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USE OF COCONUT SHELL AS AN ALTERNATIVE MEDIA OF WATER FILTRATION REPLACEMENT FOR FORMATION

By

Dito Utomo Dimantoro[1], Havisinah[2], Rahmi Aini Utami[3]
Politeknik Akamigas Palembang

Abstract

The quality of the injection water is a matter of concern in the injecting of a water formation (injection water). In an effort to improve the quality of water injection usually treatment in the form of filtration first. The water formation that has passed the wash tank is not completely free from crude oil, so it is necessary to filter before injection. Generally, charcoal and other types of activated carbon are commonly used as cartridge filters for the separation of manufactured water from crude oil, usually less efficient due to the long time and relatively high cost. The research using coconut shell is expected as an alternative to the use of water formation filtration cartridge (charcoal and other activated carbon), the research is done by preparing the waste of coconut shell with sample size in the form of sample 1 (Fine with mess 40), sample 2 (Medium with mess 30) , sample 3 (Coarse with mess 20), sample 4 (Fine-Medium), sample 5 (Fine-Coarse) and Sample 6 (Medium-Coarse). Then tested filtration with water produced that still contain oil content. The samples analyzed were water formation samples before and after filtration using filtration water formation media with coconut shell cartridge of each size, samples analyzed with speed of flow rate, sediment and oil content before and after filtration test. The best result will show the fastest flow rate, the lowest percentage of sediment and the biggest decrease of oil content, then the filtration media is obtained from the scorring result with the best affair of sample number 6, number 4, number 5, number 1, number 3 and number 2

Keywords: *Coconut Shell, Water Formation, Oil Content*

PRELIMINARY

According to the Ministry of Energy and Mineral Resources (ESDM), at the beginning of the fourth quarter of 2017 showed oil production in Indonesia reached 812,083 barrels per day (Anonim, first, starting from the production well to marketing. In its production, the oil extracted from the production well is not entirely crude oil. But there is salt water in the reservoir formation where the presence of oil is called formation water.

After being lifted to the surface, the formation water will be separated from the oil and then injected using a pump called the injection pump to the well injection well which is not far from the production well. For production wells, Indonesia has many production wells spread from Sabang to Merauke owned by various companies. As for many of them, old wells that contribute to the production of formation water are very large. Comparison between the amount of formation water production and the gross amount of Water Cut production. In old wells, this water cut value can reach 95 to 99% (close to 100%) so it is necessary to inject intense formation water compared to other new wells with injection pumps that can work well, continuously, and last longer .

Injection pumps, especially centrifugal pumps, are very sensitive to the oil content carried by formation water. The presence of oil content in the formation water will disturb the pumping a little more, so that it can shorten the pump life. Separation of formation water from oil content is carried out using a filtration process. The filtration process is one way that can be done. The filtration process usually uses media such as activated carbon (charcoal), palm fiber, and coconut shell as an adsorbent medium that is good enough to bind the oil content carried in formation water.

RESEARCH PURPOSES

Based on the introduction above, there are problems in the formation water that will be injected into the well. Usually formation water will be filtered using a cartridge containing activated carbon which is quite expensive. The purpose of this study is to determine whether coconut shells are effective enough to replace activated carbon as a filter for formation water that will be injected into the well.

In addition, this research can be used as a guideline or guide in making simple and inexpensive screening tools for practicum activities as teaching aids. The results of this study can be used as a reference and as a basic concept in making more complex tools later in accordance with the development of science in the oil sector.

RESEARCH METHODOLOGY

From the condition of the oil content in injection water in the field, this research is focused on getting media that can filter injection water so that it is free of oil content. Based on literature data obtained information that coconut shell powder has good adsorption power so it has the possibility to be used as an alternative filter media.

Coconut shells used in the trial are coconut shells that follow several conditions, namely: (1) comes from old coconut and (2) has been separated from coir and dirt that is attached to the shell. Coconut shells that have fulfilled this requirement will go through several

preparation of the coconut shell is: (1) it must be crushed into smaller fragments, (2) cleaned from dirt and dried, and (3) sorted according to mesh size and then used as an adsorbent medium to be studied further.

Data Collection Method

Literature study is carried out by collecting additional information from various reference sources regarding the materials related to "The Use of Coconut Shell as an Alternative Media in Replacing Water Filtration Cartridge Formation" from books, the internet, e-books, journals, and from the results of research conducted by previous researchers. It aims to be a comparison as well as to support research so that the discussion will be supported by the foundations of a strong theory.

The research was carried out by means of crushing and separating the coconut shell into several categories, then testing included fluid flow rate testing, absorption capacity test and formation water quality test. It aims to determine the ability of how much the ability of coconut shells in absorption to form water.

The discussion was carried out by way of consultation and direct discussion with the related supervisors "The Use of Coconut Shell as an Alternative Media in Replacing Water Filtration Cartridge Formation".

The equipment used in the research on "The Use of Coconut Shell as an Alternative Media in Replacing Cartridge Water Filtration Formation" can be seen in table 1

The material used in the study of "The Use of Coconut Shell as an Alternative Media in Replacing Cartridge Water Filtration Formation" can be seen in Table 2

RESEARCH PROCEDURES

The research procedure on "The Use of Coconut Shell as an Alternative Media in Replacing Formation Water Filtration Cartridges" was carried out as follows:

Preparing Samples

there are four stages that must be done in preparing the sample. the workflow scheme can be seen in Figure 1

1. Destruction Process

In this process coconut shells that have been separated from the skin are then crushed to become granules. The process of destroying coconut shells is done manually, namely by pounding the coconut shell using pestle and mortar until a fine fine medium is obtained. Lesung is a tool commonly used for pounding rice which is still widely used in rural areas. The process can be seen in Figure 2.

2. Washing Process

In this process the coconut shell that has been separated is then carried out the washing process. The process itself aims to make the coconut shell granules

destruction process. This washing process is done manually by washing coconut shells with water so that the residual pulp in the coconut shell powder will automatically rise to the surface of the water while the coconut shell will be below the water surface so that it can be separated. The process can be seen in Figure 3.

3. Drying Process

In this process, the coconut shell that we have washed will experience wetness so we must dry it first. This drying process is carried out using an oven. In this process the coconut shell is put into the oven until the water content still attached to the coconut shell is gone. This process lasts for approximately 20 minutes. The process can be seen in Figure 4.

4. Sorting Process

In this process coconut shells that have been destroyed before, then carried out a sorting process that aims to make the coconut shell that we have destroyed before can be separated according to the desired size. For this study the size used was fine, medium and rough. This sorting process is carried out automatically by using a tool that is Tyler Sieve Shaker Analysis. In this tool we can separate the coconut shell granules automatically according to the size of the desired mess. Mesh used is mesh 40 (fine), 30 (medium), 20 (rough). The process can be

In this study there were three tests carried out on coconut shell samples in each of the sizes of coconut shells, among others.

1. Fluid Flow Test

In the process of testing the fluid flow rate, this test aims to know how many fluid flow rates can be produced from each category in the coconut shell. So from this experiment we can find out which category is more effective for flowing fluid, this process is carried out by inserting coconut shell samples starting from a fine size first into a prepared filtering container, after that pour the formation water into the filtering place and when start counting using a stopwatch from the beginning of the formation water is poured until the formation water can not drip again in the collection container filtering results repeat this step by using different sizes of coconut shell samples

2. Absorption Capacity Test

In the absorption capacity testing process, it is intended to find out how many each sample of coconut shell granules can absorb the oil content contained in the formation water with a certain mass. This process is carried out by entering the formation water gradually into the filter until the coconut shell can no longer absorb the oil content.

3. Formation Water Content Test

the study whether there is a change or not. In this process the tool is used using a centrifugal device.

RESULTS AND ANALYSIS

In the process of oil separation, will get crude oil, raw gas and a number of water fomation. Crude oil separated from the separator will be purified in the wash tank. While formation water will be forwarded to the filter cartridge for filtering the crude oil that is included with formation water. It is expected that through filtering in the cartridge filter water is obtained which is ready to be injected into the subsurface. Water from the wash tank and cartridge filter will be collected in the water storage tank for further treatment with various chemicals so that substances that are not expected to be in formation water can be minimized. After that the formation water which can be categorized as injection water can be injected into the nearest injection wells.

Often it is found that injection water still contains a little crude oil (called oil content). This is greatly avoided in injecting water into injection wells because it will have negative effects on production equipment such as pumps (especially centrifugal pumps) and pipes. The equipment is very susceptible to damage when dealing with different

After the coconut shell is crushed and clean from impurity particles, the coconut shell is then separated and grouped (sorting) coconut shell fragments using a tool called Shieve Shaker. There are three mesh sizes used in this separation, namely mesh 30, 40 and 50. Mesh 30 is referred to as Coarse Sample (K), mesh 40 is called Medium Sample (S), and mesh 50 is referred to as Fine Sample (H). Of the three available samples, crossing is carried out where 100gr of each sample is crossed with another sample to get the diversity of results for the mass of samples used can be seen in table 3.

Fluid Flow Rate

Theoretically it can be immediately known that the size of a smaller coconut shell gives a slower flow rate compared to a sample of a larger size shell. Based on the data tabulation in Table 4 a comparison was made between the size of the coconut shell sample and the flowing fluid flow rate.

From Figure 6 it can be seen that samples with number 3 (coarse) are able to flow fluid faster than samples of other sizes, and samples with number 1 (smooth) are able to flow fluid more slowly due to the relatively smaller pore size between coconut shell granules. This sample with number 1 (smooth) is less effective against time because of its ability to flow fluid slowly. samples with

order of sample size based on the flow rate from the fastest to the oldest is the sample with number 3 rough sample size, 6 (medium coarse), 5 (coarse fine), 2 (medium), 4 (medium fine), 1 (medium fine).

Absorption Capacity

test the absorption capacity of coconut shell samples to the oil content contained in formation water using various sample sizes. to get the results of this absorption capacity test, it is done by filtering the oil content with coconut shells gradually until the coconut shell is no longer able to absorb the oil content. can be seen in table 5.

Based on Figure 7 it is known that samples with number 1 (fine) have better absorption capacity compared to other samples. Samples with number 3 (rough) have worse absorption capacity. The order of the sample size based on its absorption capacity from the largest to the smallest is sample number 1 (fine), 4 (medium fine), 2 (medium), 5 (fine rough), 6 (medium rough), 3 (rough).

Oil Content on Formation water

In the test of the water content of the formation carried out in the study, it was found out that the coconut shell samples used in this screening could influence the quality of the formation water samples containing the oil content. This test is carried out by conducting a series of studies which then obtained quality data rather than formation water before centrifugal device. The results obtained can be seen in table 6.

In addition, from the data in table 5 an analysis of the formation of water content regarding the percentage of sediment content before and after can be seen in Figure 8.

The percentage of sediment after filtering shows an increase. This increase is indicated that coconut shells contain sediment. From the coconut shell sample number 1 (fine) shows the greatest sediment value. A large percentage of sediment is avoided in formation water so that the number 1 coconut shell sample (fine) is not appropriate in equipment that is sensitive to sediment. While the smallest sediment content is in the number 3 coconut shell sample (coarse) and number 6 (being rough), because the coarse-sized coconut shell sample is easier to clean from the sediment during the washing process. For equipment that is sensitive to sediment content, it is advisable to use coarse (3) and coarse-sized (6) samples.

From Figure 9 shows the percentage of oil before and after filtering. The initial percentage of oil is at 12% constant for use in some of the samples studied. From the existing screening results, the number of coconut shell number 1 (fine) gives the smallest percentage of oil at 0.50% to the total volume of filtered fluid. The largest oil percentage is in the number 5.10% owned by the number 2 coconut shell

better the absorption power of the oil. Mixing of a number of shell sizes indicated by sample number 4 (medium fine), 5 (fine coarse), and 6 (medium coarse) gives the percentage of oil that can be used as an alternative to coconut shell number 1 (fine) which was previously indicated to contain a lot of sediment.

Final Research Results

Untuk menentukan komposisi sampel dengan ukuran terbaik yang dapat diajukan sebagai alternatif pengganti media filter pada *cartridge filter* maka dilakukan proses penilaian (*scorring*) pada tiap-tiap sampel. Dimana system penilaian yang dilakukan adalah dengan memberi nilai 6 untuk sampel terbaik dan nilai 1 untuk sampel terburuk dalam hasil analisis. Selengkapnya dapat dilihat pada tabel 7.

From the results of scoring, the suggested composition to be proposed as an alternative filter media is:

1. Sample number 6 with medium-coarse grain composition
2. Sample number 4 with medium-fine grain composition
3. Sample number 5 with coarse fine grain composition.
4. Sample number 1 with fine grain composition
5. Sample number 3 with coarse grain composition
6. Sample number 2 with medium composition

CONCLUSION

1. After conducting research on formation water filtration, it turns out that coconut shells have the ability to bind and absorb oil content due
2. The adsorption power of coconut shells based on their size is: (1) fine 600 ml / 200 gr (2) medium 550 ml / 200 gr (3) rough 450 ml / 200 gr (4) medium fine 560 ml / 200 gr (5) coarse fine 540 ml / 200 gr (6) while coarse 470 ml / 200 g.
3. Efficient composition of coconut shell size, namely the sample order number 6 (16), number 4 (15), number 5 (15), number 1 (14), number 3 (14) and number 2 (11).

SUGGESTION

1. More complete equipment is needed in the study so that the results of this study are more relevant.
2. Further research is needed on the ability of coconut shells to filter oil content.

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Table 1. Tools

No	Tools	Amount
1.	Beaker Glass	8
2.	Sepatula	1
3.	Funnel	1
4.	Thermometer	1
5.	Oven	1 Set
6.	Neraca Digital	1 Set
7.	Bucket	3
8.	Reaction Tube Rack	1 Set
9.	Measuring Pipettes	1
10.	Rubber Ball	1
11.	Centrifugal	1 Set
12.	Stopwatch	1
13.	Centrifugal Tube	2
14.	Sieve Shaker	1 Set
15.	Filter Set	1 Set
16.	Lesung	2 Set

Table 2. Material

No	Bahan	Jumlah
1.	Air Formasi	4 liter
2.	Batok kelapa	9 buah

Table 3. Sample Mass

Sample	Fine (100gr)	Medium (100gr)	Coarse (100gr)
Fine (100gr)	F (200gr)	SM (200gr)	SC (200gr)
Medium (100gr)		M (200gr)	MC (200gr)
Coarse (100gr)			C (200gr)

Table 4. Fluid Flow Rate Test Results

No	Size	Volume (ml)	Time (sec)	Debit (ml/sec)
1	Fine	200	97.00	2.06
2	Medium	200	39.18	5.10
3	Coarse	200	27.60	7.24
4	Fine Medium	200	44.11	4.53
5	Fine Coarse	200	38.66	5.17
6	Medium Coarse	200	29.18	6.85

Table 5. Sample Capacity Testing Results

No.	Siz	Mass (gr)	Capacity (ml)
1	Fine	200	600
2	Medium	200	550
3	Coarse	200	450
4	Fine Medium	100 100	560
5	Fine Coarse	100 100	540
6	Medium Coarse	100 100	470

Table 6. Results of Formation Water Content Testing

No Sample	Before					
	Cediments		Oil		Water	
	cm	%	Cm	%	cm	%
1	0.01	0.25	0.50	12.47	3.50	87.28
2	0.01	0.25	0.50	12.47	3.50	87.28
3	0.01	0.25	0.50	12.47	3.50	87.28
4	0.01	0.25	0.50	12.47	3.50	87.28
5	0.01	0.25	0.50	12.47	3.50	87.28
6	0.01	0.25	0.50	12.47	3.50	87.28

No. Sample	After (Average of 2 samples taken)					
	Sedimen		Oil		Water	
	cm	%	cm	%	cm	%
1	0.04	1.00	0,02	0.50	4.00	98.50
2	0.03	0.68	0.15	4.10	3.50	94.60
3	0.01	0.26	0.20	5.10	3.70	93.70
4	0.02	0.49	0.05	1.20	4.00	98.30
5	0.02	0.36	0.10	2.40	4.00	97.30
6	0.01	0.26	0.10	2.60	3.80	97.20

Table 7. Sample Assessment

No	Parameter	SAMPLE ASSESSMENT					
		1 (F)	2 (M)	3 (C)	4 (FM)	5 (FC)	6 (MC)
1	Flow Rate	1	3	6	2	4	5
2	Absorption Capacity	6	4	1	5	3	2
3	Sediment	1	2	6	3	4	6
4	Oil	6	2	1	5	4	3
TOTAL		14	11	14	15	15	16

Figure 1. Workflow

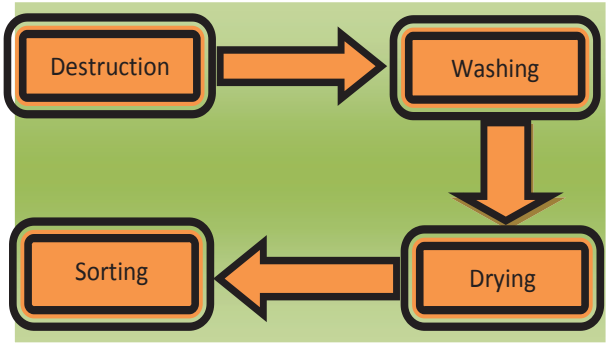

Figure 2. Destruction Process

Figure 2.Washing Process

Figure 3. Drying Process

Figure 5. Sorting

Figure 6. Size vs Flow Rate

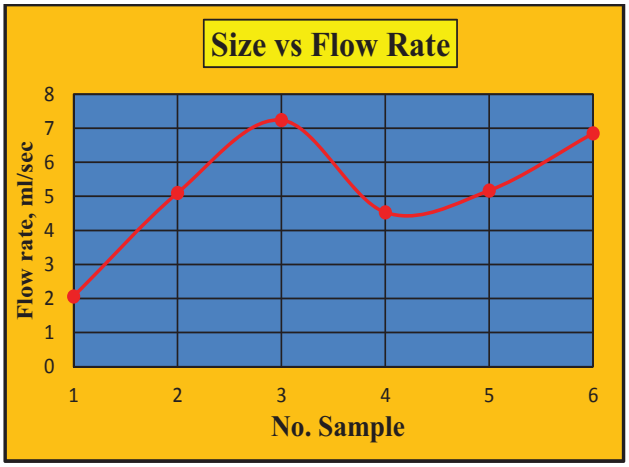

Figure 7. Size vs Absorbtion Capacity

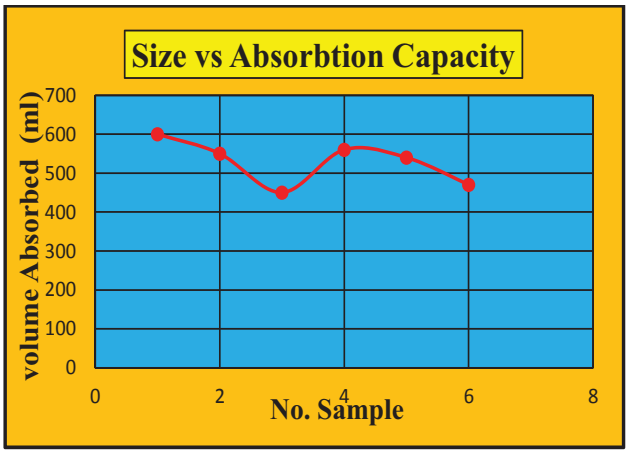

Figure 8. Percentage of Sediments Before and After Filtration

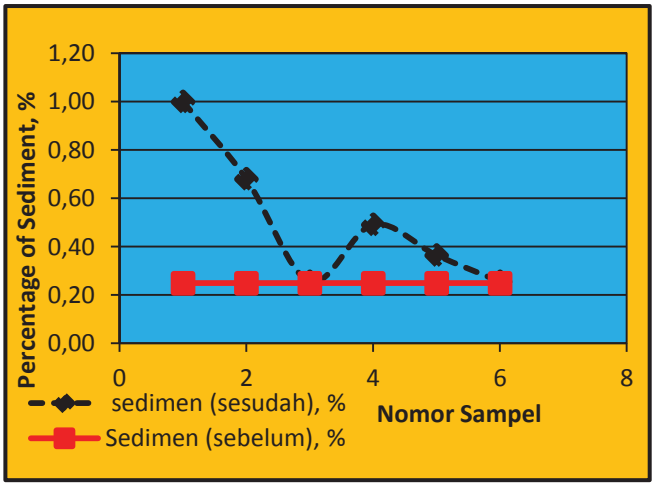

Figure 9. Oil Percentage Before and After Filtration