7.04% lignin. Based on these contents, banana peel powder can be categorized as a polymer type of cellulose. This study used concentrations of 2 gr, 4 gr, 6 gr, and 8 gr tested at a temperature of 200 ^{o}F, so it can be seen whether there is a significant impact on the addition of these concentrations on the value of plastic viscosity, yield point and gel strength of drilling mud. [6], [19], [20]

2.0 METHODOLOGY

The research design conducted was experimental.

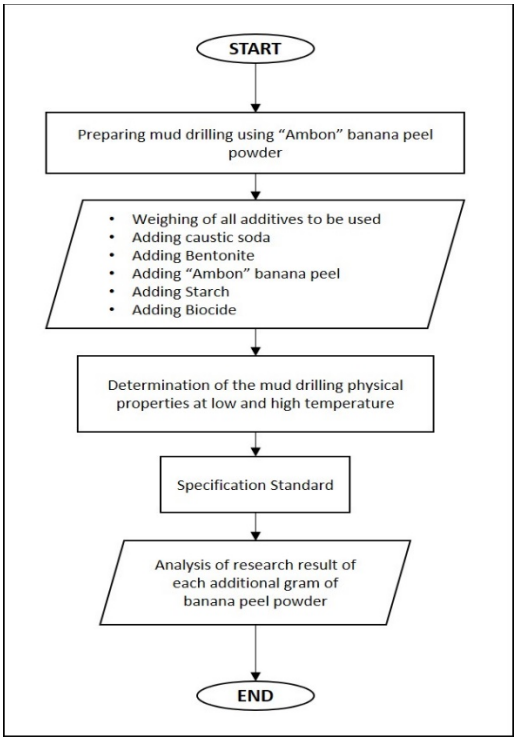

Figure 1 Research Flowchart on Banana Peel Powder Against Mud Rheology

Based on Figure 1, this research is testing Ambon banana peel powder against drilling mud and it can be seen what the effects of adding each gram of banana peel powder are to the plastic yield point which is affected by temperature. The process of using an Ambon banana peel is the peel must be dehydrated and then turn it into a powder before it can be used, and these are the following steps:

1. Prepare ripe banana peels that have been separated from the fruit, ensuring that the banana peels are still fresh.
2. Once you have collected the banana peels, proceed to cut them into small pieces to expedite the drying process.
3. After cutting the banana peels into small pieces, place them in an oven at a temperature of 80 degrees Celsius or (175°F) for one hour.
4. The banana peels will appear wilted after being in the oven and should be sun-dried for 14 days until completely dry to eliminate any bacteria present in the peels.
5. Once the banana peels are thoroughly dried, place them in the oven for one more hour to ensure they are completely dry and ready to be ground into powder.
6. After approximately 1 hour of heating in the oven, proceed to finely grind the banana peel powder using a food processor.
7. The banana peel powder can now be used as an additive in drilling mud.

The analysis of the studies carried out in this research was to look at the ability of Ambon banana peel powder as a polymer material to maintain the value of the plastic yield viscosity and gel strength point, and see how the performance of the banana peel powder was.

The flow chart shows the flow of research carried out at the Drilling and Production Engineering Laboratory. The initial step is to prepare the water to be used, and then weigh all the additives to be used in accordance with the provisions, the additives used include Caustic Soda, Bentonite, Banana Peel Ambon, Starch, and Biocide, all the additives are mixed slowly with a predetermined time until all the additives are thoroughly mixed and nothing is lumpy, the sludge production starts from the concentration of banana peel powder 2 grams, 4 grams, 6 grams, and 8 grams.

After the sample is finished, it is then checked to see the quality of the drilling mud made, checking using laboratory tools such as the Fann vg meter. The test was carried out in two stages, namely testing at a temperature of 80 °F and a temperature of 200 °F. The selection of a temperature of 80 °F was carried out to determine the condition of the plastic viscosity, yield point and gel strength at room temperature. The selection of 200 °F is carried out by heating the mud sample using hot rolling for 16 hours. This is done to determine the condition of the plastic viscosity, yield point and gel strength if it is already at high temperatures in the drilling well. In testing the sample has a specification value that has been determined to see whether the banana peel powder can be used as an additive. Below is a table of the specifications required.

Table 1 Drilling Mud Specifications

No	Properties	Specs	Unit
1	PV	≤ 15	cps
2	YP	8-20	lb/100 sq.ft
3	Gel Strength	5-9/9-14	lb/100 sq.ft

3.0 RESULTS AND DISCUSSION

Plastic viscosity is a resistance to flow that is caused by friction between solid objects in the borehole, the value of plastic viscosity is very dependent on the solid materials or commonly referred to as solid content. The solid content that contain in drilling mud should not be more than or above 5%, because it will affect the performance of the drilling mud, one of which affects the cutting removal process, a special treatment process is needed on solid control equipment to reduce the solid content in the drilling mud. mud. The solid content in the mud also affects the viscosity of a drilling mud which can be seen in Figure 2 which shows the plastic results of the viscosity of the mud at the concentration of mud samples with the addition of 2 grams, 4 grams, 6 grams and 8 grams banana peel powder at temperatures of 80 °F and 200 °F.

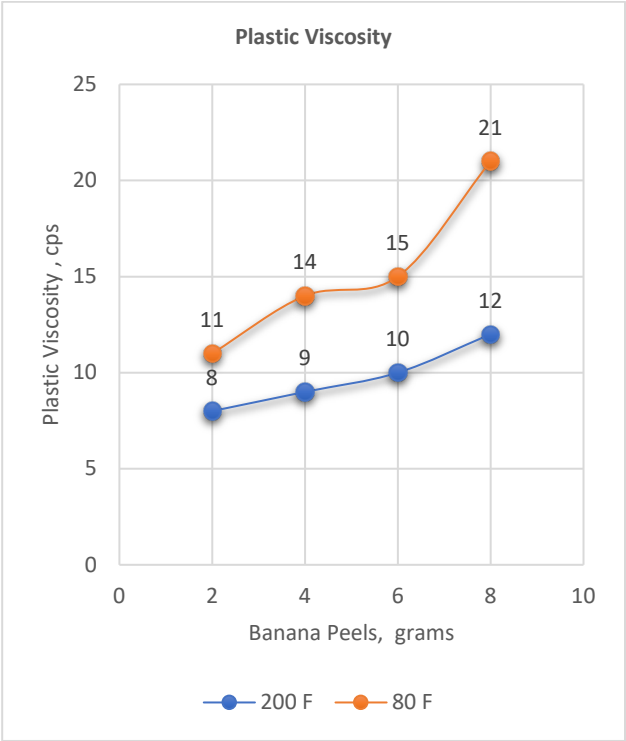

Figure 2 Measurement Result of Plastic Viscosity against temperature changes

The results of this study indicates that temperature has a major factor on resulting plastic viscosity of each drilling mud sample. As shown in Figure 2, as the temperature increases in a mud sample, the plastic viscosity value of the drilling mud decreases. This occurs because there is an expansion process in the mud sample with the same composition conditions in each mud sample but there are differences in temperature behavior, namely at temperatures of 80 °F and 200 °F.

In the first test, with the addition of 2 concentrations of banana peel powder at a temperature of 80 °F and 200 °F, the result was a plastic viscosity value of 11 cps for the mud sample at 80 °F and 8 cps for the mud sample at 200 °F. If seen from these results there was a decrease in yield in the two samples, this was due to the temperature change factor in the two samples so that the results in the 200 °F sample experienced an expansion.

In the results of the second test sample added a banana peel powder concentration of 4 grams, this sample showed an increase in results from the previous sample. Obtained plastic viscosity results in the 80 °F mud sample of 14 cps while in the 200 °F mud sample it was 9 cps. Even though there was an increase with the addition of concentration in the second sample, there was still a decrease in the resulting plastic viscosity in both of them. This is caused by changes in temperature in the two samples. The 200 °F sample experienced a decrease due to the expansion factor in the sludge when hot rolling was carried out, even though it has the same concentration, if there is a difference in temperature behavior in the sample, the results at higher temperatures will decrease. Even though it experienced a decrease in yield on the sample, the resulting value of the plastic viscosity was still within the specifications specified in Table 1.

In the results of the third test sample added a banana peel powder concentration of 6 grams, this sample showed an increase in results from the previous sample. Obtained plastic viscosity results in the 80 °F mud sample of 15 cps while in the 200 °F mud sample it was 10 cps. Even though there was an increase with the addition of concentration in the third sample, there was still a decrease in the resulting plastic viscosity in the second. This is due to the temperature change factor in the two samples. The 200 °F sample experienced a decrease due to the expansion factor in the sludge when hot rolling was carried out, even though it has the same concentration, if there is a difference in temperature behavior in the sample, the results with a higher temperature will decrease. Even though it experienced a decrease in yield on the sample, the resulting value of the plastic viscosity was still within the specifications specified in Table 1.

In the results of the fourth test sample added a banana peel powder concentration of 8 grams, this sample showed an increase in results from the previous sample. Obtained plastic viscosity results in the 80 °F mud sample of 21 cps while in the 200 °F mud sample it was 12 cps. Even though there was an increase with the addition of concentration in the fourth sample, there was still a decrease in the plastic viscosity results for the two samples. This is due to the temperature change factor in the two samples. Especially for the 80 °F mud sample, the results are above the specified specifications, so these results are not recommended. However, for the 200 °F mud sample, even though it has the same concentration as the 80 °F mud sample, there is a difference in behavior with respect to temperature so that the results for the 200 °F mud sample have smaller results than the 80 °F mud sample. So if you want to use an additional concentration of 8 grams, get it used if the sludge sample gets behavior at temperatures above 200 °F

The results of this study indicate that the value of the plastic viscosity will decrease if there is a higher temperature change behavior, this is due to the expansion factor in the sludge, so the results will decrease. Based on the results of adding each sample of banana peel powder from 2 grams, 4 grams, 6 grams and 8 grams experienced this increase due to the presence of cellulose content in the banana peel powder. Among natural polymers, cellulose stands out as a viable option for incorporation into drilling mud. When we focus on banana peels, particularly those derived from "Ambon" bananas, we find a composition consisting of 37.52% hemicellulose, 12.06% cellulose, and 7.04% lignin. If you look at the four samples that were carried out, the most recommended is the third sample with the addition of 6 grams because the results obtained are still within the specified specification range, while the 8 gram sample is not recommended for samples with a temperature of 80 °F, because it has a viscosity value that is too large . While in the process of making sludge the plastic viscosity value should not be too high, this will indicate that the soid content in the sludge is too much and will have an impact on the performance of the sludge to be used.

Yield point is the electro-chemical force of solids, liquids-solids chemicals that occur under dynamic conditions and is related to flow patterns, debris removal, pressure loss in the annular and contamination. In research conducted in the laboratory using a tool, namely the Fann VG Meter, in research to determine the amount of yield point value, 4 samples were tested at different temperatures, for samples to be tested starting from 2 grams, 4 grams, 6 grams , and 8 grams at each temperature of 80 °F and 200 °F, the values obtained must be appropriate or still within the specified specification range, apart from the temperature the yield point value is also influenced by the plastic viscosity value where to find the value of the yield point, the value from the dial reading Fann VG meter 300 minus the value of the plastic viscosity, the values are interconnected.

The following are the results of research conducted in the laboratory at various temperatures.

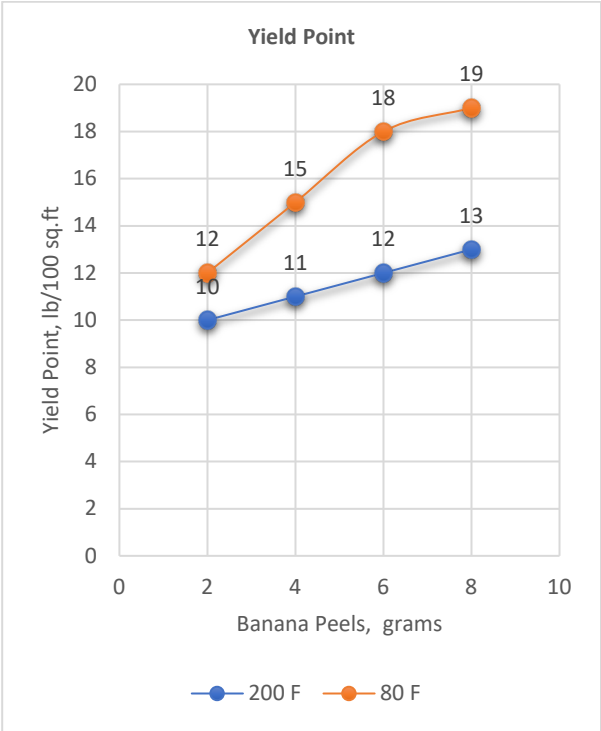

Figure 3 Yield Point Measurement Results for temperature changes

The value of yield and plastic viscosity is very important because in practice the function of the viscosity plastic is to mix the mud circulated into the drilled hole with the cuttings in the hole, while the function of the yield point is to lift the cuttings to the surface. The yield value is obtained from bentonite additives and also from banana peel powder (cellulose).

In the research that has been done, it was found that there is a decrease in the value of the yield point caused by temperature, the yield point value was determined in several experiments, namely in the experiment of banana peel powder 2 grams, 4 grams, 6 grams, and 8 grams at 80 °F and 200 °F, which causes the yield point to decrease because the sludge when heated will experience dilution so that the dial reading Vann FG Meter reads the sludge value to be greater, the yield point value is obtained from the plastic viscosity value minus the dial reading value of 300 Vann FG meter so that the greater the value of the dial reading is 300, the lower the value of the yield point, which can affect the removal of cuttings, the value of the previous yield point has been set or has a standard value.

In the mud sample with a concentration of 2 grams of banana peel powder, testing was carried out at 80 °F and 200 °F, the results were obtained, namely at 80 °F measurement of 12 lb/100 sq.ft and at 200 °F measurement of 10 lb/100 sq.ft the

value It was found that there was a decrease due to the temperature factor which resulted in the sludge becoming thinner and the value of the yield point getting smaller.

In the next sample, 4 grams of banana peel powder was tested in the laboratory with temperatures ranging between 80 °F and 200 °F, there was a decrease in the value of the yield point due to the temperature factor. The values obtained from each experiment were 15 lb/100 sq.ft and 11 lb/100 sq.ft, the values obtained were still in accordance with predetermined standard specifications.

In the next study, samples with a concentration of 6 grams of banana peel powder were tested using a temperature of 80 °F and 200 °F, at 80 °F a yield point value of 18 lb/100 sq.ft was obtained and for a temperature of 200 F a yield point value of 12 lb/100 sq.ft due to the temperature which makes the mud thinner so the dial reading gets bigger. When the value of the plastic viscosity is reduced by the dial reading value of 300 which is a relatively large value, a small yield point value will be obtained, for the value obtained both before and after heating are still included in the standard specifications that have been determined.

In the last sample of 8 grams, trials were carried out using temperatures of 80 °F and 200 °F, the values obtained from each experiment for 80 °F were 19 lb/100 sq.ft, and for experiments with a temperature of 200 °F a value of 13 lb/ 100 sq.ft, in the experiment of 8 grams of banana peel powder, the value for the yield point decreased due to the temperature factor, but for this experiment it was still included in the category of standard specifications that had been determined.

The agar power in the drilling mud is used when drilling in a static state, this value must be maintained in accordance and balanced so that when the drilling is continued there are no difficulties in pushing the drill cuttings that are stuck and high pressure is not needed for the circulation to run again. The tensile force in the mud is static or in a state of rest. Measurement of gel strength consists of two measurements of gel strength for 10 seconds and for 10 minutes. Below is a graph of gel strength at 10 seconds.

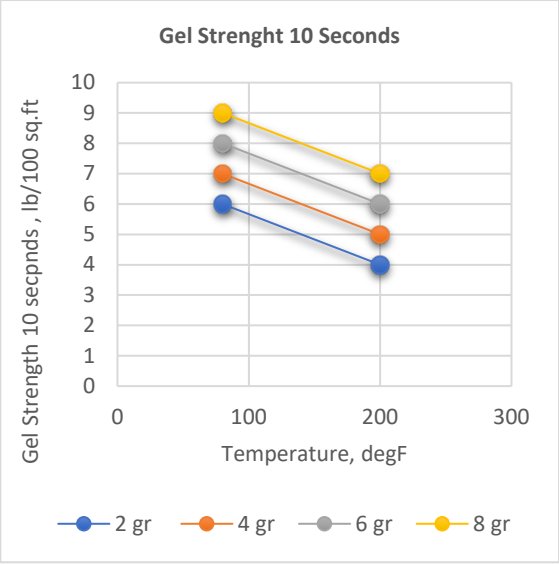

Figure 4 Gel strength 10 seconds Measurement Results to changes in temperature

Based on Figure 4, the results of measuring the gel strength of each concentration, it can be seen that each addition of banana peel powder concentration has an increase in the value of gel strength because each addition of banana peel powder concentration contains cellulose which can increase the value of gel strength. The gel strength value has decreased from the initial conditions due to the behavior of temperature changes, the higher the temperature, the sludge will experience expansion in the sample so that the power of the mud to bind the cuttings is reduced, as can be seen from Figure 3, the decrease can be seen due to temperature changes. seen in the initial measurement at the concentration of banana peel powder 2 g the value of the initial gel strength was (6 lb/100 sq.ft)/10 seconds whereas if it was affected by the temperature it decreased to (4 lb/100 sq.ft)/10 seconds, Likewise for the concentration of banana peel powder 4grams, which is initially (7 lb/100 sq.ft)/10 seconds to (5 lb/100 sq.ft)/10 seconds due to the temperature affecting it, while 6 grams is initially (8 lb/100 sq.ft)/10 s due to temperature becomes (6 lb/100 sq.ft)/10 s, and the last 8 grams the initial (9 lb/100 sq.ft)/10 s becomes (7 lb/100 sq.ft)/10 sec.

Below is Figure 5 which is a graph of the results of measuring the gel strength for 10 minutes with respect to temperature changes.

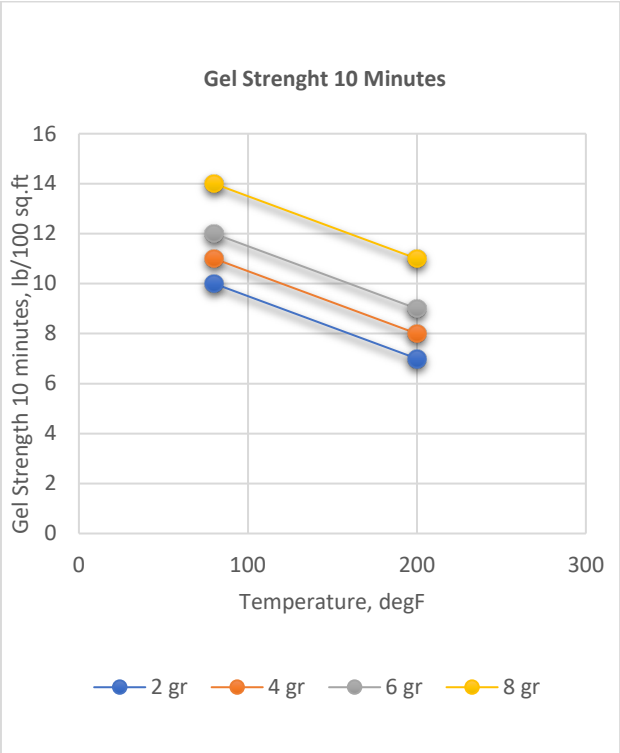

Figure 5 Measurement results Gel strength 10 minutes to changes in temperature

Based on Figure 5, the results of the study obtained the value of each gel strength at 80 °F and 200 °F with each concentration of banana peel powder as much as 2 grams, 4 grams, 6 grams, and 8 grams. Gel strength in drilling functions as a cutting barrier when circulation is stopped, when the drilling process is stopped and the mud used blends with the cutting, the function of gel strength is so that the cutting that has been mixed in the drilling

mud does not go down or it is also called settling, because Therefore, gel strength is needed in the drilling process. It can be seen from the graphic that the greater the temperature being tested, the lower the gel strength value. Each gel strength can also be affected by the use of additive concentrations. It can be seen in the picture that the more banana peel powder is used, the higher the gel strength value will be due to the cellulose content in the banana peel powder. However, the gel strength value should not be too high because will be successful spirit in the mud pumping process, the sludge will burden the pump performance,

The value that most corresponds to the predetermined specifications is the concentration of 6 grams of banana peel powder where the gel strength value is not too large and not too small and the value is also within the specified range or specification, for banana peel powder 8 grams the value of the gel strength was too large in the test so that it did not comply with the predetermined specifications even though the value was quite high, therefore the use of 6 grams of banana peel powder was highly recommended for drilling mud with predetermined specifications.

4.0 CONCLUSION

The results of testing with each concentration starting from 2 grams, 4 grams, 6 grams, and 8 grams obtained different values for different plastic viscosity, yield point and gel strength with the condition that each gram of banana peel powder was added the value on plastic viscosity, yield point and gel strength also increased due to the cellulose content in the banana peel powder, but due to the temperature factor so that the values of each plastic viscosity, yield point and gel strength also decreased due to temperature changes, but these results can still be said to be good because The results obtained are still within the desired specifications.

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