THE EFFECT OF SOLUTION SODIUM HYDROXIDE (NAOH) DOSAGE AND CONCENTRATION OF ORGANIC MATERIAL DEGRADATION PROCESS OIL PALM EMPTY FRUIT BUNCHES (ELAEIS GUINENSIS JACQ)

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Abstract— This study investigates the influence of Sodium hydroxide (NaOH) ondegradationprocess of organic materialpalmempty fruit bunches. The aim is to identify concentration (dosage)ofNaOH solutionneeded todegradecomponents of bunch empty fruits. The study was framed on Gomez and Gomez (1995) split plots experimental design. A 2cm size reduction was done prior to NaOHtreatment. NaOH treatment carried out with three times the dose variation spraying with a concentration of (1) 60 grams = 600 milliliters (ml) ,800ml, 1000ml , with a concentration of (2)80 grams (600 ml , 800 ml , 1000ml) and (3) 100 grams of a concentration (600ml , 800ml , 1000ml) then the curing process is carried out for 14 days. Curing process included water content, crude fiber content, and carbon-to-nitrogen ratio (C/N). Observationsexperiment after14daysof curingincludewater content, carbon, ash, crude fiber, andC/N. Research reports indicate that the dose and concentration of NaOH affect the water content , crude fiber content , and C / N but did not affect the ash content . The results showed that NaOH dosage of 80 grams and 600 ml NaOH concentration shown by the low crude fiber content, another word the maximal degradation fiber on a variety of treatments.

Keywords— C/N, Degradation, fiber content, NaOH, oilpalmempty fruit bunches,

I. INTRODUCTION

Palm oil plant (elaeisguinensisjacq) growths rapidly in Indonesia.It produces 25 tons of fruit fresh bunch (FFB)for one hectare / year (Anonymous, 2007) which contains approximately 22-25% of crude palm oil (CPO) oil extraction (Pahan, 2007.p 221). Processing of FFB will produce some sides products such as oil palm empty fruit bunches (PEFB) of about 23%, palm kernel 25%, and shell 20% (Purwadi, 2007). In 2006 the number of palm oil millfactories reached 317 which mostly located on the island of Sumatra, Indonesia. The factories can produceas much waste PEFB 15.2 million tons / year. The availability of thiswaste PEFBis not used optimally. The contentsof lignohemiselulosa on PEFBare: cellulose is about 40-60%, hemicellulose is about 20-30%, lignin is about 15-30% (Dekker, 1991). The length of duration of degradation ofPEFB causes the available of land will not be able to accommodate PEFB waste generated every day, so we need a technology that can accelerate the degradation of PEFB waste process.

Chemical treatment which is using sodium hydroxide is a strong alkali that deemed most effective in accelerating the degradation of the content oflignohemiselulosa on PEFB. Compared to the use of microorganisms that require a relatively long time and the problems that often arise due to the large loss of organic materials used by microbes as a source of nutrients during the degradation process underway (Anonymous, 2007).

II. LITERATURE REVIEW

Palm Oil Plant growths well in tropical countries with the temperature or 29-30 Cwith the sun shine about 5-7 hours per day, while ideal humidity is about 80-90% and rainfall is about 200-2500 mml per day.
Palm Oil Plant can growth on certain lands such as Podzolicland, Latosolland, and Alluvial land with the degree of maximum PH 4,0 – 5,5, while the height of the land is up to 5000 meters above sea level (Anonymous, 2007).

Palm Oil Plant can be classified as follows:

Division	: *EmbryophytaSiphonagama*
Class	: *Angiospermae*
Ordo	: *Monocotyledonae*
Family	: *Arecaceae*
Subfamily	: *Cocoideae*
Genus	: *Elaeis*
Species	: *E.guineensisJacq*

1. Bunches of palm oil
Each of the branches of palm oil has 10-18 palm fruits hanging from perfection pollination. Comparison with fruit and bunches (60-70%) and about 30-40% in the form of PEFB (Corley, 2003). But in the turn processing the amount of PEFB occupies 23% of the bunches (Corley, 2003). Palm empty fruit bunches (PEFB) contains nutrients that needed by the soil such as: 42.8% Carbon, 2.90% K2O, 0.80% nitrogen, 0.22% P2O5, 0.30% MgO and

micronutrients other B 10 ppm, 23 ppm Cu and 51 ppm Zn (Singh et al, 1990).

Table 2.1 Chemical Ingredients of palm empty fruit bunches

Component	Pratiwi (1988)	Darnoko (1990)	Khoo 1991)
cellulose (%)	36,81	49,95	42,7
Hemicellulose (%)	15,70	22,84	27,3
Lignin (%)	27,01	16,49	17,2
Ash(%)	6,04	1,23	0,70

Source: Nugroho, et al ,. 1999

2. The Degradation of Cellulose using NaOH

NaOH alkaline treatment (4%) on a substrate produces cellulose degradation is higher than that of the untreated substrate alkali (Chalal, 1982). Alkali treatment can cut most of the bonds between the cellulose and hemicellulose and lignin because alkali has the ability to reduce the hydrogen bonds in cellulose molecules that cause the fibers to swell (Anonymous, 2007).

NaOH can break the glycosides bonds between glucose units (Hanafi, 2004),because an OH group on NaOH can bind oxygen elements via hydrogen bonds to the oxygen of carbon number two and number six carbon oxygen glucose molecules. Hydrogen bonds are formed causing tensile force is stronger than the pull force glycoside bond between the individual units D-glucose (Narsito, 1985). Discontinuation of the unit of the D-glucose causes a decrease in DP cellulose (Lindberg, 1956; Mutton 1964; Fengel and Wegener, 1995).

3. The degradation of lignin using NaOH

Lignin can be degraded by alkali,the alkali activity in that lignification process begin with the entrance of alkali to wood cell by phenol acetate activity from lignin. Goyal et al, (1992) adds the process of hydrolysis on lignin produces compounds fenilpropanathat derived from dimer at a concentration of 60% NaOH. Alkali activity that occurs by cutting the hydrogen bridge linking lignin to cellulose thereby increasing the flexibility of the cell wall (Brwon et al., 1952 in Marwin Leonardo 1993).

4. Degradation of hemicellulose with NaOH

Hemicellulose degradation using a solution of KOH 24% or 17.5% NaOH will produce simpler compounds that is glucomannan. Degradation of hemicellulose using H2SO4 0.1% will produce xylose (Beall and Eickner, 1970; Maryana 2005).

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B. Flowchart Research

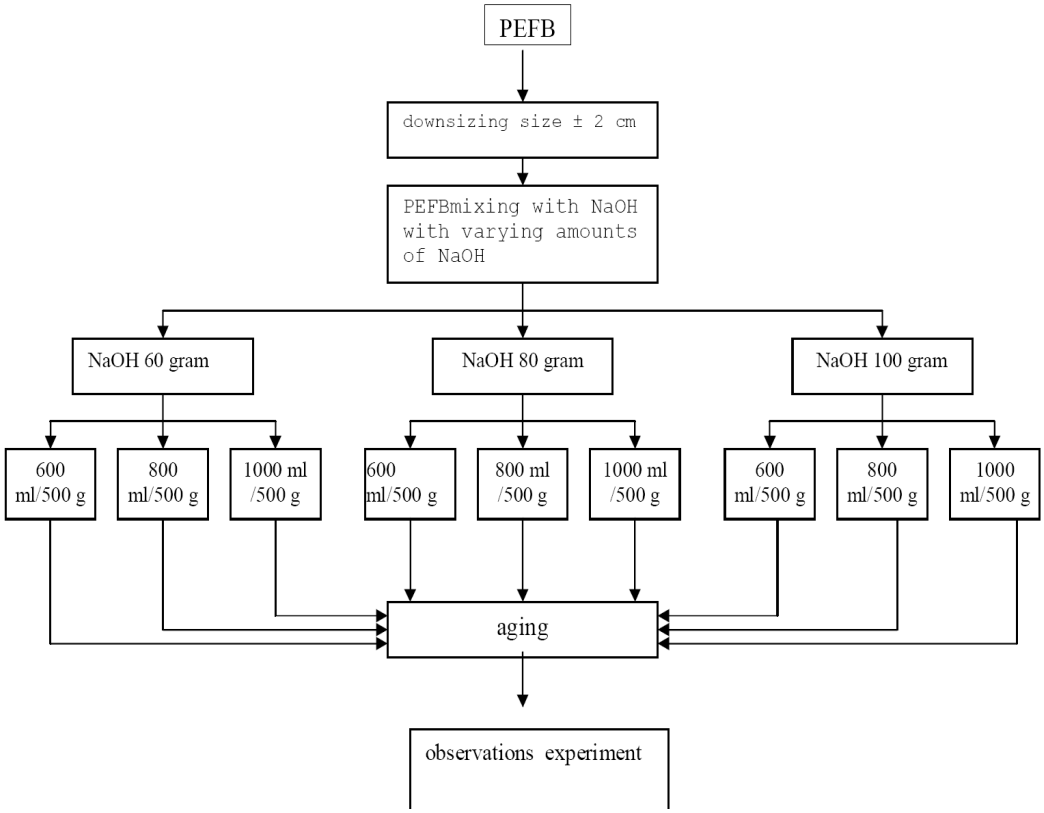


Figure 1 : Flow diagram degradation Palm Empty Fruits Bunches uses a variation dosage NaOH and concentration NaOH

C. Discussion

The parameters of the degradation of the chemical components of oil palm empty fruit bunches (EFB) resulting from the addition of NaOH and the volume of water includes the analysis of: water content , ash, fiber, the nitrogen, carbon , and C / N.

Table 1 :Mean results of the analysis of materials (before treatment)

Average	water	Ash	Carbon	nitrogen	Crude fiber
	10.12965	63.032682	27.458	0.85904463	63.03268248

The average of all observations of the chemical composition degradation of PEFBwhich is derived as follows :

Table 2: The results of the average of componentschemical observations degradationPEFBgenerated as follows

dosageNAOH/500 kg PEFB	concentration/500 kg EFB	water	Ash	Carbon	nitrogen	fiber	C/N
(B.1) 60 gram	(L.1) 600 ml	19.90	16.83	33.71	1.01	28.22	34.69
	(L.2) 800 ml	12.79	15.33	30.97	1.05	52.74	29.53
	(L.3) 1000 ml	12.74	14.70	38.92	1.03	59.40	37.65
(B.2) 80 gram	(L.1) 600 ml	11.69	17.94	42.33	0.98	60.15	42.87
	(L.2) 800 ml	9.95	16.88	44.88	0.80	48.12	55.63
	(L.3) 1000 ml	10.07	18.50	41.22	0.95	49.15	42.97
(B.3) 100 gram	(L.1) 600 ml	11.34	24.16	45.19	0.85	47.58	52.98
	(L.2) 800 ml	10.01	20.14	43.69	0.80	41.30	54.12
	(L.3) 1000 ml	13.21	27.26	51.39	0.81	43.67	64.26

PEFB = Palm empty fruit bunches

1. The water content

The mean results of the additional of water volume (L) obtained data that L1 = 14.315367%, L2 = 10.922658%, L3 = 12.010252%. It showsthat the additional of 600 mlwater producedthe highest water content in PEFB. The mean results of the additionalNaOH (B) to water content PEFB in Table 4. shows B1 = 30.29%,B2= 21.15%, and B3 = 23.05%. The average shows that the additional of NaOH 80 grams has the highest water content, This is because the provision of NaOH 80 grams is the maximum in degrading the fiber at PEFB, so many generating unit of glucose from the degradation of the fiber binding water.

2. The ash content

Tabel 5 shows that the additional of water and NaOH does not affect the ash content of PEFB. It is possible caused of the additional of NaOH, it will increase the salt content of PEFB and will bind minerals contained in the ingredients (Sudarmadji, 1996), at the time of incineration of materials, it is not all materials burned, it is caused ash content remains high.

3. The content of crude fiber

The mean results of the additional of water volume (L) obtained data that L1 = 45.320188%, L2 = 47.392737%, and L3 = 50.744892%. The data showed thatthe less additional water the lower fiber content PEFB . With the low levels of fibers content obtain, it is indicating the maximum EFB fiber degradation. This is due to fewer additional of water, so the concentration of NaOH is higher. The mean results of the additional of NaOH (B) effect on fiber contentPEFB produced, the average fiber content in additional of NaOH treatment on Table 7 shows B1 = 93.58%, B2 =104.96%, and B3 = 88.38%. Based on these results it can be seen that the additional of NaOH as much as 100 grams produced the maximum fiber degradation PEFB. It shows that the more of NaOH the higher process of degradation . Alkali has the ability to reduce the hydrogen bonds in cellulose molecules crystals, so that cellulose swells and parts of Crystalline cellulose will be reduced, causing a cellulose Swelling Loose ties lignocellulose and cell of lignohemiselulosa become weak (Mandels, 1924).

Levels of nitrogen

The absence of real different in additionalof water volume and the additional of NaOH at levels of nitrogen. During the degradation processNaOH raised carbon, the rising of carbon allegedly because of glucose produced during the degradation of the fiber by NaOH. From the above statement the degradationof usingNaOH able to increase this carbon. This is caused of the additional of NaOH had no effect on levels of nitrogen.

4. Content of Carbon

The mean results of the additional of water volume (L) affect the carbon content. Table 10 shows. The L1 = 40.414166%, L2 = 39.849631%, and L3 = 43.847626%. Based on the average can be seen that the additional of 800 ml of water produced the lowest carbon content. The mean results the additional of NaOH (B) of the carbon content, shows on Table 11. B1 = 9.07311453%, B2 = 85.6295145%, and B3 = 93.5202167%. It can be seen that the lowest additional of NaOH 60 grams is the maximum cut ties “C”.so the amount of carbon produced is lower.

5. Content of C / N

The additional of NaOH and the water had no effect on content of C / N (PEFB) due to the additional of NaOH and additional of water is not able to lower the C / N ratio but increases the ratio of C / N PEFB

CONCLUSION

From previous observations and the results of discussions researcher can draw conclusions as follows:

1. Additional of water affect the fiber content, carbon and water on PEFB, and has no effect on C / N and the nitrogen content.
2. The additional of NaOH does not give effect to the C / N ratio PEFB.
3. The additional of NaOH B1 (60 g), B2 (80 g), and B3 (100 g) gives a different effect on the parameters of fiber content and carbon content. B3 (100 g) with the additional of 600 ml of water is the maximum in lignohemiselulosa fiber degradation.

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