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Calculation of oil losses in dampas press in the pressing process of the screw press unit PT. Sumber Bumi Sawit Jadi Jaya

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ABSTRACT

This research was conducted at PT. Sumber Bumi Sawit Jadi Jaya. Oil losses are the percentage of oil that does not exist or is not included in the next oil processing process but is included in the marine process. The purpose of this study was to determine the percentage of oil loss contained in the dregs of the press using the soxhletation extraction method. Based on the results of the mass balance calculation, the number of components that enter the screw press is 22,401 kg/hour digester and 6000 kg/hour delusional water. The number of components that came out of the screw press were dregs press of 8,400 kg/hour and delution crude oil of 20,001 kg/hour. The results of this study indicate that the oil losses obtained in the pressing process are 4.45% or 373.80 kg/hour. This is in accordance with factory standards where oil losses are 4-6%.

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1. INTRODUCTION

The Palm oil is one of the main commodities that affect Indonesia's economic growth. Processing of Palm Fruit Bunches at the Palm Oil Mill is intended to obtain palm oil from the fruit flesh (mesocarp) and palm kernel (kernel) from the seed (Nut). The quality of palm oil is affected by the fruit in the garden, in the palm oil processing process it is only to extract it and reduce oil loss as little as possible[1]. Fruit that has been chopped in the digester unit is then pressed in the screw press unit. The pressing process is a process of pressing the fruit mass to separate the oil from the fruit flesh. During the pressing process, hot water is added to the screw press as a source of heat energy [2]. This aims for dilution (dilution) so that the mass of the fruit pulp that is pressed is not too tight. If the mass of fruit pulp is too dense, a high viscosity liquid will be produced which will complicate the separation

process thereby increasing oil loss. For this reason, water is poured into the fruit pulp that has been crushed so that the oil content in the fruit flesh comes out[3]. The diluent water used is usually 18-20% of the amount of processed FFB. The amount of diluent water given affects the oil losses in the fiber. If the amount of diluent water given is small, the oil produced is purer but losses are high[4].

In addition to the need for dilution in the pressing process, what also needs to be considered is the pressure and temperature of the palm oil mixture. The standard temperature for the pressing process at a palm oil mill (PKS) is between 90-95 oC. Temperatures below 900C will cause poor results when the palm dough is extracted. Unfavorable results like this still have a lot of palm oil attached to the extracted fibers[5]. On the other hand, the temperature of the palm dough above 950C will cause the dough to turn brown dry charred. The pressure at the screw press station in the process of pressing oil palm fruit is 50-60 bar. The by-product of pressing is dregs. The pressing process is the first station to start extracting oil from the fruit flesh by crushing and pressing loose fruit[6].

The mass balance of a process operating system in industry is a quantitative calculation of all the materials that are accumulated (stored) and wasted in the system. Balance calculations are used to find process variables that are not yet known based on the process variable data you want to find[7].

To prevent increased losses in the screw press, several things can be considered such as press pressure, temperature and also the addition of delusional water. The method of determining oil loss in the pressing process this time was carried out by the sokhlet extraction method. In the standard or norm of CPO losses, the limit for oil losses in the dregs press (press cake) must be around 4 – 6%[8].

The digester is a layered cylindrical tube and has a rotary axle equipped with a stirring blade. These knives are made to cross each other so that the stirring power of the knife is large enough and the blade is tilted so that the fruit is stirred up and down so that the pulverizing process becomes more perfec[9]t. This tool serves to pulverize Loose Fruit before being processed in a screw press machine. The main purpose of the digestion process is to prepare the fruit pulp for pressing so that the oil can easily be separated from the fruit flesh with the smallest possible loss. Several things must be considered in the mixing process. The oil formed in the mixing process must be removed because if the oil and water are not removed it will act as a lubricating agent so that the frictional force will be reduced in the press machine[10].

The digester must always be full or at least ¾ of the capacity of the digester, this is done so that there is pressure on the fruit inside the digester to enter the screw press so that perfect pressing will occur.

The chopped results from the digester will enter the screw press, where the function of the screw press is to squeeze out the chopped and crushed lumps from the digester to get crude oil. This machine consists of 2 mixed iron rods in the form of a spiral (screw) with a horizontal arrangement and rotating in opposite directions. Palm that has been crushed will be pushed and pressed by the cone on the other side, so that the palm fruit becomes squeezed. This tool is used to separate the crude oil from the pericarp[11].

This tool consists of a cylinder with holes in which there are two screws rotating in opposite directions so that the fruit pulp is pressed against the cones. Oil exits from the mixing boiler through the feeder screw or pressing section which has holes, and is then accommodated in the oil gutter. While the fibers and seeds are transported by cake breaker conveyor (CBC) to the separation and flow of oil on the feed screw, steam injection is carried out and hot water or delusional water is added with hydraulic pressure on the accumulator 50-70 bar. The crude oil extract from the screw press machine is then added to the condensate as dilution water. This mixture of crude oil and diluted water is called diluted crude oil (DCO). The added dilution water serves to facilitate the separation process between crude oil and sludge at the Clarification Station[12].

In the compression process, the fruit pulp that has been crushed will be squeezed out of the pulp densely from all directions and will be subjected to hydraulic resistance. The screw rotation will also bring the dregs out of the press to the Cake Breaker Conveyor for further processing. To make the oil extraction process efficient in the screw press, the things that must be considered are:

1. Process pressure. If the process pressure is not optimal, it can cause high oil losses or a high percentage of broken kernels.
2. The temperature of the fruit flesh that comes out of the digester must be 90-950C so that the oil separation can work perfectly.
3. The condition of the worm screw, press cage and cone must be considered including checking for wear, because it affects the yield of oil obtained, if the pore holes of the press cage are clogged then the oil will be carried out along with the dregs.

The pulp that has been crushed, the oil content should not be too little (because it has come out of the digester). This can cause the worm screw to easily wear out and if the oil content is not quoted from the digester it will also cause high oil losses. Therefore, monitoring of oil extraction must be maintained carefully.

The delusional water given to the screw press depends on the type of tool. Giving diluent water is done by watering the cake in the press from above the middle and/or in the chute screw press. The amount of delusional water given depends on the temperature of the delusional water, the higher the temperature of the diluent water, the less amount of water given. Giving too much diluent can result in:

1. High cake water content can cause the process of:
   - More difficult cake breaking in cake breaker conveyor (CBC). This often causes the CBC load to be too heavy.
   - The higher the water content of the dregs, the lower the heat of combustion which can reduce the capacity and efficiency of the boiler.
   - Ripening seeds with high water content in seed silos will be more and can lead to lower seed extraction efficiency.

2. Decreased screw press capacity due to increased water content and cake movement speed in the worm.

The amount of diluent water given, according to the experimental results on several screw presses, is 50-70% of the oil content in the dough, for example if the yield of oil is 22% with a screw press capacity of 10 tons of FFB/hour then the water sprayed as diluent is 1 .1-1.65 m3.

Loss comes from the word "lost" which according to the Big Indonesian Dictionary means no longer exists or is not visible. When it is associated with the process of producing palm oil into crude palm oil (CPO), oil losses are the percentage of oil that does not exist or is not involved in the next oil processing process but is carried over to other processes. The loss/loss figure for palm oil is the amount of oil that is not taken up in the processing process. In this oil losses analysis using socket extraction method. Soxhlet extraction is an extraction that separates oil and hexane. The principle of extraction for oil losses is to separate two substances with different densities, namely oil and hexane. The mass balance at the press station is the unreacted mass balance. The mass balance at the press station is calculated at the digester and screw press units consisting of a total mass balance and a component mass balance. The total mass balance in the digester consists of incoming and outgoing materials where the incoming material is loose and steam while the outgoing material is digester chunks consisting of oil, water and steam. Component balance in the digester consists of oil, water and NOS. The mass balance in the screw press also consists of a total mass balance and a component mass balance, the total mass balance consists of incoming and outgoing materials where the incoming material is chopped digester and delusional water while the outgoing material is press dregs and crude oil. The component balance in the screw press consists of oil, water, core, shell, fiber and mud. The mass balance is a precise calculation of all incoming, accumulated and outgoing materials in a certain time. This statement is in accordance with the law of the conservation of mass, namely: mass cannot be incarnated or destroyed. The general principle of a mass balance is to make a number of equations

that are independent of one another, where the equations are independent of one another, where the sum of the equations is equal to the sum of the unknown mass compositions[13].

2. RESEARCH METHOD

esearch conducted at PT. Sumber Bumi Sawit Jadi Jaya which is located in Hatonduhan District, Simalungun district, North Sumatra Province.

The tools used in this study were digesters, screw presses, desiccators, extraction flasks, analytical balances, ovens, hot plates, shocks and thimbles. Meanwhile, the materials used in this study were coconut bbrondola and also delusional water.

The work procedures used in this study are as follows:

1. Work procedures carried out in the laboratory:

Analysis of the water content contained in the dregs press (fiber).

- The empty cup is weighed as W1.
- Press dregs (fibre) is taken as much as 10 grams and then put into a cup and weighed as W2.
- The pressed dregs were dried in an oven at 103 OC for 3 hours and then cooled in a desiccator for 15 minutes and then weighed as W3.

Analysis on dregs press to calculate oil loss.

- The empty extraction flask is weighed as W4.
- The dried lead is put into the sokhlet.
- The extraction flask is assembled together with the sokhlet condenser and hot plate.
- Extraction was carried out for 5 hours using N-hexane solvent.
- N-hexane and flask filled with oil are evaporated in the oven for 15 minutes.

$water\ level = \frac{W_2 - W_3}{W_2 - W_1} x\ 100\%$ .....(equation 1)

$oil\ level = \frac{W_5 - W_4}{W_2 - W_1} x 100\%$.....(equation 2)

3. RESULTS AND DISCUSSIONS

Table 1. Tabulation of mass balance calculation results in the digester unit

No	Komponen	Masuk				Keluar	
		F¹=2001 Kg/jam		F²=20.400 Kg/jam		F³ = 22.401 Kg/jam	
		Persentase (%)	Laju Massa (Kg/jam)	Persentase (%)	Laju Massa (Kg/jam)	Persentase (%)	Laju Massa (Kg/jam
1	Minyak	-	-	40,26	8123,04	36,66	8217,2066
2	Air	100	2001	4,69	956,76	13,20	2,956,9320
3	Inti	-	-	3,96	807,84	3,61	808,6761
4	Cangkang	-	-	9,93	2025,72	9,04	2025,0504
5	Serabut	-	-	7,87	1605,48	7,17	1606,1517
6	Lumpur	-	-	33,29	6791,16	30,32	6791,9832
Jumlah		2001 Kg/jam		20400 Kg/jam		22401 Kg/jam	
Total		**22401 Kg/jam**				22401 Kg/jam	

Table 2. Tabulation of mass balance calculation results in the screw press unit

		Masuk	Keluar	

No	Komponen	F^3=22401 Kg/jam		F^5=6000 Kg/jam		F^5 = 8400 Kg/jam		F^6= 20001 Kg/jam
		Persentase (%)	Laju Massa (Kg/jam)	Persentase (%)	Laju Massa (Kg/jam)	Persentase (%)	Laju Massa (Kg/jam	Laju Massa (Kg/jam)
1	*Oil Losses*	36,66	8217,2066	-	-	36,66	8217,2066	7838,3919
2	Air	13,20	2956,9320	100	956,76	13,20	2,956,9320	5370,2685
3	Inti	3,61	808,6761	-	807,84	3,61	808,6761	-
4	Cangkang	9,04	2025,0504	-	2025,72	9,04	2025,0504	-
5	Serabut	7,17	1606,1517	-	1605,48	7,17	1606,1517	-
6	Lumpur	30,32	6791,9832	-	6791,16	30,32	6791,9832	6792,3396
Jumlah		22401		6000		8400		20001
Total		**28401**				**28401**		

The pressing station consists of a Digester unit as a place for counting loose lumps and a Screw Press as a place for separating crude oil from the mixed mass by means of compression. To find out the balance between incoming feed and outgoing product in the pressing unit, it is necessary to calculate the mass balance.

The mass balance calculation is based on a processing capacity of 30 tons/hour that the loose fruit digester enters 68% of the total processed FFB, which is 20,400 kg/hour consisting of 6 components, namely oil of 8,213.04 kg/hour, water of 956 .76 kg/hour, core of 807.84 kg/hour, shell of 2025.72 kg/hour, fiber of 1605.48 kg/hour, and mud of 6791.16 kg/hour, with a temperature of 660C. Then chopped in the digester with the addition of steam as much as 2,001 kg/hour at 123ºC. After the loose lozenges are chopped, they are then pressed in a screw press with an inlet rate of 22,401 kg/hour. During the pressing process hot water (delusional water) is added as much as 6,000 kg/hour at 95ºC into the screw press as a source of heat energy. This aims for dilution (dilution) so that the mass of the slurry that is pressed is not too tight and makes the pressing process easier. The main product of the screw press is crude oil which consists of 7,838.3919 kg/hour of oil, 5,370.2685 kg/hour of water and 6,792.3396 kg/hour of sludge. And the by-products are dregs with a composition of 373.80 kg/hour of oil, 3,585.96 kg/hour of water, 808.92 kg/hour of core, 2,025.24 kg/hour of shell, and 1,606.08 kg of fiber. /O'clock.

Determination of oil losses is carried out by the soxhletation extraction method. Where as much as 10 g of sample (fiber) was taken and then brought to the laboratory to check the water content and oil losses. The fiber was dried in an oven at 103˚C for 3 hours to remove the moisture content. Then the dry sample was extracted with N-hexane for 5 hours to extract the oil in the sample. And obtained oil losses of 4.45% and water content of 42.69%. Oil losses obtained are in accordance with the norms of oil loss in the factory, namely 4-6%.

4. CONCLUSION

Based on the results of the analysis that has been carried out, it can be concluded that:

The percentage of oil loss obtained from the dregs of the press is 4.45%, The amount of oil losses in the screw press unit with a sample of press pulp (fiber) is 373.80 kg/hour.

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