Characterization of α-Cellulose from Bagasse Cane Bz 132 (*Saccharum officinarum*)

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Abstract: A study concerning the separation of α - cellulose from bagasse were conducted using Okhamafe. The first stage is the preparation of bagasse powder type Bz 132. Stage second is the separation of α - cellulose from bagasse is done with the method Okhamafe done by immersion in 3.5 % HNO acid, bleaching with Sodium Hypochlorite 1.75 % and purification with 17.5 % NaOH. The third stage is the characterization of α - cellulose from bagasse types Bz 132 showed visible surface with large round -shaped grains are almost the same size (uniform). This may indicate that the resulting α - cellulose has a form of homogeneous size (as large). From the analysis of functional groups with the free OH groups visible wave number 4001.50 cm-1 which shows a typical chain of cellulose CH2OH and OH hydrogen bonds with wave number 3437.30 cm-1 as supporting data. Of the thermal test with test results obtained DTA melting point at a temperature of 60oC and 320oC decomposition point.

1 INTRODUCTION

Sugarcane is one of the agricultural commodities containing lignocellulose so that it has the potential as a raw material in the manufacture of biodegradable composites. So far the use of sugar cane is still limited to the sugar processing industry by only taking the water, while the pulp of about 35-40% of the weight of sugarcane milled is only used as industrial fuel or may be disposed of so that it becomes waste (Krisna, 2009). Cellulose is the main constituent part of woody plant tissue. The ingredients are mainly found in perennials, however, cellulose is basically found in every type of plant, including seasonal plants, shrubs and vines, even the simplest plants. Such as: mushrooms, algae and mosses (Tarmansyah, 2007). Separation of α-cellulose from corn cob fiber was carried out by Okhamafe by taking fine and dry fibers from corn cobs which were then immersed in 3.5% HNO3 containing a number of NaNO3 at 900C for 2 hours. The mixture is then soaked and heated with 2% NaOH and 2% Sodium Sulfite at 50oC for 1 hour, then bleached with Sodium hypochlorite (Ohwoavworhua, 2005). Based on the descriptions above, the researcher was interested in conducting research on the extraction of α-cellulose from sugarcane bagasse Bz 132 (*Saccharum officinarum*). The results of α-cellulose from sugarcane bagasse Bz 132 (*Saccharum officinarum*) were obtained analyzed by functional groups by Fourier Transform Infrared Spectroscopy (FTIR) test, analysis of morphological properties by Spectra Electro Magnetic (SEM) test, thermal properties analysis with Differential Thermal Analysis (DTA) test. This study is expected to provide information about the analysis of the properties of α-cellulose from sugarcane bagasse Bz 132 (*Saccharum officinarum*) which is expected to be able to increase the economic value of bagasse waste.

2 MATERIALS AND METHODS

2.1 Research Location

This research was carried out at the Kimia Terpadu Universitas Sumatera Utara, the SEM test was

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conducted at the PPGL Laboratory, the DTA test was conducted at the Politeknik Teknologi Kimia Industri (PTKI), the FTIR Test was conducted at the Bea Cukai Belawan Laboratory.

2.2 Methods

2.2.1 Preparation of Sugarcane Bagasse

Discarded the skin of sugarcane bagasse type Bz 132, milled with a grinder, extraction wet bagasse from sugarcane waterdir. Wet bagasse washed with water, soaked in water for 2 hours, dried under the sun for 6 days, cut to from fine fibers, mashed up and get dry sugarcane bagasse.

2.2.2 Extraction of α -Celullose from Bagasse Cane Bz 132

About 75 gram of Bagasse cane put into beakerglass, added 1000 mL of HNO_3 with 10 mg of $NaNO_2$, dipped for 2 hours in the water bath, washed and filtrate, residue was heated with 375 mL NaOH 2% and 375 mL Na Sulfite 2% with temperature 50oC for one hour, washed and filtrated, residue was heated with 500 mL sodium hypochlorite 1,75% for 0,5 hour with temperature 100ºC for 0,5 hour, washed and filtrated until neutral pH. Cellulose (residue) added 500 mL NaOH 17,5% and heated for 80ºC, washed and filtrated until neutral pH., wet alpha cellulose dried with oven 60ºC, and saved in desiccator, characterization with FTIR, SEM, and DTA test.

3 RESULTS AND DISCUSSIONS

3.1 SEM Analysis of α -Celullose Bagasse Cane Bz 132 (*Saccharum officinarum*)

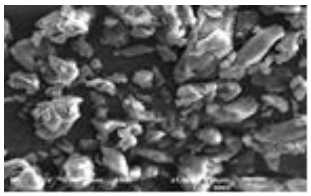

Figure 1: Test results of α-cellulose SEM from bagasse pulp Bz 132 (*Saccharum officinarum*).

Figure 1: is the result of SEM photos of the surface of α-cellulose from bagasse Bz 132 (*Saccharum officinarum)* with a magnification of 1000 times. Visible round nutiran surface with almost the same size (uniform). This can show that the resulting α-cellulose from sugarcane bagasse Bz 132 (*Saccharum officinarum*) has a homogeneous size.

3.2 the Cross-Linked Al-CMC

The following are the results of α-cellulose FTIR test from bagasse Bz 132 (*Saccharum officinarum*).

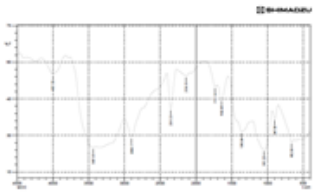

Figure 2: α-cellulose FTIR Test results from sugarcane bagasse Bz 132 (*Saccharum officinarum*).

Table 1: The spectra of FT-IR analysis of α-cellulose from bagasse Bz 132 (*Saccharum officinarum*) provide absorption spectrum peaks with wave numbers.

Functional group	Wavenumber	Shriner. (2004)
Free O-H group	4001.50 cm^{-1}	3500 – 4000
O-H hydrogen bond	3437.30 cm^{-1}	3330 – 3500
C-H streching	2898.17 cm^{-1}	2840 – 3000
C-O carbonil Cyclic ring	1380.84 cm^{-1} 897.90 cm^{-1}	1200 – 1400 800 - 900

From the FTIR spectra of α-cellulose from sugarcane bagasse Bz 132 (*Saccharum officinarum*) it is seen that the OH Group is free with wave numbers 4001.50 cm^{-1} which shows the CH chain that is typical for hydrogen cellulose and OH bonds with wave numbers 3437.30 cm-1 as supporting data. And there is a CH stretching at wave number 2898.17 cm^{-1} which proves the existence of CH bonds at the end of cellulose and carbonyl CO at the wave number 1642.46 cm^{-1} which is also a typical group of cellulose supported by fingerprint region finger 897.90 cm^{-1} which shows a cyclic ring chain. So it can be concluded that there are cellulose compounds in the spectra displayed.

3.3 Result of DTA Test from α -Cellulose N 132 (*Saccharum officinarum*)

The tool used in the DTA test on α-cellulose from bagasse Bz 132 (*Saccharum officinarum*) is termocouple / mv: PR / 15mv brand shimadzu, japan. The temperature of the experiment is the

temperature of 20°C - 600°C. MCC used in this test is 30 gram with DTA range ± 250 μv, heating speed 10°C mm / minute and chard speed 2.5 mm / minute. The following is a picture of the DTA test equipment used.

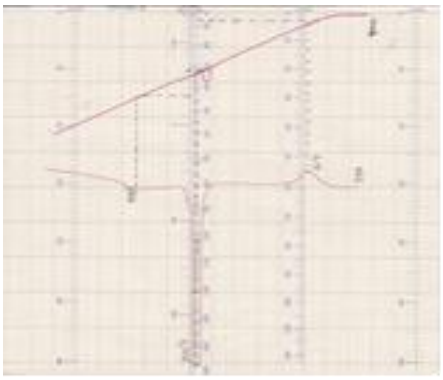

Figure 3: DTA Test.

From thermocouple DTA, α-cellulose from sugarcane bagasse Bz 132 (*Saccharum officinarum)* shows a peak at 60°C, a peak formed on the right area which shows a decrease in temperature (endotherm) and a peak on the left at 320°C indicating there is an increase in temperature (exotherm). At 60°C α-cellulose from bagasse Bz 132 (*Saccharum officinarum*) evaporates which is likely to be the water that is still stored α-cellulose from bagasse Bz 132 (*Saccharum officinarum*), and at 320°C α-cellulose from pulp sugar cane Bz 132 (*Saccharum officinarum*) burns by showing its optimum peak.

4 CONCLUSIONS

Separation of α-cellulose from bagasse is done by the Okhamafe method by extraction which is done by immersion in 3.5% of HNO_3 acid, bleaching with Sodium Hipochlorite 1.75% and purification with NaOH 17.5%. Analysis of the characteristics of the resulting α-cellulose was obtained from the results of α-cellulose SEM photos of the surface with a magnification of 1000 times. Visible spherical-shaped surfaces with almost the same size (uniform). This can indicate that the resulting α-cellulose has a homogeneous size (equal in size). From the functional group analysis, we can see the free O-H group with wave number 4001.50 cm^{-1} which shows the CH2OH chain that is typical for cellulose and O-H hydrogen bonds with wave numbers 3437.30 cm^{-1} as supporting data. From the thermal test, the DTA test obtained the melting point at a temperature of 60^0C and a decomposition point of 320^0C according to the reference cellulose in general.

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REFERENCES

Astawan, M., 2008. Kemasan*:Pengaman Dan Pengawet Makanan*. Senior:Jakarta

Azubuike, Chukweumeka.P.C., Okhamafe, Augustine. O., Falodun, abiodun., 2011. *Some Pharma Copocial and diluent-Binder Properties of MaizeCob-derive from α-cellulose in Selected Tablet Formulations*. Journal of Chemical and Pharmaceutical research. 481-488.

Eichhorn, S. J., Baillie, C. A., Zafeiropoulos, N., Mwaikambo, L. Y., Ansell, M. P., Dufresne, A., Entwistle, K. M., Herrera-Franco, P. J., Escamilla, G. C., Groom, L. and Hughes, M., 2001. Current international research into cellulosic fibres and composites. Journal of materials Science, 36(9), pp.2107-2131.

Kazakova, E. G. and Demin, V. A., 2009. A new procedure for preparing microcrystalline cellulose. Russian Journal of Applied Chemistry, 82(3), pp.496-499.

Malau, KM., 2009. Pemanfaatan Ampas Tebu Sebagai Bahan Baku Dalam Pembuatan Papan Partikel.Skripsi. Medan: USU.

Leppänen, K., Andersson, S., Torkkeli, M., Knaapila, M., Kotelnikova, N. and Serimaa, R., 2009. Structure of cellulose and microcrystalline cellulose from various wood species, cotton and flax studied by X-ray scattering. Cellulose, 16(6), pp.999-1015.

Ohwoavworhua, F. O. and Adelakun, T. A., 2005. Some physical characteristics of microcrystalline cellulose obtained from raw cotton of Cochlospermum planchonii. Tropical Journal of Pharmaceutical Research, 4(2), pp.501-507.

Ohwoavworhua, F. O. and Adelakun, T. A., 2005. Phosphoric acid-mediated depolymerization and decrystallization of α-Cellulose obtained from corn cob: preparation of low crystallinity cellulose and some physicochemical properties. Tropical Journal of Pharmaceutical Research, 4(2), pp.509-516.

Oksman, K., 2007. Extrusion and Mechanical Properties of Highly Filled Cellulose Fibre-Polypropylene Composites. Division of Manufacturing and Design of Wood and Bionano composites. Lulea University of Technology: Sweden.

Penebar Swadaya., 2000. Pembudidayaan Tebu Dilahan Sawah dan Tegalan.Penebar Swadaya: Jakarta.

That, T., 2008. Improving the Processing and Properties of Cellulose fibre Composite. National Research Council: Canada.

Tarmansyah, U. S., 2007. Pemanfaatan Serat Rami Untuk Pembuatan Selulosa. STT No.2288.Volume 10 Nomor 18. Tim Puslitbang Indhan Balitbang Dephan: Jakarta.