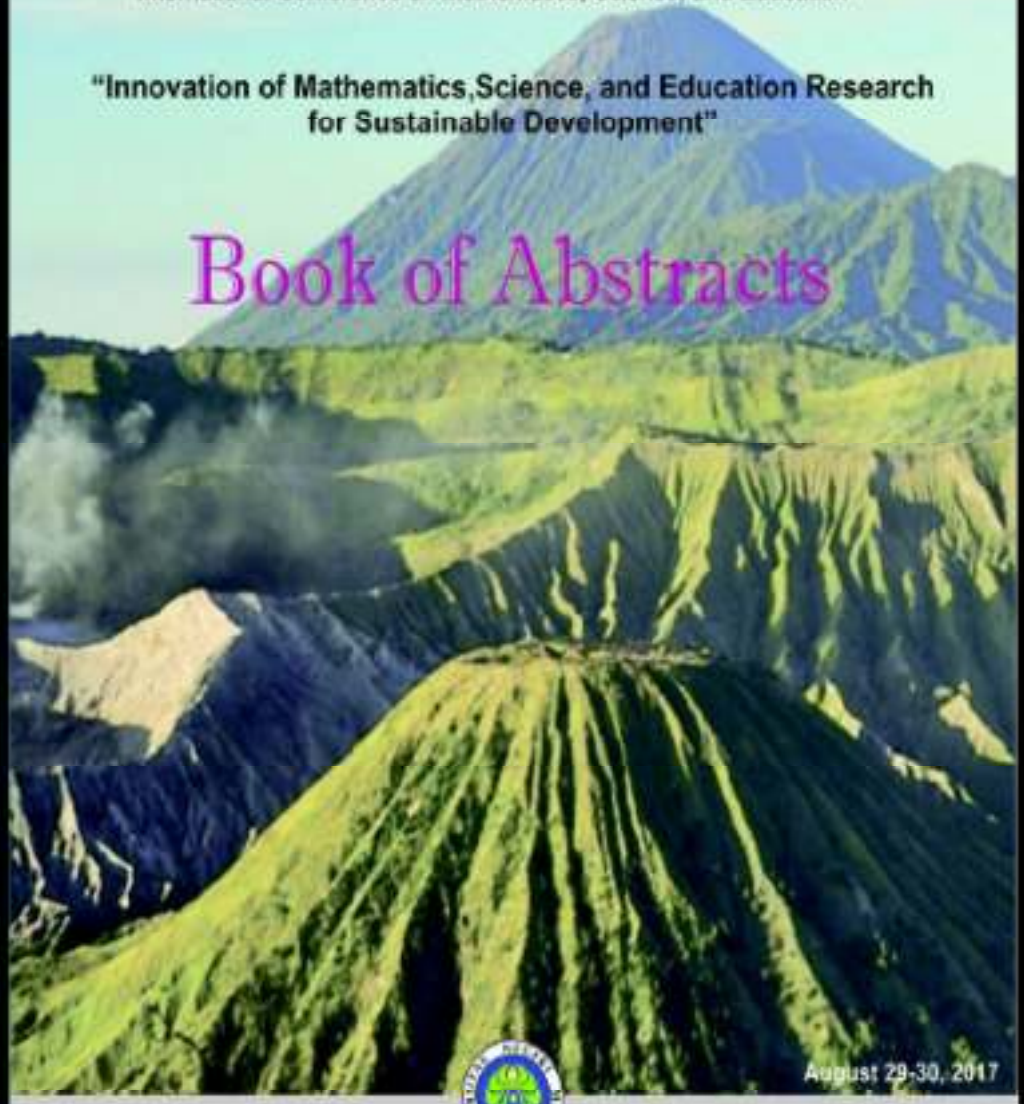
ICoMSE 2017

International Conference on Mathematics, Science, and Education

"Innovation of Mathematics,Science, and Education Research for Sustainable Development"

Book of Abstracts



August 29-30, 2017

UNIVERSITAS NEGERI MALANG

Sponsored by

GeneCraft Labs

PT TAJAR MAS MURNI

ID: I2017648

The Influence Of Natrium Hidroxide Concentration In Celluloce Synthesis From Rice Straw

Dewi Umaningrum, Radna Nurmasari, Maria Dewi Astuti

Lamburg Mangkurat University
dewiumaningrum79@gmail.com

Cellulose synthesized from rice straw by using a simple and an efficient method. After extracted with toluene and n-hexane, rice straw powder were dilute in a various concentration of natrium hidroxide (1%, 3%, 5%, 7% and 9%) and heated to 800 C for 5 hours. Celluloce was synthesized successfully in presence of natrium hidroxide 7% with the yield 34.26% and presence lignin 0.15%. The IR spectra shows that the O-H binding at 3400 cm-1 and C-H binding at 2900 cm-1 are the characteristic of cellulose.

Keyword: natrium hidroxide concentration, cellulose, synthesis, rice straw

Artikel Seminar ICOMSE :

The Influence of Natrium Hidroxide Concentration in Celluloce Synthesis of Rice Straw

(Use the Microsoft Word template style: *Paper Title*)

Dewi Umaningrum[1, a)] , Radna Nurmasari[2, b)], Maria Dewi Astuti[3, c)]

(Use the Microsoft Word template style: *Paper Author*)

[a)]Corresponding author: dewiumaningrum@gmail.com
[b)]radnanurmasari@gmail.com

Abstract.

Celluloce synthesized from rice straw by using a simple and an efficient method. After extracted with toluene and n-hexana, rice straw powder were dilute in a various concentration of natrium hidroxide (1%, 3%, 5%, 7% and 9%) and heated to 80^0 C for 5 hours. Celluloce was synthesized succesfully in presence of natrium hidroxide 7% with the yield 34.26% and presence lignin 0.15%. The IR spectra shows that the O-H binding at 3400 cm^{-1} and C-H binding at 2900 cm^{-1} are the charateristic of celluloce

Keywords : natrium hidroxide concentration, celluloce, synthesis, rice straw

Introduction

One technology that has been developed rapidly for environmental monitoring is sensor technology. One of the main components in the sensor is the membrane. The membrane has an active ingredient in capturing the desired ion called ionophores. Some compounds that can be used as ionophores include humic acid and its derivatives are humate amide compounds (Muhali, 2013), azokrown compounds and derivatives (Purba, 2013) and cellulose acetate compounds (Mashuni, 2012). The advantage of cellulose acetate as a membrane material is that it is a renewable source, easy to produce and environmentally friendly.

Rice straw is a lignocellulosic material that is available in large quantities and has not been utilized optimally in Indonesia. Rice straw is part of the stems and stems of rice plants after harvesting butirbutir fruit. Rice straw is one of agricultural waste containing cellulose about 34,2%. The average nutrient content contained in rice straw in Indonesia is 5.6% Si, 0.4% N, 0.02% P and 1.4% K. The average composition of rice straw content is 34.2% cellulose, 26.1% hemicellulose, 11.71% lignin, 17.11% ash, 2.8% pectin and 3.0% protein (Chem, 2008).

Initial stages in cellulose acetate synthesis one of them is cellulose isolation. In the cellulose isolation there is a very important process, namely delignification. The delignification process generally uses NaOH and H2SO4. Gunam et al. (2011), conducted a study on the delignification of bagasse using 2%, 4% and 6% NaOH delignification. The results showed that

most lignin reductions were obtained through the use of NaOH 6% which was 32%, from 17.65% to 11.9%, while in the delignification process using H2SO4 comparing pretreatment using chemical method with bagasse, that is with H2SO4 ¬ (0 , 25% and 0.5%) and variations of heating time using autoclocs at 121 ° C for 15, 30, and 45 minutes. Based on the result of analysis, in pretreatment method using H2SO4 0,5% at heating time for 30 minutes there was decrease of lignin level from 21,11% to 12,97% (Wardani & Kusumawardini, 2012).

Therefore, based on the above description, it is interesting to conduct research on cellulose isolation from rice straw by studying the effect of variation of base concentration NaOH. This is done to find out which concentration of the best base variations produce the highest levels of cellulose.

Material and Methods

Materials and Chemicals

The tools used in this research are glassware (Pyrex) such as glass cup, watch glass, glass stirrer, erlenmeyer, pumpkin measure, volume pipette, spindle, glass funnel, three neck flask, burette, dropper dropper, thermometer, glass bottle , pH meter CT Lutron, oven, magnetic stirrer, blender, 60 mesh sieve, analytical balance of OHAUSS brand galaxy TM 160 model, buchner filter, vacuum pump, petri dish, separating funnel, a set of socket tools, scissors and hotplate stirrer; analysis equipment such as the Fourier Transform Infrared (FTIR) spectrofotometer Shimadzu 8201PC.

The materials used in this study were rice straw waste, sodium hydroxide (E.Merck), , 30% peroxide acid (E.Merck), sulfuric acid 98 % (E.Merck), distilled water, and filter paper.

Pretreatment of Rice Straw

Sample of rice straw taken Mahang Barabai Village. The small cut sample is then washed with water and rinsed with aquades for 1 hour to remove impurities. The sample is dried in the sun, then heated in an oven at 600C. The dried samples were cut small by blending and milling, then filtered with a 60 mesh sieve. The filtered powder sample is stored in an air-free plastic bag.

Isolation of Celluloce from Rice Straw

100 g rice straw powder samples were placed in filter paper and tied with yarn. The sample was extracted with a hexane-methanol mixture (2: 1 v / v) using a socket tool for 6 hours, then the sample was dried. The extraction samples were weighed respectively by 10 g in a glass cup and added 300 mL of NaOH solution with a concentration variation of 1%; 3%; 5%; 7% and 9%, then heated for 5 hours at a temperature of 800C. The sample was cooled and acidified with 10% H2SO4 to pH 3-4 at a temperature of 500C. Samples were separated by filtrate using a buchner funnel using a vacuum pump. The precipitate was added with 2% H 2 O 2 (ratio 30: 1), with pH ~ 9 and stirred for 5 hours. The obtained residue is filtered and washed with distilled water, then dried (Das et al, 2014). The dry deposited cellulose obtained is weighed to a constant weight.

Determination of Lignin

0.1 g of cellulose weighed and then transferred to 80 mL cup glass. 2 mL of 72% sulfuric acid was added slowly in a submersible bath at temperature (20 ° C ± 1 ° C) while stirring and maceration with a stir bar for 2-3 minutes. Once dispersed, cover the cup glass with a watch glass and leave it for 2 hours and stirring occasionally during the process. Then 77 mL of distilled water was added

and refluxed for 4 hours. After that the solution is cooled and allowed to stand until the lignin precipitates settle perfectly. The solution is then decanted and the precipitate is transferred quantitatively to a glass funnel with a coated weighted sheet of paper. The lignin deposit is washed until it is acid-free with hot water. The filter paper containing the lignin precipitate is then dried at the oven (105 ° C ± 3 ° C), then cooled in desiccators and weighs to a constant weight.

Result and Discussion

The size of the rice straw will have an effect on the cellulose extraction process, thus determining the amount of liberated lignin and hemicellulose. The smaller the sample particles the more extracted cellulose and the higher the yield of the cellulose produced. Therefore at the pretreatment stage the rice straw sample is sieved up to 60 mesh. Lignin bound to cellulose can be removed by a delignification process. Lignin removal can be done by using a base, one of which is sodium hydroxide. The cooking process with alkali will degrade lignin, causing lignin to dissolve in water during the washing process. The bleaching process using peroxide acids will oxidize the remaining lignin in extracted cellulose and the white cellulose pulp will be obtained.

Table 1. The influence of NaOH concentration

NaOH (%)	W selulosa (gram)	% selulosa	W lignin (gram)	% lignin
1	1,9386	19,39	0,0275	0,28
3	2,1769	21,77	0,1538	1,54
5	1,655	16,55	0,0618	0,62
7	3,3626	33,63	0,2415	2,42
9	0,9111	9,11	0,1242	1,24

Table 1 shows that the concentration of sodium hydroxide solution gives a significant effect on the resultant cellulose content. The increase of yield of cellulose obtained increased with increasing of NaOH concentration from 1% - 7% with cellulose yield of 33,63% at 7% concentration. At 9% concentration will decrease the yield of cellulose to 9,11% because with increasing of NaOH solution hence degradation of cellulose polymer by NaOH solution.

Conclusion

In cellulose isolation process from rice straw yield cellulose yield of 33,63% by using sodium hydroxide concentration equal to 7%

References

Bruice, P. Y. 2001. *Organic Chemistry*. Prentice Hall International, Inc., New Jersey.

Chem, E. 2008. *Technical Institutes of Physics and Chemistry*. Chinese Academy of Sciences, Beijing China.

Cheng, H.N., Dowd, M.K., Selling, G.W., & Biswas, A. 2010. Synthesis of cellulose acetate from cotton byproducts. *Carbohydrate Polymers*. 80(2): 449–452.

Dian C. S. (2012). Sintesis Selulosa Asetat dari Jerami Padi untuk Aplikasi Baterai Ion Litium. *Jurnal Student UNY*. **1***(3)*: 14-21.

Dietrich Fengel, G.W., 1984. Kayu; Kimia, Ultrastruktur, Reaksi-reaksi. Gadjah Mada University Press, Yogyakarta.

Fajriutami T., W. Fitriasari & E. Hermiati. 2016. Pengaruh Pra Perlakuan Basa Pada Ampas Tebu Terhadap Karakterusasi Pulp dan Produksi Gula Pereduksi. *Jurnal Riset Industri*. ***10*** (3): 147-161.

Fan, G., Wang, M., Liao, C., Fang, T., Li, J., & Zhou, R. 2013. Isolation of cellulose from rice straw and its conversion into cellulose acetate catalyzed by phosphotungstic acid. *Carbohydrate Polymers*. 94(1): 71–76.

Fengel, D & G. Wegener. *Kayu: Kimia, Ultrastruktur, Reaksi-reaksi.* UGM Press*,* Yogyakarta.

Gunam, I. B., Wartini, N. M., Anggreni, A. A., & Suparyana, P. M. 2011. Delignifikasi Ampas Tebu Dengan Larutan Natrium Hidroksida Sebelum Sakarifikasi Secara Enzimatis Menggunakan Enzim Selulase Kasar Dari Aspergillus Niger FNU 6018. *Teknologi Indonesia LIPI Press , 34* (Edisi Khusus 2011): 24-32.

Kroschwitz, J. 1990, *Polymer Characterization and Analysis.* John Wiley and Sons, Inc., Canada.

Lynd L.R., P.J. Weimer, W.H. van Zyl WH and I.S. Pretorius. 2002. Microbial Cellulose Utilization: Fundamentals and Biotechnology. Microbiol. Mol. Biol. Rev.***66***(3):506-577.

Mashuni. 2012. Pengembangan Biosensor Elektrokimia Berbasis Enzim Asetilkolinesterase Untuk Analisis Residu Pestisida Pada Produk Pertanian. *Jurnal Agroteknos.* 2*(2)*: 69-76.

Muhali. 2013. Aplikasi Senyawa Amida Humat Sebagai Ionofor dalam Membran Elektroda Selektif Ion Ni (II). *Jurnal Prisma Sain*s. 1*(1)*: 66-78.

Muslihah S. & Y. Trihadiningrum. 2013. Produksi Bioetanol Dari Limbah Tongkol Jagung Sebagai Energi Alternatif Terbarukan. *Prosiding Seminar Nasional Manajemen Teknologi XVIII*, Surabaya.

Palonen, H., 2004. Role Of Lignin In The Enzymatic Hydrolysis Of Lignocellulose VTT Biotechnology. Helsinki University of Technology, Finland.

Perez, J., J. Munoz-Dorado, T. de ls Rubia, and J. Martinez. 2002. Biodegradation and biological treatments of cellulose, hemicellulose and lignin: an overview. *Int Microbiology* ***5***: 53-63

Permatasari, H.R., F. Gulo & B. Lesmini. 2014. Pengaruh Konsentrasi H_2SO_4 dan NaOH terhadap Delignifikasi Serbuk Bambu (*Gigantochloa apus*). Program Studi Pendidikan Kimia FKIP Universitas Sriwijaya, Palembang.

Purba, J. Zainiati, Eko A., S, dan Manihar S. 2013. Pembuatan Ion Selektif Elektroda Menggunakan Ionofor Dtodc Untuk Penentuan Merkuri (ISE-Hg). *Semirata*.

Sastrohamidjojo, H. 1992. *Spektroskopi Inframerah*. Liberty, Yogyakarta.

Wardani, A. K., & Kusumawardini, I. 2012. *Pretreatment Ampas Tebu (Saccharum Oficinarum) sebagai Bahan Baku Bioetanol Generasi Kedua,* (Online), (http://tehapeub.net/ejurnal/715d7-Indah-K.pdf, diakses 10 Juni 2013).