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Variation of Resurrection Duration Using 0,50% NaOCl Solution on Delignification of Mahoni Wood Powder Waste (Swietenia Macrophylla King)

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Abstract--- *Cellulose is one source of the synthesis of ethanol contained in various plants, including mahogany. In the synthesis of ethanol from plants, delignification process is required to degrade lignin that binds the cellulose in this wood. This research conducted to determine the optimal conditions delignification of mahogany. The studies initiated by smoothing wood, then sievedusing a sieve mesh no. 60 for similarity of size and increase the surface area. It followed by soaking the powder using a saline solution of 0.50% NaOCl as delignification within 27, 28, 29, 30, 31 and 32 hours. Then it followed by extraction of mahogany extractive substances using benzene and ethanol with soxhlet extractormethod, and followed by testing lignin with Klason method through H2SO4withprinciple cellulose hydrolysis using sawdust in order to obtain residual lignin deposition. The results showed the most optimal time delignification process was 30 hours of immersion that is a decrease of 10.05% lignin degradation with the highest rise as much as 0.20%.*

Keywords--- *mahogany, delignification, NaOCl, lignin*

I. PREFACE

Indonesia has the potential of wood waste that is abundant, such as waste from the remains of the manufacture of construction materials, furniture and other processed products (Falah Set all, 2007-2012). One of it is wood mahogany tree (Swietenia macrophylla King.) which are found in urban areas as in the provinces of Jakarta, is used as water absorber trees and can reduce the high levels of pollution in urban areas (Nazaruddin, 1996).The higher the utilization, the fewer natural resources that can be usedfor the synthesis of ethanol. One of the natural resources that can be utilized to produce ethanol is residual wood processing. Manufacture of bio ethanol from wood waste containing ligno cellulose,through four stages: pre-treatment, hydrolysis, fermentation, and purification of ethanol (Mosier, Wyman, Dale, Elander, Lee, &1Holtzapple, 2005). Lignin can interfere with the process of hydrolysis because it would inhibit the activity enzymes in the yeast in the conversion of simple sugars into ethanol (Wiratmaja, Kusuma, & Winaya, 2011).*Pre-treatment* also called delignification, delignification aims to reduce the lignin content in berligno cellulose material. In order make bio ethanol production process better, lignin that binds the cellulose will make bio ethanol process not perfect, so we need to be open delignification of lingo cellulosic structure in

order to make cellulose easily extracted. Delignification process is dissolving the lignin content in biomass materials so that lignin easily separated from other fibers (Sumada, Tamara and Fiqh, 2011).

In some studies, the delignification commonly used chemical method by comparing the variation of corncob powder immersion time (Zea Mays) using NaOH 10%, ie for 12, 16, 20, 24, 28, and 32 hours at room temperature. From these results, the highest weight of cellulose obtained at the time of 28 hours with a weight of 5.729 g while the lowest weight was obtained in 12 hours at 2,452 g (Syaiful Bahri and Nurhaeni, 2008).In other studies, there is also wastedelignification seaweed (Eucheuma Cottonii) by immersionNaOCl0.25%, 0.50% and 0.75% at 100 ° C for 30 minutes. From these studies obtained the highest ethanol content of 14% is generated from NaOCl 0.50% (I Nyoman Wijaya, I Gusti Bagus and I Nyoman Suprapta, 2011).Mahogany wood delignification (Swietenia macrophylla King.) has not been studied, therefore it is necessary to do further research on mahogany wood delignification process in decreasing the lignin content, so it resulting the maximum bio ethanol. This experiment uses a concentration of 0.50% NaOCl and looks at soaking time variations at room temperature.

II. RESEARCH METHODS

Tools

The tools used in the present study is Analytical balance, Beaker glass, flask, pipette, measuring cup, stir bar, pipette measure, rubber bulb, thermometer, pH indicator, spray bottle, filter paper, funnel glass, filter Buchner, saucer steam, water bath, stone Boiling,pumpkisolvent (solvent), heating mantle, desiccator, 2condenser, extractor, chiller, plastic basin, No. 60 mesh sieve, blender, oven, water bath, magnetic stirrer, stir bar, hand gloves.

Material

Wood shavings mahoganytrees (Swietenia macrophylla King.), Sodium Hypochlorite (NaOCl) of 0.50%, concentrated sulfuric acid (H2SO4) 72%, benzene (C6H6) pro analysis 99.89%, ethanol (C2H5OH) 95%, and aquademineralized ,

Research procedure

Sample Preparation Saw Dust

Mahogany sawdust waste (Sweeteniamacrophylla King) washed cleanly of impurities using aquademineralized then dried with aerated at room temperature. Mahogany wood powder cut into smaller size, then dried using an oven at 50 ° C for 24 hours. Once dried, crushed with a blender and sieved with a sieve mesh no. 60 resulting the smoother and identical powder, then stored in clean and covered containers.

Delignification Process

A total 5 gram samples of wood powder put in a 50 ml glass beaker, then add a delignification in form of NaOCl 0.50% saline solution 50 ml or in comparisons sawdust 1: 10 delignification . Then it soaked for 27 hours, 28 hours, 29 hours, 30 hours, 31 hours, and 32 hours while stirring a few times during the immersion process samples. After that, it filtered using filter paper and funnel glass 75 mm. The precipitate is filtered, then separated and washed with aquadem until neutral pH, then put in a petri dish, and then dried in an oven with a temperature of 55 ° C for 24 hours.

Extraction of impurities

Wood powder that has been delignified with a solution of NaOCl and conditions of the powder is dried and then mahoganypowder extracted with soxkhletextractormethod using ethanol 95% and benzene pro analysis of the ratio of 1: 2 for 6 hours at a temperature of 60 ° C so that withinone hour occurs five times the circulation of the solvent. After that, the sample powder that rinsed with aquademin and filtered using filter paper and funnel glass of 70 mm and then transferred into a saucer steam to dry at room temperature. The mahogany3extractive components substances in the form of sap, resin, wax, tannin and alkaloid (Walker, 1993)

Determination of lignin

The process of determining the lignin content in the present study using Klason method, namely by including 1 gram sample of sawdust-free test extractive into a 50 ml beaker and add 15 mL sulfuric acid 72%. The addition is done slowly in a soaking bath at a temperature (20 ° C ± 1 ° C) while stirring with a stir bar for 2 to 3 minutes. After it perfect dispersed, cover the beaker with a watch glass and let the marinade bath for two hours and stirring at all times during the process. Put 300 mL aquademin into 1000 mL glass beaker, then add soaked wood powder and sulfuric acid previously. Added another 575 mL aquademin slowly into the glass beaker so that the concentration becomes 3%. Then the glass beaker using a water bath heated to boiling for one hour withkeeping the fixed volume of the solution, and then allowed to stand at room temperature until the precipitate is perfect. Then filter the solution using a known weight filter paper. The precipitate washed until neutral, and then the filter paper containing lignin precipitate dried in an oven at 105 ° C, and then weighed. Dried precipitate weighed calculated using the formula:

Lignin content (%) = x 100% .... (1)

A = weight of sawdust before testing

B = weight of dried sawdust after testing

III. RESULTS AND DISCUSSION

Extraction Substance Impurities (SNI 1032 1989)

Impurities Extraction is taken to minimize errors on qualitative and quantitative analysis of lignin. Extraction of impurities carried by sokhletasi method using ethanol 95% and benzene pro analysis (2: 1), it is done to minimize the use of organic solvents. In this case the impurity is expected to be dissolved well so that the process of determining the lignin content is not disturbed by the presence of impurities. This process is carried out for 6 hours in order to maximize the extraction of powder. If solvent has turned into a dark brown or dark brown, it indicate already dissolved the solvent (Tondra, 2011).

Determination of Lignin Content (SNI 0492 2008)

Delignification process begins by soaking the sawdust with aquadem, used as a standard raw. This is done to se th effect of NaOCl against wood delignification process. The next process is carried out delignification with 0.50% NaOCl solution with a time of 27, 28, 29, 30, 31 and 32 hours. Then do the assay with Klason method to determine levels of lignin in wood.

The process of determining the lignin content need to use Klason method, this method has the remaining lignin isolation principle of delignification process. This process is done by soaking the samples using H2SO4 that make polymerized cellulose and hemicellulose as the largest component constituent mahogany inside the sawdust into the solvent (Fengel and Wegener, 1995), so the color of the solvent turned into a light brown-black after soaking and stirring for some time.

When the soakingtimeis finished then it becomes more brownish black color due to the dissolution of the cellulose, it is caused by a hydrolysis reaction that occurs in sulfuric acid and cellulose. Hydrolysis reactions that occur can be seen in the following figure.

Figure 5. Hydrolysis Cellulose Reaction of Sulfuric Acid

The picture above shows the hydrolysis reactions that occur in the process of determining the lignin content Klason method. Cellulose can be reacted with sulfuric acid to break the ties of 1,4- glycosidic, then each monosaccharide molecules bind to oxygen atoms (O) of sulfuric acid so that it becomes glucose is a simple sugar that is dissolved in sulfuric.

Lignin Content Analysis

The analysis results of the sawdust delignification using Klason method with a solution of 0.50% NaOCl concentration, and variations in the duration of immersion for 27, 28, 29, 30, 31, and 32 hours are described briefly in the following table.

No.	Soaking time (Hour)	Lignin levels Remaining (%)	Lignin levels Unraveling (%)
1	27	17.75	9.61
2	28	17.58	9.78
3	29	17.51	9.85
4	30	17,31	10.05
5	31	17.30	10.06
6	32	17.28	10.08

From the table above, it can be explained that the NaOCl solution concentration of 0.50% for 27 hours to degrade lignin by 9.61%, so that the lignin content in the powder become 17.75. Soaking for 28 hours resulted in a decrease in the higher lignin content is 9.78% with the remaining lignin content with a difference of as much as 17.58% of the previous lignin content increased by 0.17% in 1 hour time difference. Soaking 29 hours leaving lignin as much as 17.51%, which means a decrease in the lignin content of 9.85%, this decrease is higher by 0.07% from the previous.

Soaking for 30 hours lower the lignin content of 10.05% of the initial content of lignin be 17.31%, the decline increased by 0.20% from the previous. Soaking for 31 hours degrade lignin by 10.06% to 17.30% residual lignin, the comparison with the previous level of 0.01%. Soaking for 32 hours degrade lignin by 10.08% to 17.28% residual lignin, the comparison from the previous 0.01%. The duration of the analysis obtained most effective in powder soaking mahogany with a solution of 0.25% NaOCl is 28 hours, which has an increase in lignin degradation by 0.17% from the previous immersion duration.

Decomposed lignin content at this stage can be illustrated by the graph below.

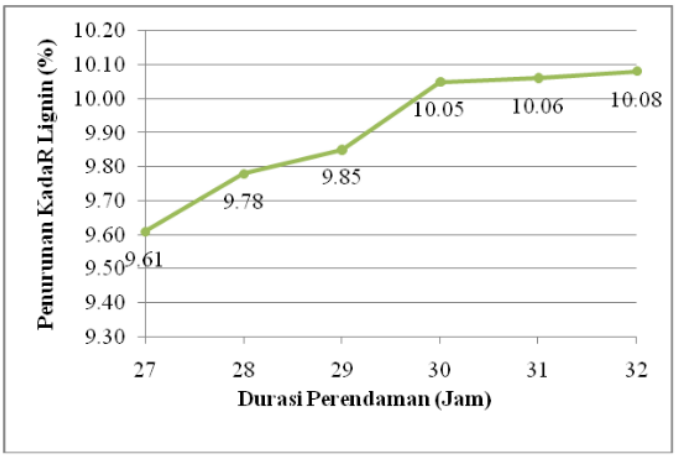

Figure 6. Levels of Unraveling lignin on the Mahogany powder delignification Using 0.50% NaOCl solution

Variations in the duration of immersion are done in order to get the most optimal and effective conditions in the delignification processmahogany wood dust. Results of analysis using *Klason* test with the principle of insoluble lignin isolation sulfuric acid. The picture above shows a comparison of the degradation of lignin in the delignification process. The changes in concentration of lignin degradation achieved on the difference in the duration of soaking the sawdust seen increased with longer duration of immersion achieved in delignification process.

Delignification results observed from the data mahogany powder using a variation of immersion time by0.50% NaOCl solution, obtained the most optimal conditions for lignin degradation. The condition is obtained from the difference between the reduced amount of lignin obtained when delignification. Starting from immersion duration of 27 hours to 30 hours increase in the amountof lignin significant shrinkage.

It thought due to the prolonged interaction between the solvent NaOCl with mahogany wood dust samples, so that the solvent has a compound Chlorine (Cl) as delignifikator aimed only to break the bonds between lignin becomes unstable and reacts with the cellulose and hemicellulose. When solvents as these oxidants react with other compounds, the effect of the termination of the lignin is not optimal

Data analysis

From the data analysis results obtained, further advanced analysis with statistical tests one-way ANOVA method, is useful to look at the influence of the effective time of soaking the sawdust with0.50% NaOCl solutionto the delignification process mahogany sawdust. From the statistical test known that the hour to 30, 31 and 32 there is a difference of Meaningful10.0450, 10.0600 and 10.0750 with sig. 0.008 <0.05, It is apparently there is a difference in the delignification process of soaking time 30, 31 and 32 hours.

IV. CONCLUSION

Based on the conducted research, Mahogany wood delignification (*Swietenia macrophylla* King.) using NaOCl solution concentration of 0.50% with a variation of the duration of immersion for 27, 28, 29, 30, 31 and 32 hours at room temperature there is significant different that is delignification process at the time of immersion 30, 31 and 32 hours.

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