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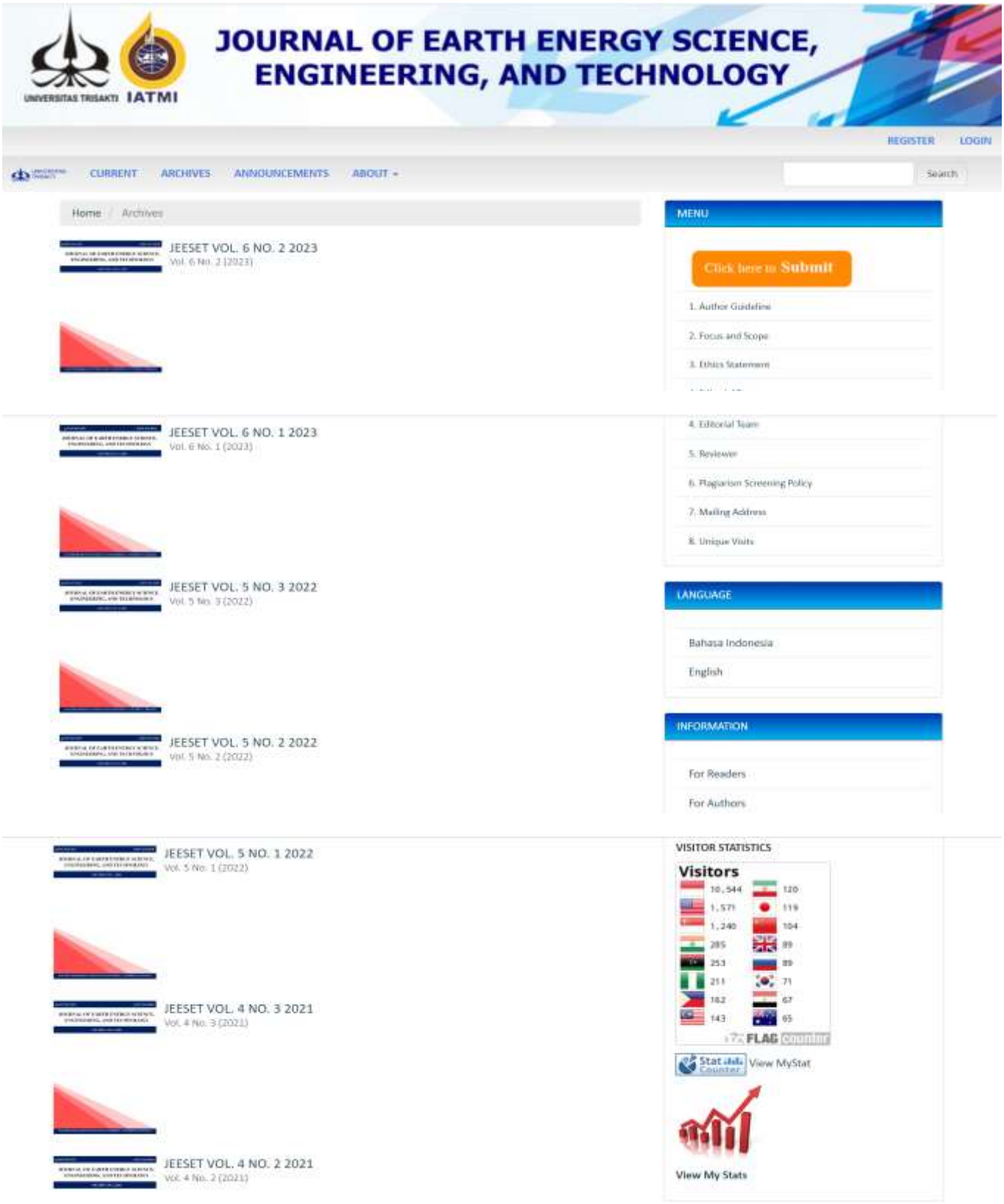

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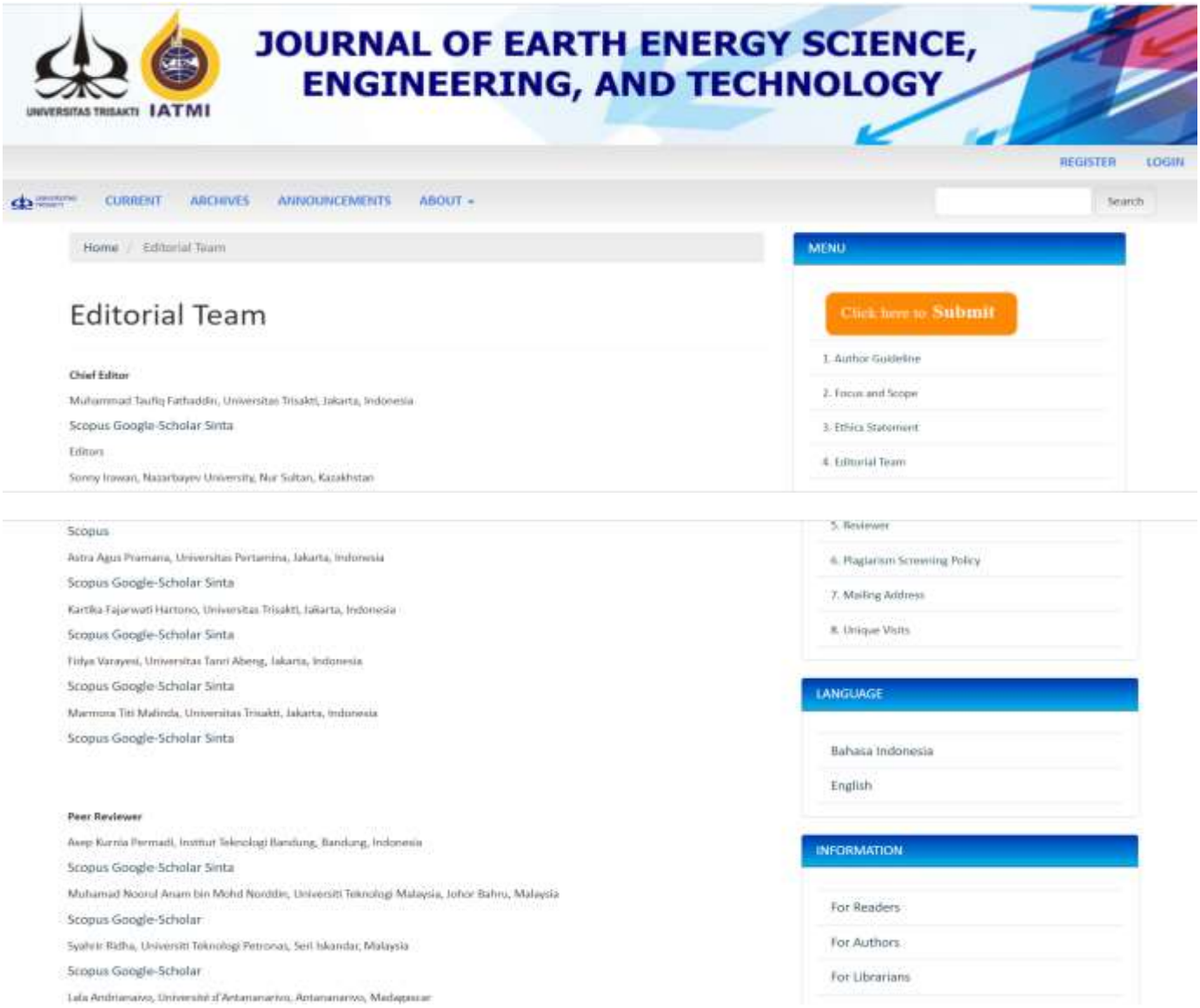

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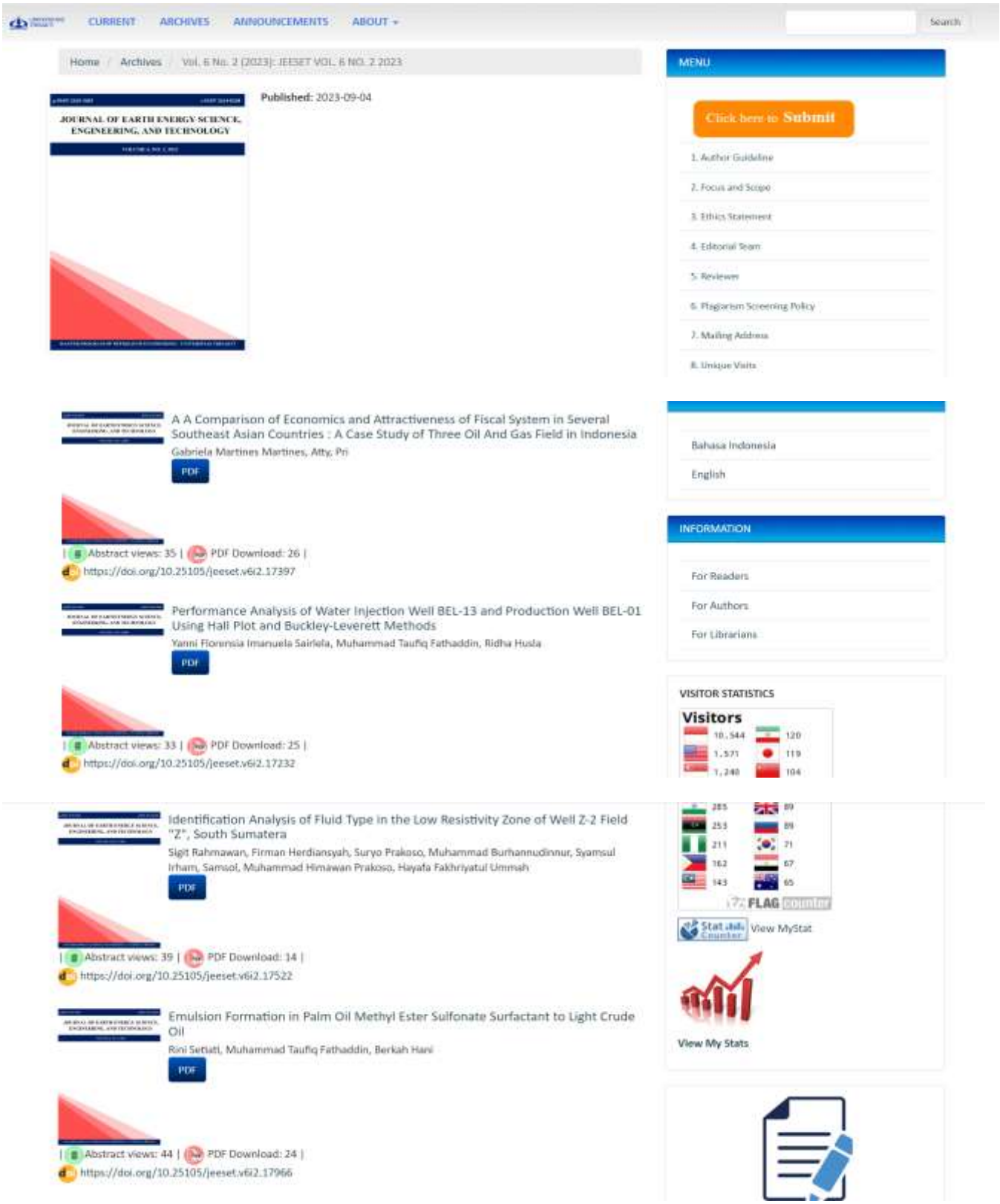

The Effect of Temperature on Filtration Loss and Mud Cake on The Concentration of Corn Starch Using the KCl-Polymer Sludge System

Safira Azzahra fira, Lestari, Lisa Samura, Asri Nugrahanti, Rachmi Kartini

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The Effect of Corn Starch Concentration and Temperature on Filtration Loss and Mud Cake of the KCl-Polymer Mud System

(Pengaruh Konsentrasi dan Suhu Tepung Jagung terhadap Kehilangan Filtrasi dan Kue Lumpur Sistem Lumpur Polimer KCl)

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Abstract
Drilling mud is a type of fluid that can help smoothing a drilling. The function of the drilling mud in the drilling process is to lift the drilling cutting. In this laboratory research, corn starch was used as a substitute for starch to reduce filtration loss. Corn starch is made by cleaning, drying, grinding, and sieving. The purpose of this research is to make mud with the addition of corn starch. its effect on filtration loss and mud cake at two temperature conditions. In this study the use of corn starch to be mixed into the mud with concentrations of 3 grams, 5 grams, 7 grams, 9 grams, and 11 grams. Accordingly, it can be seen which mud composition complies with the standard drilling mud specifications. Laboratory test results showed that the addition of corn starch additives caused a decrease in filtration loss for each difference in concentration and temperature. With the addition of 11 grams of corn starch, filtration loss decreased from 6.2 ml to 4.4 ml at 80°F, and it decreased from 5.2 ml to 3.9 ml at 200°F. In addition, corn starch additives cause the thickness of the mud cake formed to decrease. At a temperature of 80 °F the thickness of the mud cake decreased from 0.76 mm to 0.46 mm, while at a temperature of 200 °F it decreased from 0.62 to 0.42 mm. Based on the research results, corn starch additives and temperature influence changes in filtration loss and mud cake.

Keywords: Drilling Mud; Corn Starch; Filtration Loss; Mud Cake; Temperature

Sari
Lumpur pengeboran merupakan salah satu jenis fluida yang dapat membantu kelancaran suatu pengeboran. Fungsi lumpur pemboran dalam proses pemboran adalah untuk mengangkat serbuk bor. Dalam penelitian laboratorium ini, pati jagung digunakan sebagai pengganti pati untuk mengurangi kehilangan filtrasi. Tepung maizena dibuat dengan cara dibersihkan, dikeringkan, digiling, dan diayak. Tujuan dari penelitian ini adalah membuat lumpur dengan penambahan tepung maizena. pengaruhnya terhadap kehilangan filtrasi dan kue lumpur pada dua kondisi suhu. Pada penelitian ini penggunaan tepung maizena untuk dicampurkan ke dalam lumpur dengan konsentrasi 3 gram, 5 gram, 7 gram, 9 gram, dan 11 gram. Dengan demikian dapat diketahui komposisi lumpur mana yang memenuhi spesifikasi standar lumpur pemboran. Hasil uji laboratorium menunjukkan bahwa penambahan bahan tambahan pati jagung menyebabkan penurunan kehilangan filtrasi setiap perbedaan konsentrasi dan suhu. Dengan penambahan 11 gram pati jagung, kehilangan filtrasi menurun dari 6,2 ml menjadi 4,4 ml pada suhu 80°F, dan menurun dari 5,2 ml menjadi 3,9 ml pada suhu 200°F. Selain itu penambahan tepung maizena menyebabkan ketebalan kue lumpur yang terbentuk semakin berkurang. Pada suhu 80 °F ketebalan kue lumpur menurun dari 0,76 mm menjadi 0,46 mm, sedangkan pada suhu 200 °F ketebalan kue lumpur menurun dari 0,62 menjadi 0,42 mm. Berdasarkan hasil penelitian, bahan tambahan pati jagung dan suhu mempengaruhi perubahan kehilangan filtrasi dan kue lumpur.

Kata-kata kunci: Lumpur pengeboran; Tepung Jagung; Kehilangan Filtrasi; Kue lumpur; Suhu

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I. INTRODUCTION

Drilling mud is one of the factors supporting success in well drilling operations. Determination of the composition and selection of the type of drilling mud to be used in drilling a particular formation must be precise, so as to support the smooth running and determine the success of the drilling operation and avoid any difficulties that may arise. Apart from that, by using a type of drilling mud that is appropriate to the conditions of the formation to be penetrated, an optimal penetration rate will be obtained and will also reduce drilling operation costs to a minimum [1]. Drilling mud has an important role in the drilling operations of oil and gas wells to achieve the planned targets. The function of the drilling mud is to lift the cutting to the surface and maintain the stability of the borehole, and control formation pressure [2].

The main physical properties of drilling mud that must be controlled in a good oil and gas drilling operation are density, viscosity and gel strength, and filtration loss. Filtration loss is a liquid component that is lost from the drilling mud system into the formation penetrated by the drill bit. Meanwhile, the solid component that sticks to the drill hole wall is

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called mudcake. The effect of this filtrate is to cause formation damage or swelling and reduce the borehole diameter due to the presence of the mudcake [3]. Filtration loss happens when the hydrostatic pressure is higher than the formation pressure, allowing the invasion of the formation fluid into the wellbore. When drilling mud is flowing to the bottom of the borehole during the drilling operation, fluid loss from the mud happens [4]. A water-based drilling fluid that is affordable and environmentally benign that can address these problems while drilling the well is therefore greatly needed [5].

In general, filtrate loss in permeable formations depends on the relatively high particle size distribution and colloidal content in the range of 60 % mud solids content in diameter 0–1 micron. For example, the dispersion of bentonite mud in a well will cause lower filtrate loss because the size of the colloidal particles is larger than that of kaolinite mud or attapulgite clay. However, clay cannot be used solely to control fluid loss because it damages the mud, where the fluid viscosity will increase with increasing clay content [2, 6].

KCl-Polymer mud is widely used in drilling operations in areas of active shale formations. The mud is used as a borehole stabilizer and minimizes the spread of cutting so that this polymer can carry drill powder (cutting) when cleaning boreholes [7-10].

The objective of this study was to ascertain the impact of corn starch using a KCL Polymer mud system with temperature influences of 80°F and 200°F in each concentration of adding corn starch by controlling the thickness of the mud cake and filtration loss in accordance with the API 13A specification standard [7].

II. METHODOLOGY

The method used in this research was to carry out laboratory tests on the use of different corn starches with the addition of various starch concentrations and temperatures. This research will prove the effect of cornstarch as an additive which functions to reduce filtration loss and the value of mud cake. Mud testing was carried out to see the effect of adding corn starch additive concentration on the physical properties of filtration loss and mud cake according to standard specifications so that the mud composition at the additional concentration is feasible or not to be used.

Tools and materials used in the research are given in Tables 1 and 2. While, the steps performed in laboratory testing were as follows.

1. Preparation of tools and materials.
2. Measurement of materials using scales.
3. Mud manufacturing with KCl-polymer system.
4. Mud is mixed with different times and speeds.
5. Measurement of filtration loss and thickness of mud cake.
6. Mud resistance test at 200°F.

Table 1. Equipment Used in Research

No.	Tools	Function
1	Electric scales	To weight the composition of the materials used
2	Cup	As a container for stirring mud materials
3	Measuring cup	To measure the volume of the filtrate
4	Stopwatch	To calculate the time of mud research
5	Rotary shaker	To filter additives that are still solids
6	Mixer	To make mud with prepared materials
7	Filter press	To measure filtration loss and mud cake
8	Roller oven	To condition the mud to the specified temperature

Table 2. Material Used in Research

No.	Komposisi	Fungsi
1	Fresh water	Basic materials in the manufacture of mud
2	KOH	To control pH for polymers to work perfectly
3	Bentonite	As a thickening agent and reduce fluid loss
4	Corn starch	To increase viscosity and maintain filtration loss
5	XCD	As a Viscosifier, for thickening drilling mud
6	PAC-LV	As filtration control additive
7	KCL	To inhibit the development of clay
8	SOLTEX	To control high temperature
9	Barite	As a mud weighter
10	Biocide	To control the growth of WBM bacteria

In the mud test, the all compositions were stirred slowly according to the specified time so that the sludge did not agglomerate. Mud samples were made with varying cornstarch concentrations, namely 3 grams, 5 grams, 7 grams, 9 grams and 11 grams. Then the samples were tested for 30 minuter to measure loss of filtration and mud cake at 80°F and 200°F. Heating was done using a rolling oven for 16 hours. After that, testing was carried out to get the value of filtration loss and mud cake.

III. RESULTS AND DISCUSSION

Filtration Loss is the amount of fluid that enters the formation with readings that depend on temperature, pressure and solids. The effect of the fluid entering this formation will cause formation damage so that and reduce the diameter of the hole therefore mud cake is formed. To find out which mud cake is good to use, a thin mud cake can stabilize the

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borehole [11]. This mud cake is obtained from filter paper which is measured using a caliper to determine the thickness of the mud cake. If the mud used has a mud cake yield of less than 1.5 mm, the circulation process is easier.

If the filtration loss value obtained is not in accordance with the provisions, there are several problems when drilling operations. One of the problems is formation damage and differential sticking [12, 13]. Therefore, it is necessary to control filtration loss so as not to cause problems during drilling operations [14]. If the mud cake obtained is thin, the filtrate that enters the formation is also not excessive so that the drilling operation can run smoothly.

In this study, filtration loss and mud cake testing were carried out with the addition of corn starch additive concentrations of 3 grams, 5 grams, 7 grams, 9 grams and 11 grams. Table 3 and Figure 1 show the filtration loss measurement results.

Table 3. Filtration Loss Measurement Results

Corn Starch, gr	Filtration loss, ml	
	80°F	200°F
0	4.42	4.41
3	6.2	5.2
5	5.8	4.8
7	5.3	4.25
9	4.9	4.1
11	4.4	3.9

Based on Figure 1 and Table 3, it was indicated at 80°F that the filtration loss value before using corn starch was 4.42 ml. After corn starch was added, the filtration loss changed to 6.2 ml, 5.8 ml, 5.3 ml, 4.9 ml, and 4.4 ml for corn starch concentrations of 3 to 11 grams respectively. The decrease in the value of filtration loss research was due to addition of mud additives in the sample. The best filtration loss value was found at a concentration of 11 grams namely 4.4 ml, for a temperature of 200 °F of 3.9 ml.

Based on Figure 1 and Table 3, the filtration loss value before using corn starch at 200°F was 4.41 ml. After adding corn starch, filtration loss changed to 5.2 ml, 4.8 ml, 4.25 ml, 4.1 ml, and 3.9 ml for corn starch concentrations of 3 to 11 grams respectively. The best filtration loss value was found at a concentration of 11 grams namely 3.9 ml.

In general, the value of filtration loss decreases with increasing temperature. In this case the value of the filtration loss is maintained according to the function of corn starch which can control the value of the filtration loss.

Based on the results of experiments, the thickness of mud cake was affected by the value of filtration loss. Mud cake was formed because the mud experienced filtration loss. This causes the solid mud particles on the filter paper to settle. If the value of filtration loss was higher, the value of the mud cake obtained was thicker. Table 4 shows the results of mud cake measurements.

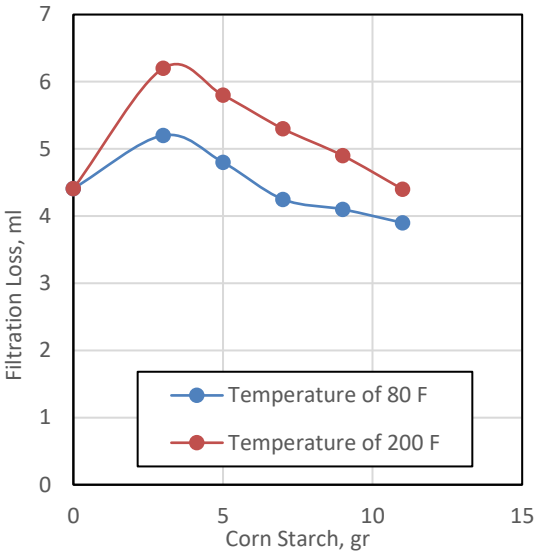

Figure 1. Effect of Corn Starch Additif on Filtration Loss

Table 4. Mud cake measurement results

Corn Starch, gr	Mud Cake Thickness, mm	
	80°F	200°F
0	0.76	0.58
3	0.76	0.62
5	0.66	0.52
7	0.55	0.50
9	0.50	0.44
11	0.46	0.42

Figure 2 shows the effect of adding cornstarch on filtration loss at 80°F and 200°F. Based on Figure 2 and Table 4, it was indicated at 80°F that the mud cake value before using corn starch was 0.76 mm. After corn starch was added, the filtration loss changed to 0.76 mm, 0.66 mm, 0.55 mm, 0.50 mm, and 0.46 mm for corn starch concentrations of 3 to 11 grams respectively.

Based on Figure 2 and Table 4, the mud cake value before using corn starch at 200°F was 0.58 mm. After adding corn starch, mud cake thickness changed to 0.62 mm, 0.52 mm, 0.50 mm, 0.44 mm, and 0.42 mm for corn starch concentrations of 3 to 11 grams respectively.

Tables 3 and 4 show the relationship between filtration loss and mud cake thickness. The smaller the filtration loss value, the thinner the thickness of the mud cake. In addition, the volume of filtration loss and the thickness of the mud cake decreased with increasing temperature. Table 4 shows that all mud samples that have been tested meet drilling mud specification standards because the thickness of the mud cake is less than 1. If the mud cake obtained is

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too thick, the drilling pipe in the drill hole will be pinched and difficult to lift. Therefore, in tests with the addition of corn starch as an additional material, it is good for use in the drilling process and this additional material is the chosen alternative because it is economical and easy to obtain [15].

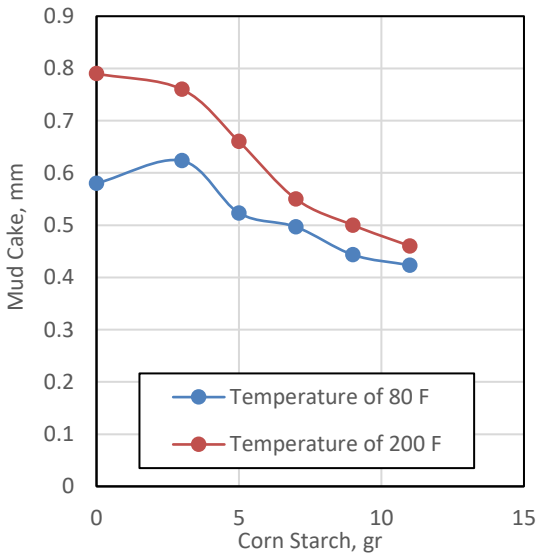

Figure 2. Effect of Corn Starch Additif on Mud Cake

IV. CONCLUSIONS

Several statements that can be taken from this research are as follows:

1. The higher the mass of corn starch from 3 to 11 grams, the smaller the filtration loss for a temperature of 80 °F is from 6.2 ml to 4.4 ml and the smaller the value of mud cake obtained from 0.76 mm to 0.46 mm. For temperatures of 200 °F, the filtration loss is from 5.2 to 3.9 ml, while mud cake is from 0.62 mm to 0.42 mm. Because the addition of starch can reduce the fluid that enters the formation so that the mud cake formed becomes thin.
2. The higher the temperature, the smaller the filtration loss value and the smaller the thickness of the mud cake.
3. Adding cornstarch to drilling mud can reduce filtration losses and mud cake thickness. So cornstarch has the potential to be used as an additive for filtration loss problems.

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On this occasion the author would like to express his thanks to Allah for all his grace and gifts so that the author can complete the writing of his scientific work. The author would also like to thank everyone who has supported this research.

REFERENCES

[1] Satiyawira, B. 2018. Pengaruh Temperatur Terhadap Sifat Fisik Sistem Low Solid Muddengan Penambahan Aditif Biopolimer Dan Bentonite Extender. Jurnal Petro, Vol. 7, No. 4, pp. 144-151. Doi:10.25105/petro. v7i4.4282.

[2] Amin, M.M. 2013. Lumpur dan Hidrolika Lumpur Pengeboran. Kementerian Pendidikan dan Kebudayaan Republik Indonesia.

[3] Suhascaryo, N., Rubiandini, R.R.S., and Handayani, S.R. 2001. Studi Laboratorium Additif Temperatur Tinggi Sifat-Sifat Rheologi Lumpur Pemboran Pada Kondisi Dinamis. Proceeding of the 5th Inaga Annual Scientific Conference & Exhibitions, Yogyakarta, March 7 – 10, 2001.

[4] Ghazali, N.A., Alias, N. H., Mohd, T.A.T., Adeib, S.I., and Noorsuhana, M.Y. 2015. Potential of Corn Starch as Fluid Loss Control Agent in Drilling Mud. Applied Mechanics and Materials, Vol. 754–755, pp. 682–687. Doi:10.4028/www.scientific.net/amm.754-755.682.

[5] Yalman, E., Federer-Kovacs, G., Depci, T., Al Khalaf, H., Aylikci, V., and Aydin, M. G. 2022. Development of Novel Inhibitive Water-Based Drilling Muds for Oil and Gas Field Applications. Journal of Petroleum Science and Engineering, 210, pp. 109907. Doi:10.1016/ j.petrol. 2021.109907.

[6] Buntoro, A. 2017. Lumpur Pemboran Perencanaan dan Solusi Masalah Secara Praktis. 1st Edition, Teknosain, Yogyakarta.

[7] Pratama, A.B. 2020. Studi Laboratorium Pengaruh Penambahan Bentonite terhadap Sifat Fisik Lumpur KCl-Polimer pada Temperatur 80º, 150º dan 250ºF. Department of Petroleum Engineering, Universitas Trisakti, Jakarta.

[8] Zakky, Satyawira, B. and Samsol. 2018. Studi Laboratorium Pemilihan Additif Penstabil Shale di Dalam Sistem Lumpur KCl-Polimer pada Temperatur Tinggi. Journal of Mechanical Engineering and Mechatronics, Vol. 3, No. 1, pp. 50-54. Doi: 10.33021/jmem.v3i1.544

[9] Setyanto, D.A., Sudibjo, R., and Hamid, A. 2018. Field Case: Application of Polyamine Based Mud System to Drill Kintom Formation in Sulawesi and Comparison to Conventional KCl-Polymer Mud System. Journal of Earth Energy Science, Engineering, and Technology, Vol. 1, No. 2, pp. 55-61. https://doi.org/ 10.25105/jeeset.v1i2.3941

[10] Wijayanti, P., Satiyawira, B., Prima, A., Ristawati, A., and Sciorra, F. 2021. Determination of Suitable KCl Polymer Mud Properties for POK Field. Journal of Earth Energy Science, Engineering, and Technology, Vol. 4, No. 1, pp. 27-30. https://doi.org/ 10.25105/jeeset.v4i1.9078

[11] Ginting, R.M. 2018. Studi Laboratorium Pengaruh Penambahan Polimer Sintesis dan

Tepung Sagu terhadap Sifat Rheology Lumpur Air Asin Sistem Dispersi pada Berbagai Temperatur. Petro, Vol. 7, No. 4, pp. 166-170. Doi: 10.25105/ petro.v7i4.4286.

[12] Sadya, R. 1984. Diktat Teknik Lumpur Pemboran. Jurusan Teknik Perminyakan, Universitas Trisakti, Jakarta.

[13] Rubiandini, R. 2012. Teknik Pemboran 1, Institut Teknologi Bandung, Bandung.

[14] Ricky, E., Mpelwa, M., Wang, C., Hamad, B., and Xu, X. 2022. Modified Corn Starch as an Environmentally Friendly Rheology Enhancer and Fluid Loss Reducer for Water-Based Drilling Mud. SPE Journal, Vol. 27, No. 2, p. 1064-1080. SPE-209195-PA. https://doi.org/ 10.2118/209195-PA

[15] Talukdar, P., Kalita, S., Pandey, A., Dutta, U., and Singh, R. 2018. Effectiveness of different Starches as Drilling Fluid Additives in Non-Damaging Drilling Fluid. In International Journal of Applied Engineering Research, Vol. 13, No. 16, pp. 12469-12474.

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by Lisa Samura FTKE

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Kata-kata kunci: Lumpur pengeboran; Tepung Jagung; Kehilangan Filtrasi; Kue lumpur; Suhu

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I. INTRODUCTION

Drilling mud is one of the factors supporting success in well drilling operations. Determination of the composition and selection of the type of drilling mud to be used in drilling a particular formation must be precise, so as to support the smooth running and determine the success of the drilling operation and avoid any difficulties that may arise. Apart from that, by using a type of drilling mud that is appropriate to the conditions of the formation to be penetrated, an optimal penetration rate will be obtained and will also reduce drilling operation costs to a minimum [1]. Drilling mud has an important role in the drilling operations of oil and gas wells to achieve the planned targets. The function of the drilling mud is to lift the cutting to the surface and maintain the stability of the borehole, and control formation pressure [2].

The main physical properties of drilling mud that must be controlled in a good oil and gas drilling operation are density, viscosity and gel strength, and filtration loss. Filtration loss is a liquid component that is lost from the drilling mud system into the formation penetrated by the drill bit. Meanwhile, the solid component that sticks to the drill hole wall is

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called mudcake. The effect of this filtrate is to cause formation damage or swelling and reduce the borehole diameter due to the presence of the mudcake [3]. Filtration loss happens when the hydrostatic pressure is higher than the formation pressure, allowing the invasion of the formation fluid into the wellbore. When drilling mud is flowing to the bottom of the borehole during the drilling operation, fluid loss from the mud happens [4]. A water-based drilling fluid that is affordable and environmentally benign that can address these problems while drilling the well is therefore greatly needed [5].

In general, filtrate loss in permeable formations depends on the relatively high particle size distribution and colloidal content in the range of 60 % mud solids content in diameter 0–1 micron. For example, the dispersion of bentonite mud in a well will cause lower filtrate loss because the size of the colloidal particles is larger than that of kaolinite mud or attapulgite clay. However, clay cannot be used solely to control fluid loss because it damages the mud, where the fluid viscosity will increase with increasing clay content [2, 6].

KCl-Polymer mud is widely used in drilling operations in areas of active shale formations. The mud is used as a borehole stabilizer and minimizes the spread of cutting so that this polymer can carry drill powder (cutting) when cleaning boreholes [7-10].

The objective of this study was to ascertain the impact of corn starch using a KCL Polymer mud system with temperature influences of 80°F and 200°F in each concentration of adding corn starch by controlling the thickness of the mud cake and filtration loss in accordance with the API 13A specification standard [7].

II. METHODOLOGY

The method used in this research was to carry out laboratory tests on the use of different corn starches with the addition of various starch concentrations and temperatures. This research will prove the effect of cornstarch as an additive which functions to reduce filtration loss and the value of mud cake. Mud testing was carried out to see the effect of adding corn starch additive concentration on the physical properties of filtration loss and mud cake according to standard specifications so that the mud composition at the additional concentration is feasible or not to be used.

Tools and materials used in the research are given in Tables 1 and 2. While, the steps performed in laboratory testing were as follows.

1. Preparation of tools and materials.
2. Measurement of materials using scales.
3. Mud manufacturing with KCl-polymer system.
4. Mud is mixed with different times and speeds.
5. Measurement of filtration loss and thickness of mud cake.
6. Mud resistance test at 200°F.

Table 1. Equipment Used in Research

No.	Tools	Function
1	Electric scales	To weight the composition of the materials used
2	Cup	As a container for stirring mud materials
3	Measuring cup	To measure the volume of the filtrate
4	Stopwatch	To calculate the time of mud research
5	Rotary shaker	To filter additives that are still solids
6	Mixer	To make mud with prepared materials
7	Filter press	To measure filtration loss and mud cake
8	Roller oven	To condition the mud to the specified temperature

Table 2. Material Used in Research

No.	Komposisi	Fungsi
1	Fresh water	Basic materials in the manufacture of mud
2	KOH	To control pH for polymers to work perfectly
3	Bentonite	As a thickening agent and reduce fluid loss
4	Corn starch	To increase viscosity and maintain filtration loss
5	XCD	As a Viscosifier, for thickening drilling mud
6	PAC-LV	As filtration control additive
7	KCL	To inhibit the development of clay
8	SOLTEX	To control high temperature
9	Barite	As a mud weighter
10	Biocide	To control the growth of WBM bacteria

In the mud test, the all compositions were stirred slowly according to the specified time so that the sludge did not agglomerate. Mud samples were made with varying cornstarch concentrations, namely 3 grams, 5 grams, 7 grams, 9 grams and 11 grams. Then the samples were tested for 30 minuter to measure loss of filtration and mud cake at 80°F and 200°F. Heating was done using a rolling oven for 16 hours. After that, testing was carried out to get the value of filtration loss and mud cake.

III. RESULTS AND DISCUSSION

Filtration Loss is the amount of fluid that enters the formation with readings that depend on temperature, pressure and solids. The effect of the fluid entering this formation will cause formation damage so that and reduce the diameter of the hole therefore mud cake is formed. To find out which mud cake is good to use, a thin mud cake can stabilize the

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borehole [11]. This mud cake is obtained from filter paper which is measured using a caliper to determine the thickness of the mud cake. If the mud used has a mud cake yield of less than 1.5 mm, the circulation process is easier.

If the filtration loss value obtained is not in accordance with the provisions, there are several problems when drilling operations. One of the problems is formation damage and differential sticking [12, 13]. Therefore, it is necessary to control filtration loss so as not to cause problems during drilling operations [14]. If the mud cake obtained is thin, the filtrate that enters the formation is also not excessive so that the drilling operation can run smoothly.

In this study, filtration loss and mud cake testing were carried out with the addition of corn starch additive concentrations of 3 grams, 5 grams, 7 grams, 9 grams and 11 grams. Table 3 and Figure 1 show the filtration loss measurement results.

Table 3. Filtration Loss Measurement Results

Corn Starch, gr	Filtration loss, ml	
	80°F	200°F
0	4.42	4.41
3	6.2	5.2
5	5.8	4.8
7	5.3	4.25
9	4.9	4.1
11	4.4	3.9

Based on Figure 1 and Table 3, it was indicated at 80°F that the filtration loss value before using corn starch was 4.42 ml. After corn starch was added, the filtration loss changed to 6.2 ml, 5.8 ml, 5.3 ml, 4.9 ml, and 4.4 ml for corn starch concentrations of 3 to 11 grams respectively. The decrease in the value of filtration loss research was due to addition of mud additives in the sample. The best filtration loss value was found at a concentration of 11 grams namely 4.4 ml, for a temperature of 200 °F of 3.9 ml.

Based on Figure 1 and Table 3, the filtration loss value before using corn starch at 200°F was 4.41 ml. After adding corn starch, filtration loss changed to 5.2 ml, 4.8 ml, 4.25 ml, 4.1 ml, and 3.9 ml for corn starch concentrations of 3 to 11 grams respectively. The best filtration loss value was found at a concentration of 11 grams namely 3.9 ml.

In general, the value of filtration loss decreases with increasing temperature. In this case the value of the filtration loss is maintained according to the function of corn starch which can control the value of the filtration loss.

Based on the results of experiments, the thickness of mud cake was affected by the value of filtration loss. Mud cake was formed because the mud experienced filtration loss. This causes the solid mud particles on the filter paper to settle. If the value of filtration loss was higher, the value of the mud cake obtained was thicker. Table 4 shows the results of mud cake measurements.

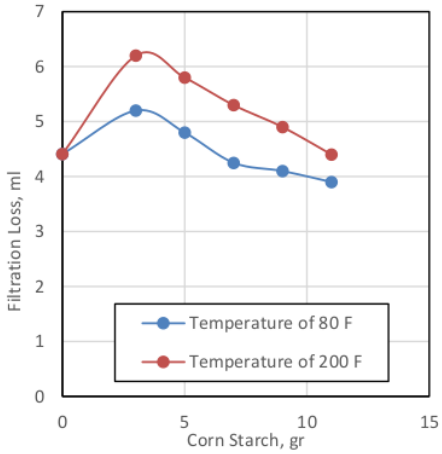

Figure 1. Effect of Corn Starch Additif on Filtration Loss

Table 4. Mud cake measurement results

Corn Starch, gr	Mud Cake Thickness, mm	
	80°F	200°F
0	0.76	0.58
3	0.76	0.62
5	0.66	0.52
7	0.55	0.50
9	0.50	0.44
11	0.46	0.42

Figure 2 shows the effect of adding cornstarch on filtration loss at 80°F and 200°F. Based on Figure 2 and Table 4, it was indicated at 80°F that the mud cake value before using corn starch was 0.76 mm. After corn starch was added, the filtration loss changed to 0.76 mm, 0.66 mm, 0.55 mm, 0.50 mm, and 0.46 mm for corn starch concentrations of 3 to 11 grams respectively.

Based on Figure 2 and Table 4, the mud cake value before using corn starch at 200°F was 0.58 mm. After adding corn starch, mud cake thickness changed to 0.62 mm, 0.52 mm, 0.50 mm, 0.44 mm, and 0.42 mm for corn starch concentrations of 3 to 11 grams respectively.

Tables 3 and 4 show the relationship between filtration loss and mud cake thickness. The smaller the filtration loss value, the thinner the thickness of the mud cake. In addition, the volume of filtration loss and the thickness of the mud cake decreased with increasing temperature. Table 4 shows that all mud samples that have been tested meet drilling mud specification standards because the thickness of the mud cake is less than 1. If the mud cake obtained is

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too thick, the drilling pipe in the drill hole will be pinched and difficult to lift. Therefore, in tests with the addition of corn starch as an additional material, it is good for use in the drilling process and this additional material is the chosen alternative because it is economical and easy to obtain [15].

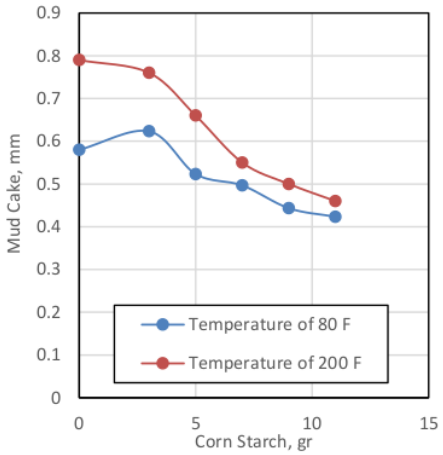

Figure 2. Effect of Corn Starch Additif on Mud Cake

IV. CONCLUSIONS

Several statements that can be taken from this research are as follows:

1. The higher the mass of corn starch from 3 to 11 grams, the smaller the filtration loss for a temperature of 80 °F is from 6.2 ml to 4.4 ml and the smaller the value of mud cake obtained from 0.76 mm to 0.46 mm. For temperatures of 200 °F, the filtration loss is from 5.2 to 3.9 ml, while mud cake is from 0.62 mm to 0.42 mm. Because the addition of starch can reduce the fluid that enters the formation so that the mud cake formed becomes thin.
2. The higher the temperature, the smaller the filtration loss value and the smaller the thickness of the mud cake.
3. Adding cornstarch to drilling mud can reduce filtration losses and mud cake thickness. So cornstarch has the potential to be used as an additive for filtration loss problems.

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REFERENCES

[1] Satiyawira, B. 2018. Pengaruh Temperatur Terhadap Sifat Fisik Sistem Low Solid Muddengan Penambahan Aditif Biopolimer Dan Bentonite Extender. Jurnal Petro, Vol. 7, No. 4, pp. 144-151. Doi:10.25105/petro. v7i4.4282.

[2] Amin, M.M. 2013. Lumpur dan Hidrolika Lumpur Pengeboran. Kementerian Pendidikan dan Kebudayaan Republik Indonesia.

[3] Suhascaryo, N., Rubiandini, R.R.S., and Handayani, S.R. 2001. Studi Laboratorium Additif Temperatur Tinggi Sifat-Sifat Rheologi Lumpur Pemboran Pada Kondisi Dinamis. Proceeding of the 5th Inaga Annual Scientific Conference & Exhibitions, Yogyakarta, March 7 – 10, 2001.

[4] Ghazali, N.A., Alias, N. H., Mohd, T.A.T., Adeib, S.I., and Noorsuhana, M.Y. 2015. Potential of Corn Starch as Fluid Loss Control Agent in Drilling Mud. Applied Mechanics and Materials, Vol. 754–755, pp. 682–687. Doi:10.4028/www.scientific.net/amm.754-755.682.

[5] Yalman, E., Federer-Kovacs, G., Depci, T., Al Khalaf, H., Aylikci, V., and Aydin, M. G. 2022. Development of Novel Inhibitive Water-Based Drilling Muds for Oil and Gas Field Applications. Journal of Petroleum Science and Engineering, 210, pp. 109907. Doi:10.1016/ j.petrol. 2021.109907.

[6] Buntoro, A. 2017. Lumpur Pemboran Perencanaan dan Solusi Masalah Secara Praktis. 1st Edition, Teknosain, Yogyakarta.

[7] Pratama, A.B. 2020. Studi Laboratorium Pengaruh Penambahan Bentonite terhadap Sifat Fisik Lumpur KCl-Polimer pada Temperatur 80°, 150° dan 250°F. Department of Petroleum Engineering, Universitas Trisakti, Jakarta.

[8] Zakky, Satyawira, B. and Samsol. 2018. Studi Laboratorium Pemilihan Additif Penstabil Shale di Dalam Sistem Lumpur KCl-Polimer pada Temperatur Tinggi. Journal of Mechanical Engineering and Mechatronics, Vol. 3, No. 1, pp. 50-54. Doi: 10.33021/jmem.v3i1.544

[9] Setyanto, D.A., Sudibjo, R., and Hamid, A. 2018. Field Case: Application of Polyamine Based Mud System to Drill Kintom Formation in Sulawesi and Comparison to Conventional KCl-Polymer Mud System. Journal of Earth Energy Science, Engineering, and Technology, Vol. 1, No. 2, pp. 55-61. https://doi.org/ 10.25105/jeeset.v1i2.3941

[10] Wijayanti, P., Satiyawira, B., Prima, A., Ristawati, A., and Sciorra, F. 2021. Determination of Suitable KCl Polymer Mud Properties for POK Field. Journal of Earth Energy Science, Engineering, and Technology, Vol. 4, No. 1, pp. 27-30. https://doi.org/ 10.25105/jeeset.v4i1.9078

[11] Ginting, R.M. 2018. Studi Laboratorium Pengaruh Penambahan Polimer Sintesis dan

URL: https://e-journal.trisakti.ac.id/index.php/jeeset, DOI: https://dx.doi.org/10.25105/jeeset.v6i2.17685
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Tepung Sagu terhadap Sifat Rheology Lumpur Air Asin Sistem Dispersi pada Berbagai Temperatur. Petro, Vol. 7, No. 4, pp. 166-170. Doi: 10.25105/ petro.v7i4.4286.

[12] Sadya, R. 1984. Diktat Teknik Lumpur Pemboran. Jurusan Teknik Perminyakan, Universitas Trisakti, Jakarta.

[13] Rubiandini, R. 2012. Teknik Pemboran 1, Institut Teknologi Bandung, Bandung.

[14] Ricky, E., Mpelwa, M., Wang, C., Hamad, B., and Xu, X. 2022. Modified Corn Starch as an Environmentally Friendly Rheology Enhancer and Fluid Loss Reducer for Water-Based Drilling Mud. SPE Journal, Vol. 27, No. 2, p. 1064-1080. SPE-209195-PA. https://doi.org/ 10.2118/209195-PA

[15] Talukdar, P., Kalita, S., Pandey, A., Dutta, U., and Singh, R. 2018. Effectiveness of different Starches as Drilling Fluid Additives in Non-Damaging Drilling Fluid. In International Journal of Applied Engineering Research, Vol. 13, No. 16, pp. 12469-12474.

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