

## BAB V

### KESIMPULAN DAN SARAN

#### V.1 Kesimpulan

1. Perbedaan jenis pelarut (asam dan basa), konsentrasi pelarut dan waktu yang digunakan sangat berpengaruh terhadap kadar selulosa.
2. Perbedaan kombinasi kimia dan fisika yang digunakan sangat berpengaruh terhadap kadar selulosa. Hasil delignifikasi terbaik diperoleh dengan kombinasi  $\text{H}_2\text{O}_2$  50% dalam asam asetat 15% dengan pemanasan selama 60 menit pada suhu  $175^\circ\text{C}$ , yaitu menghasilkan selulosa sebesar 79,71%, hemiselulosa sebesar 10,29% dan lignin sebesar 1,46%.
3. Hasil karakterisasi dengan menggunakan *Fourier Transform Infrared* (FTIR) menunjukkan delignifikasi yang dilakukan dapat meningkatkan kadar selulosa dan menurunkan kadar lignin dengan adanya puncak pada gugus fungsi selulosa dan pada bilangan gelombang gugus fungsi lignin.

#### V.2 Saran

1. Dilakukan proses delignifikasi Tandan Kosong Kelapa Sawit (TKKS) dengan waktu yang sama.

## DAFTAR PUSTAKA

1. Perkebunan, D.J., *Tree Crop Estate Statistics of Indonesia*, M.o. Agriculture, Editor. 2015: Jakarta.
2. Mathius, I.W., D. Sitompul, and B.P.M.d. Azmi, *Produk Samping Tanaman dan Pengolahan Buah Kelapa Sawit Sebagai Bahan Dasar Pakan Komplit Untuk Sapi: Suatu Tinjauan*. 2003.
3. Pertanian, D.P.H., *Pedoman Pengelolaan Limbah Industri Kelapa Sawit*. 2006.
4. Isroi, et al., *Biological Pretreatment of Lignocelluloses with White-Rot Fungi and its Applications: A Review*. Peer-Reviewed Review Article, 2011: p. 5224-5259.
5. Granström, M., *Cellulose Derivatives: Synthesis, Properties and Applications*. 2009.
6. Poletto, M., V. Pistor, and A.J. Zattera, *Structural Characteristics and Thermal Properties of Native Cellulose*. 2013: p. 45-68.
7. Kuutti, L., *Cellulose, starch and their derivatives for industrial applications*. Structure-property studies. 2013: VTT Technical Research Centre of Finland.
8. Laine, C., *Structures of Hemicelluloses and Pectins in Wood and Pulp*. 2005.
9. Chen, H., *Chemical Composition and Structure of Natural Lignocellulose*. 2014. **18**: p. 25-71.
10. Patil, N.D., N.R. Tanguy, and N. Yan, *Lignin Interunit Linkages and Model Compounds*. 2016.
11. Haghdan, S., S. Renneckar, and G.D. Smith, *Sources of Lignin*, F.S.C. Department of Wood Science, The University of British Columbia, Vancouver, BC, Canada, Editor. 2016.

12. Surest, A.H. and D. Satriawan, *Pembuatan Pulp Dari Batang Rosella Dengan Proses Soda (Konsentrasi NaOH, Temperature Pemasakan dan Lama Pemasakan)*. 2010. **17**(3): p. 1-7.
13. Hadrawi, J., *The Content of Lignin, Cellulose, and Hemicellulose of Oyster Mushroom (Pleurotus ostreatus) medium waste at different incubation period as feed*, in *Fakultas Peternakan*. 2014, Universitas Hasanuddin Makassar.
14. Mosier, N., et al., *Features of promising technologies for pretreatment of lignocellulosic biomass*. *Bioresource Technology*, 2005. **96**: p. 673–686.
15. Law, K.-N., W.R.W. Daud, and A. Ghazali, *Morphological and chemical nature of fiber strands of Oil Palm Empty-Fruit-Bunch (OPEFB)*. Peer-Reviewed Article, 2007: p. 351-362.
16. Islam, M.N. and R. Matzen, *Size Distribution Analysis of Ground Wheat by Hammer Mill*. *Powder Technology*, 1988. **54**: p. 235-241.
17. Barakat, A., H.d. Vries, and X. Rouau, *Dry fractionation process as an important step in current and future lignocellulose biorefineries: A review*. 2013.
18. Agbor, V.B., et al., *Biomass pretreatment: Fundamentals toward application*. *Biotechnology Advances*, 2011. **29**: p. 675–685.
19. Liu, C.-Z., et al., *Ionic liquids for biofuel production: Opportunities and challenges*. *Applied Energy*, 2012. **92**: p. 406–414.
20. Pedersen, M., A. Viksø-Nielsen, and A.S. Meyera, *Monosaccharide yields and lignin removal from wheat straw in response to catalyst type and pH during mild thermal pretreatment*. *Process Biochemistry*, 2010. **45**: p. 1181–1186.

21. Silverstein, R.A., et al., *A comparison of chemical pretreatment methods for improving saccharification of cotton stalks*. *Bioresource Technology*, 2007. **98**: p. 3000–3011.
22. Wiman, M., et al., *Cellulose accessibility determines the rate of enzymatic hydrolysis of steam-pretreated spruce*. *Bioresource Technology* 2012. **126**: p. 208-215.
23. Arvaniti, E., A.B. Bjerre, and J.E. Schmidt, *Wet oxidation pretreatment of rape straw for ethanol production*. *biomass and bioenergy*, 2012. **39**: p. 94-105.
24. Banerjee, S., et al., *Evaluation of wet air oxidation as a pretreatment strategy for bioethanol production from rice husk and process optimization*. *biomass and bioenergy*, 2009. **33**: p. 1680–1686.
25. Binta, D., S. Wijana, and A.F. M, *The Influence Long of Curing to the Levels of Lignin and Cellulose Pulp (Bark and Midrib of Nypa) Using Biodegradator EM4*. *Jurnal Industrial*, 2013. **2**(1): p. 75-83.
26. Phummala, K., et al., *Delignification of disposable wooden chopsticks waste for fermentative hydrogen production by an enriched culture from a hot spring*. *Journal of Environmental Sciences*, 2014. **26**: p. 1361–1368.
27. Zuidar, A.S., et al., *Study of Delignification on Formacell Process from Palm Oil Empty Fruit Bunches Using H<sub>2</sub>O<sub>2</sub> in Acetic Acid Media*. 2014. **19**(2): p. 194-204.
28. Winarsih, S., *Pengaruh Konsentrasi NaOH dan Lama Pemaparan Microwave Terhadap Kandungan Selulosa, Hemiselulosa dan*

- Lignin Tongkol Jagung*. Seminar Nasional dan Gelar Produk 2016, 2016: p. 285-290.
29. Khozin Asror, A.R.E., *Pengaruh Suhu dan Konsentrasi NaOH Pada Proses Hidrothermal Jerami Padi Untuk Bahan Baku Biogas*. 2017, Institut Teknologi Sepuluh Nopember Surabaya: Departemen Teknik Kimia Fakultas Teknologi Industri.
  30. Mesa, L., et al., *Preliminary evaluation of organosolv pre-treatment of sugar cane bagasse for glucose production: Application of 2<sup>3</sup> experimental design*. *Applied Energy*, 2010. **87**: p. 109–114.
  31. Putera, R.D.H., *Extraction of Cellulose Fibre from Water Hyacinth Plant (Eichornia Crassipes) with a Variation of Solvent*, in *Chemical Engineering*. 2012, Universitas Indonesia: Depok.
  32. Kurniawan, E.R., *Karakterisasi Dan Alkaline Pretreatment Lignoselulosa Cabomba caroliniana*. *Teknologi Hasil Perairan*, 2016: p. 5.
  33. Susingih Wijana, N.L.R., dan Dedik Ansory *Studi Proses Pulping Serat Pelepah Dan Serat Kulit Buah Nipah (Nypa fruticans) Dengan Metode Kimia (Kajian Konsentrasi NaOH)*. 2013: p. 4.
  34. Harry Rizka Permatasari, F.G., Bety Lesmini, *Pengaruh Konsentrasi H<sub>2</sub>SO<sub>4</sub> Dan NaOH Terhadap Delignifikasi Serbuk Bambu (Gigantochloa Apus)*.
  35. Fengel, D. dan G. Wegener. 1995. *Kayu: Kimia, Ultrastruktur, Reaksireaksi*. Diterjemahkan oleh Hardjonosastro Hamidjojo. Gajah Mada University Press. Yogyakarta. 729 hlm.
  36. Moran, J.I., Alvarez, V.A., Cyras, V.P., Vazquez, A., 2008. Extraction of cellulose and preparation of nanocellulose from sisal fibers. *Cellulose* 15, 149–159.

37. Association of Official Analytical Chemist (AOAC). 1995-2005.  
*Official Methods of Analysis* : AOAC Arlington