

BAB V

KESIMPULAN

5.1 Kesimpulan

Kesimpulan yang diperoleh dari hasil penelitian ini yaitu:

1. Perolehan furfural berbanding lurus dengan penambahan konsentrasi, waktu reaksi dan suhu reaksi hingga mencapai titik optimum.
2. Perolehan asam levulinat didapat pada kondisi asam 0,05 M dan suhu reaksi 120⁰C
3. Furfural akan muncul pada waktu reaksi 10 menit, suhu 170⁰C dan konsentrasi asam 0,5 M

5.2 Saran

Saran yang dapat diberikan pada penelitian lebih lanjut yaitu:

1. Perlu adanya analisa awal terhadap kandungan biomassa di dalam tandan kosong kelapa sawit.
2. Perlu adanya pembuatan model untuk kinetika laju reaksi.

DAFTAR PUSTAKA

- [1] B. P. Statistik, *Statistik Kelapa Sawit Indonesia 2017*, Jakarta: Badan Pusat Statistik, 2018.
- [2] E. S. H. a. A. Sri, "Pengelolaan Limbah Tandan Kosong Kelapa Sawit dan Aplikasi Biomassa *Chromolaena odorata* terhadap Pertumbuhan dan Hasil Tanaman Padi," *Jurnal Teknologi Pengelolaan Limbah*, 2014.
- [3] A. Putra, "Rumah Mesin," 18 February 2017. [Online]. Available: <https://www.rumahmesin.com/pemanfaatan-tandan-kosong-kelapa-sawit/>.
- [4] E. Kurniasih, H. and U. Indraningsih, "Furfural Berbasis Tandan Kosong Kelapa Sawit," *Jurnal Reaksi*, 10 (2), pp. 30-35, 2012.
- [5] S. and S. , "Pengelolaan Limbah Kelapa Sawit (*Elaeis guineensis* Jacq.) di Perkebunan Kelapa Sawit, Riau," *Bul. Agrohorti* 3 (2), pp. 203-212, 2015.
- [6] D. P. Dewanti, "Potensi Selulosa dari Limbah Tandan Kosong Kelapa Sawit untuk Bahan Baku Bioplastik Ramah Lingkungan," *Jurnal Teknologi Lingkungan*, 19 (1), pp. 81-88, 2018.
- [7] N. d. Suparjo, "Penentuan Lama Fermentasi kulit buah kakao dengan *Phanerochaete chrysosporium*: evaluasi kualitas nutrisi secara kimiawi AGRINAK. Vol. 01 No. 1," pp. 1-10, 2011.
- [8] T. Werpy and G. Petersen, *Top Value Added Chemicals from Biomass: Volume I - Results of Screening for Potential Candidates from Sugars and Synthesis Gas*, Springfield: National Renewable Energy Laboratory, 2004.
- [9] J. J. Bozell and G. R. Petersen, *Technology development for the production of biobased products from biorefinery carbohydrates - the US Department of Energy's "Top 10" revisited*, pp. 12, 539-554, 2010.
- [10] M. J. Bidy, C. Scarlata and C. Kinchin, *Chemicals from Biomass: A Market Assessment of Bioproducts with Near-Term Potential*; National Renewable Energy Laboratory (NREL), Denver: Golden, 2016.
- [11] J. N. M. Soetedjo, "Biobased furanics from sugars," [*Groningen*]: *University of Groningen.*, pp. 25-26, 2017.
- [12] M. B. Fusaro, V. Chagnault and D. Postel, "D. Reactivity of D-Fructose and D-Xylose," *Carbohydr. Res.*, pp. 9-19, 2015.

- [13] P. Coniwanti, G. Siska H. and E. Handayani, "Pembuatan Furfural dari Campuran Biomassa Ampas Tebu (*Saccharum Officinarum* L.) dan Tempurung Kelapa (*Cocos Nucifera* L.)," *Jurnal Teknik Kimia No.2 Volume 22*, pp. 37-45, 2016.
- [14] G. Andaka, "Hidrolisis Ampas Tebu Menjadi Furfural dengan Katalisator Asam Sulfat," *Jurnal Teknologi Volume 4 Nomor 2*, pp. 180-188, 2011.
- [15] B. P. Statistik, *Statistik Perdagangan Luar Negeri Indonesia Impor*, Indonesia: Badan Pusat Statistik/BPS-Statistik Indonesia, 2017.
- [16] B. P. a. B. Gami, "Biomass Characterization and its Use as Solid Fuel for Combustion," *Iranica Journal of Energy & Environment 3*, p. 123, 2012.
- [17] T. L.-K. Yong, N. Mohamad and N. N. M. Yusof, "Furfural Production from Oil Palm Biomass Using a Biomass-derived Supercritical Ethanol Solvent and Formic Acid Catalyst," pp. 392-400, 2016.
- [18] H. Loekito, "Teknologi Pengelolaan Limbah Industri Kelapa Sawit," *Jurnal Teknologi Lingkungan Vol.3 No. 3*, pp. 242-250, 2002.
- [19] A. Hazmi, R. Desmiarti, E. P. Walidi and P. Emeraldi, "Preliminary Study on Treatment of Palm Oil Mill Effluent by Sand Filtration-Dielectric Barrier Discharge System," *ITB Journal Publisher*, pp. 21-30, 2015.
- [20] E. S. Hayat and S. Andayani, "Pengelolaan Limbah Tandan Kosong Kelapa Sawit dan Aplikasi Biomassa *Chromolaena odorata* Terhadap Pertumbuhan dan Hasil Tanaman Padi Serta Sifat Tanah Sulfaquent," *Jurnal Teknologi Pengelolaan Limbah Vol. 17 No. 2*, pp. 44-51, 2014.
- [21] A. Kurnia, A. Awaluddin and E. Saputra, "Pengaruh Konsentrasi Reaktan Terhadap Konversi Limbah Pelepah Sawit Menjadi Asam Levulinat Dengan Metode Hidrolisis Menggunakan Katalis Asam Sulfat," *JOM FMIPA Vol.1 No. 2*, pp. 181-186, 2014.
- [22] A. M. Fuadi and H. Pranoto, "Pemanfaatan Limbah Tandan Kosong Kelapa Sawit Sebagai Bahan Baku Pembuatan Glukosa," *Chemica Vol. 3 No. 1*, pp. 1-5, 2016.
- [23] A.-A. Sajjad, Y. H. Teow and A. W. M. Hussain, "Sustainable Approach of Recycling Palm Oil Mill (POME) Using Integrated Biofilm/Membrane Filtration System For Internal Plant Usage," *Jurnal Teknologi*, pp. 166-171, 2018.
- [24] F. P. Sari, N. N. Sholihat, S. H. Anita, F. and E. Hermiati, "Peningkatan Produksi Gula Pereduksi dari Tandan Kosong Kelapa Sawit dengan Praperlakuan Asam Organik pada Reaktor Bertekanan," *Reaktor, Vol. 16 No. 4*, pp. 199-206, 2016.

- [25] F. Dianto, D. Efendi and A. Wachjar, "Pengelolaan Panen Kelapa Sawit (*Elaeis guineensis* Jacq.) Pelantaran Agro Estate, Kota Waringin Timur, Kalimantan Tengah," *Bul. Agrohorti* 5(3), pp. 410-417, 2017.
- [26] M. Rahim and M. Nadir, "Optimasi Waktu Hidrolisis Tandan Kosong Kelapa Sawit Menjadi Furfural Berbantuan Gelombang Mikro," *Konversi, Volume 4 No. 2*, pp. 12-15, 2015.
- [27] A. Haryanti, N. P. S. F. Sholiha and N. P. Putri, "Studi Pemanfaatan Limbah Padat Kelapa Sawit," *Konversi, Volume 3 No. 2*, pp. 20-29, 2014.
- [28] W. Aditya, A. Awaluddin and S. , "Studi Produksi Asam Levulinat dari Pati Ubi Gajah (*Manihot esculenta*) Menggunakan Katalis Asam Sulfat," *JOM FMIPA Volume 1 No. 2*, pp. 203-212, 2014.
- [29] R. Aguilar, J. Ramirez, G. Garrote and M. Vazquez, "Kinetic Study of The Acid Hydrolysis of Sugar Cane Bagasse," *Journal of Food Engineering*, pp. 309-318, 2002.
- [30] D. B. Bevilaqua, M. K. Rambo, T. M. Rizzetti, A. L. Cardoso and A. F. Martins, "Cleaner Production : Levulinic Acid from Rice Husks," *Journal of Cleaner Production*, pp. 1-6, 2013.
- [31] C. A. Bizzi, D. Santos, T. C. Sieben, G. V. Motta, P. A. Mello and E. M. Flores, "Furfural Production from Lignocellulosic Biomass by Ultrasound-assisted Acid Hydrolysis," *UltraSonics Sonochemistry*, pp. 3-28, 2018.
- [32] S. H. Chang, "An Overview of Empty Fruit Bunch from Oil Palm As Feedstock for Bio-Oil Production," *Biomass and Bioenergy*, pp. 174-181, 2014.
- [33] S. X. Chin, C. H. Chia, Z. Fang, S. Zakaria, X. K. Li and F. Zhang, "A Kinetic Study on Acid Hydrolysis of Palm Oil Empty Fruit Bunch Fibers Using a Microwave Reactor System," *Energy and Fuels*, pp. 2589-2597, 2014.
- [34] S. X. Chin, C. H. Chia, S. Zakaria, Z. Fang and S. Ahmad, "Ball Milling Pretreatment and Diluted Acid Hydrolysis of Oil Palm Empty Fruit Bunch (EFB) Fibres for The Production of Levulinic Acid," *Journal of Taiwan Institute of Chemical Engineers*, pp. 1-8, 2015.
- [35] S. Kang, J. Fu and G. Zhang, "From Lignocellulosic Biomass to Levulinic Acid : A Review on Acid-Catalyzed Hydrolysis," *Renewable and Sustainable Energy Reviews*, pp. 340-362, 2018.

- [36] K. Lappalainen and Y. Dong, "Simultaneous Production of Furfural and Levulinic Acid From Pine Sawdust via Acid-Catalysed Mechanical Depolymerization and Microwave Irradiation," *Biomass and Bioenergy*, pp. 159-165, 2019.
- [37] X. Li, J. Yang, R. Xu, L. Lu, F. Kong, Liang, Min, L. Jiang, S. Nie and C. Si, "Kinetic Study of Furfural Production from Eucalyptus Sawdust Using H-SAPO-34 as Solid Bronsted Acid and Lewis Acid Catalysts in Biomass-Derived Solvents," *Industrial Crops and Products*, pp. 196-205, 2019.