

DAFTAR PUSTAKA

- Al Hafiizh, M. A., Widiyastuti, W., & Nurtono, T. (2022). Pra-Desain Pabrik Fraksinasi Lignoselulosa dengan Metode Steam Explosion. *Journal of Fundamentals and Applications of Chemical Engineering (JFACHE)*, 3(1), 7. <https://doi.org/10.12962/j2964710x.v3i1.17323>
- Altiok, D., Tokatli, F., & Harsa, Ş. (2005). Kinetic Modelling of Lactic Acid Production From Whey by *Lactobacillus casei* (NRRL B-441). *Journal of Chemical Technology and Biotechnology*, 81(7), 1190–1197. <https://doi.org/10.1002/jctb.1512>
- Andersen, N. (2007). Enzymatic Hydrolysis of Cellulose: Experimental and Modelling Studies. Technical University of Denmark.
- Ari, D. I. A., dkk. (2013). Hidrolisis Hemiselulosa Batang Jagung dengan Proses Organosolv Menggunakan Pelarut Asam Formiat. Program Studi Teknik Kimia, Fakultas Teknik, Universitas Riau.
- Aries, R.S. and Newton, R.D. (1954). *Chemical Engineering Cost Estimation*. New York. Mc.Graw Hill Book Company Inc.
- Arimpi, A., & Pandia, S. (2019). PEMBUATAN PEKTIN DARI LIMBAH KULIT JERUK (*Citrus sinensis*) DENGAN METODE EKSTRAKSI GELOMBANG ULTRASONIK MENGGUNAKAN PELARUT ASAM SULFAT (H₂SO₄) PECTIN PRODUCTION FROM ORANGE PEEL (*Citrus sinensis*) WITH ULTRASONIC WAVES EXTRACTION METHOD USING SULFURIC ACID (H₂SO₄). In *Jurnal Teknik Kimia USU* (Vol. 8, Issue 1).
- Badan Pusat Statistik, “Survei Angkatan Kerja Nasional (Sakernas)”, 2023.
- Ballesteros, M. (2010). Enzymatic Hydrolysis of Lignocellulosic Biomass. *CIEMAT*, 159–177. Woodhead Publishing.
- Ballesteros, M. (2010). Enzymatic hydrolysis of lignocellulosic biomass. In *Bioalcohol Production: Biochemical Conversion of Lignocellulosic Biomass* (pp. 159–177). Elsevier Inc. <https://doi.org/10.1533/9781845699611.2.159>
- Bayu, Y. E. S., Fahmi, M. F., Widjaja, T. (2022). Fraksinasi Lignoselulosa dari TKKS dengan Metode Steam Explosion Pretreatment Disertai Penambahan Asam Formiat. *JURNAL TEKNIK ITS Vol. 11, No. 2 (2022), 2337-3539 (2301-9271*

Print).

- Brodin, M., Vallejos, M., Opedal, M. T., Area, M. C., & Chinga-Carrasco, G. (2017). Lignocellulosics as sustainable resources for production of bioplastics – A review. In *Journal of Cleaner Production* (Vol. 162, pp. 646–664). Elsevier Ltd. <https://doi.org/10.1016/j.jclepro.2017.05.209>
- BusinessAnalytiq. Indeks Harga Asam Polilaktat (PLA). Online at <https://businessanalytiq.com/procurementanalytics/index/polylactic-acid-pla-price-index/>, accessed 21 Mei 2024.
- Celignis. Bioprocess Development For The Hydrolysis Of Lignocellulosic Biomass. Online at <https://www.celignis.com/bioprocess-hydrolysis.php>, accessed 17 Mei 2024.
- Chang, X., Bai, Y., Wu, R., Liu, D., & Zhao, X. (2020). Heterogeneity of lignocellulose must be considered for kinetic study: A case on formic acid fractionation of sugarcane bagasse with different pseudo-homogeneous kinetic models. *Renewable Energy*, 162, 2246–2258. <https://doi.org/10.1016/j.renene.2020.10.029>
- Chen, H. Z., & Liu, Z. H. (2014). Multilevel composition fractionation process for high-value utilization of wheat straw cellulose. *Biotechnology for Biofuels*, 7(1). <https://doi.org/10.1186/s13068-014-0137-3>
- Datta, R., dan Henry, M. (2006). Lactic Acid: Recent advances in products, processes and technologies-A review. *Journal of Chemical Technology and Biotechnology*, 81(7), 1119-1129. <https://doi.org/10.1002/jctb.1486>
- Darmein. (n.d.). *VARIASI TEMPERATUR MELTING POLYPROPYLENE TERHADAP PERUBAHAN BENTUK PRODUK DENGAN MENGGUNAKAN DESAIN EXTRUSI SINGLE SCREW*.
- Dhepe, P. L., & Sahu, R. (2010). A Green Solid-Acid-Based Process for the Conversion of Hemicellulose. *The Royal Society of Chemistry*.
- Dinas Perkebunan Provinsi Kalimantan Timur, “Pabrik Kelapa Sawit di Kalimantan Timur 2022”, 2022.
- Direktorat Jendral Perkebunan, “Statistik Perkebunan Unggulan Nasional 2021- 2023”, 2023.
- Erliana, W. H., Widjaja, T., Altway, A., & Pudjiastuti, L. (2020). Synthesis of lactic acid from sugar palm trunk waste (*Arenga pinnata*): Preliminary hydrolysis and

fermentation studies. *Biodiversitas*, 21(5), 2281–2288.
<https://doi.org/10.13057/biodiv/d210559>

ExactitudeConsultancy. (2022). Pasar Plastik Biodegradable Berdasarkan Jenis (PLS, Campuran Pati, PHA, PBAT, PBS, Poliester Biodegradable), Industri Penggunaan Akhir (Pengemasan, Barang Konsumsi, Tekstil, Pertanian & Hortikultura) dan Berdasarkan Wilayah (Amerika Utara, Amerika Latin, Eropa, Asia Pasifik dan Timur Tengah & Afrika), Tren dan Perkiraan Global dari Tahun 2022 hingga 2029. Online at <https://exactitudeconsultancy.com/id/laporan/6714/pasar-plastik-biodegradable/>, accessed 20 Mei 2024.

Fengel, A., Wegener, G. (1995). Kayu: Kimia, Ultrastruktur, Reaksi-Reaksi. Sostromidjojo H, penerjemah. Yogyakarta: Gadjah Mada University Press.

Global Asset Protection Services. (2015). OIL AND CHEMICAL PLANT LAYOUT AND SPACING. In Global Asset Protection Services LLC (pp. 1–11).

González-Navarrete, C., Sánchez-Ramírez, E., Ramírez-Márquez, C., Hernández, S., Cossío-Vargas, E., & Gabriel Segovia-Hernández, J. (n.d.). *Innovative Reactive Distillation Process for the Sustainable Purification of Lactic Acid Supporting Information for Publication*.

Green, D. W., & Maloney, J. O. (1997). *Perry's Chemical Engineers' handbook*. McGraw-Hill Professional Publishing.

Groggins, P. H. (1992). Unit Processes in Organic Synthesis. McGraw-Hill Book Company, New York.

Gurevich, V. M. (2006). Heat Capacity and Thermodynamic Functions of Epsomite $\text{MgSO}_4 \cdot 7 \text{H}_2\text{O}$ at 0–303 K. *Geochemistry International*, 45(2), 206–209.
<https://doi.org/10.1134/S0016702907020103>

Habibah, R., Nasution, D. Y., & Muis, Y. (2013). PENENTUAN BERAT MOLEKUL DAN DERAJAT POLIMERISASI α -SELULOSA YANG BERASAL DARI ALANG-ALANG (*Imperata cylindrica*) DENGAN METODE VISKOSITAS. In *Jurnal Sainia Kimia* (Vol. 1, Issue 2).

Hartari, W. R., Delvitasari, F., Maryanti, M., Undadraja, B., Hasbullah, F., & Deksono, G. A. (2023). Pengujian Lignoselulosa Tandan Kosong Kelapa Sawit dengan Waktu Delignifikasi H_2SO_4 Menggunakan Uap Bertekanan. *Jurnal Agro Industri Perkebunan*, 151–158. <https://doi.org/10.25181/jaip.v11i3.3007>

- Hidayah, N., & Wusko, I. U. (2020). Characterization and Analysis of Oil Palm Empty Fruit Bunch (OPEFB) Waste of PT Kharisma Alam Persada South Borneo. *Majalah Obat Tradisional*, 25(3), 154–160. <https://doi.org/10.22146/mot.52715>
- Indonetwork. Harga Tandan Kosong Kelapa Sawit. Online at <https://www.indonetwork.co.id/product/jual-tandan-kosong-kelapa-sawit-3963140>, accessed 21 Mei 2024.
- Intechopen. *Oil Palm Empty Fruit Bunches (OPEFB) – Alternative Fibre Source for Papermaking*. Online at <https://www.intechopen.com/chapters/76954>, accessed 20 Mei 2024.
- Ivo Andri Ari, D., Helwani, Z., & Rionaldo Laboratorium Pengendalian dan Perancangan Proses, H. (n.d.). *Hidrolisis Hemiselulosa Batang Jagung dengan Proses Organosolv Menggunakan Pelarut Asam Formiat*.
- J, V.-B. (2019). Polylactic Acid (PLA) As A Bioplastic and Its Possible Applications In The Food Industry. *Food Science and Nutrition*, 5(2), 1–6. <https://doi.org/10.24966/FSN-1076/100048>
- Jarmo Reunanen, O., Pekka Oinas, K., & Timo Nissinen, Y. (2013). *United States Patent PROCESS FOR RECOVERY OF FORMIC ACID* (Patent US 8,530,695 B2). <http://v3.espacenet.com/publicationDetails/biblio?DB-EPODOC>
- Jayasekara, T., Wickrama Surendra, Y., & Rathnayake, M. (2022). Polylactic Acid Pellets Production from Corn and Sugarcane Molasses: Process Simulation for Scaled-Up Processing and Comparative Life Cycle Analysis. *Journal of Polymers and the Environment*, 30(11), 4590–4604. <https://doi.org/10.1007/s10924-022-02535-w>
- Jessup, R. S., & Prosen, E. J. (1950). Heats of Combustion and Formation of Cellulose and Nitrocellulose (Cellulose Nitrate). *Journal of Research of the National Bureau of Standards*, 44, 387–393.
- Joglekar, H. G., Rahman, I., Babu, S., Kulkarni, B. D., & Joshi, A. (2005). Comparative Assessment of Downstream Processing Options for Lactic Acid. *Separation and Purification Technology*, 52(1), 1–17. <https://doi.org/10.1016/j.seppur.2006.03.015>
- Komesu, A., Martinez, P. F. M., Lunelli, B. H., Filho, R. M., & Maciel, M. R. W. (2015). Lactic acid purification by reactive distillation system using design of experiments. *Chemical Engineering and Processing: Process Intensification*, 95, 26–30. <https://doi.org/10.1016/j.cep.2015.05.005>

- Krull, S., Brock, S., Prübe, U., & Kuenz, A. (2020a). Hydrolyzed agricultural residues— low-cost nutrient sources for l-lactic acid production. *Fermentation*, 6(4). <https://doi.org/10.3390/FERMENTATION6040097>
- Krull, S., dkk. (2020). Hydrolyzed Agricultural Residues - Low-Cost Nutrient Sources for L-Lactic Acid Production. *Fermentation*, 6(97), 1–12. <https://doi.org/10.3390/fermentation6040097>
- Kumar, R., Nanavati, H., Noronha, S. B., & Mahajani, S. M. (2006a). A continuous process for the recovery of lactic acid by reactive distillation. *Journal of Chemical Technology and Biotechnology*, 81(11), 1767–1777. <https://doi.org/10.1002/jctb.1603>
- Kumar, P., dkk. (2008). Methods for Pretreatment of Lignocellulosic Biomass for Efficient Hydrolysis and Biofuel Production. *Industrial & Engineering Chemistry Research*, 48(8), 3713–3729. <https://doi.org/10.1021/ie801542g>
- Kresnawaty, I., Putra, S. M., Budiani, A., & Darmono, T. W. (2017). Konversi tandan kosong kelapa sawit (TKKS) menjadi arang hayati dan asap cair. *Indonesian Journal of Agricultural Postharvest Research*, 14(3), 171-179.
- Material Safety Data Sheet
- Mariana, F. L., Muchtar, Z., & Fermi, M. I. (2010). *DELIGNIFIKASI TANDAN KOSONG SAWIT DALAM MEDIA ASAM FORMIAT*. <https://doi.org/10.13140/RG.2.1.3979.1846>
- MarketsandMarkets. (2023). Lactic Acid and Polylactic Acid Market by Application (Biodegradable Polymers, Food & Beverages, Pharmaceutical Products), Raw Material, Form (Dry, Liquid), and Region (North America, Europe, Asia Pacific, Rest of the World)— Global Forecast to 2028. Online at https://www.marketsandmarkets.com/Market-Reports/polylacticacid-387.html?gad_source=1&gclid=CjwKCAjwouexBhAuEiwAtW_Zxz7oYa2AorwGsV3nvFdjnZ5CH14lyPDhJ487gNzwdSdkn46UzGwEqRoCWyYQA vD_BwE , accessed 20 Mei 2024.
- Mehmood, A., Raina, N., Phakeenuya, V., Wonganu, B., & Cheenkachorn, K. (2023). The current status and market trend of polylactic acid as biopolymer: Awareness and needs for sustainable development. *Materials Today: Proceedings*, 72, 3049-3055.

- Mehta, R., Kumar, V., Bhunia, H., & Upadhyay, S. N. (2005). Synthesis of poly(lactic acid): A review. In *Journal of Macromolecular Science - Polymer Reviews* (Vol. 45, Issue 4, pp. 325–349). <https://doi.org/10.1080/15321790500304148>
- Mo, L., Shao-Tong, J., Li-Jun, P., Zhi, Z., & Shui-Zhong, L. (2011). Design and control of reactive distillation for hydrolysis of methyl lactate. *Chemical Engineering Research and Design*, 89(11), 2199–2206. <https://doi.org/10.1016/j.cherd.2011.03.001>
- Morão, A., & de Bie, F. (2019). Life Cycle Impact Assessment of Polylactic Acid (PLA) Produced from Sugarcane in Thailand. *Journal of Polymers and the Environment*, 27(11), 2523–2539. <https://doi.org/10.1007/s10924-019-01525-9>
- Mussatto, S. I. (2016). *Biomass Fractionation Technologies for a Lignocellulosic Feedstock Based Biorefinery*. John Fedor. ISBN: 978-0-12-802323-5.
- Özgürlük, Ö., Özlüsoylu, Ş., Gülsoy, S. K., & Kılıç Pekgözlü, A. (2023). Effect of ternary deep eutectic solvents on delignification of stone pine cone. *Turkish Journal of Forestry | Türkiye Ormancılık Dergisi*, 107–112. <https://doi.org/10.18182/tjf.1379904>
- Pasaribu, M. J., dkk. (2020). Pra Desain Pabrik Poly Lactic Acid (PLA) dari Porang. *JURNAL TEKNIK ITS*, 10(2), 2337–3539.
- Payne, J., McKeown, P., & Jones, M. D. (2019). A circular economy approach to plastic waste. In *Polymer Degradation and Stability* (Vol. 165, pp. 170–181). Elsevier Ltd. <https://doi.org/10.1016/j.polymdegradstab.2019.05.014>
- Peters, M. S., Timmerhaus, K. D., and West, R. E. (2003). *Plant Design and Economics for Chemical Engineering, 5th edition*. New York: McGraw-Hill Companies, Inc.
- Pham, T. A., Ngo, D. S., & To, K. A. (2022). Formic Acid-Based Organosolv Delignification of Sugarcane Bagasse for Efficient Enzymatic Saccharification. *Sugar Tech*, 24(3), 779–787. <https://doi.org/10.1007/s12355-022-01114-6>
- Pinelli, D., Gonzalez-Vara, A., & Matteuzzi, D. (1997). Assessment of Kinetic Models for the Production of L- and D- Lactic Acid Isomers by *Lactobacillus casei* DMS 20011 and *Lactobacillus coryniformis* DMS 20004 in Continuous Fermentation. *Journal of Fermentation and Bioengineering*, 83(2), 209–212.
- Popovic, M., dkk. (2020). Elemental Composition, Heat Capacity from 2 to 300 K and Derived Thermodynamic Functions of 5 Microorganism Species. *Journal of*

Biotechnology, 331, 99–107. <https://doi.org/10.1016/j.jbiotec.2021.03.006>

- Prendiz, J., Mena, M., Vega-Baudrit. (2019). Polylactic Acid (PLA) As A Bioplastic And Its Possible Applications In The Food Industry. *Food Science and Nutrition*, 5(2), 1–6. <https://doi.org/10.24966/FSN-1076/100048>
- Rahimi, A., Ulbrich, A., Coon, J. J., & Stahl, S. S. (2014). Formic-acid-induced depolymerization of oxidized lignin to aromatics. *Nature*, 515(7526), 249–252. <https://doi.org/10.1038/nature13867>
- Ria, D., Irawan, A., Suhendi, E., Prasetya, B., & Gozan, M. (2016). *SINTESIS POLILAKTIDA (PLA) DARI ASAM LAKTAT DENGAN METODE POLIMERISASI PEMBUKAAN CINCIN MENGGUNAKAN KATALIS LIPASE*.
- Rouches, E., dkk. (2016). White-rot Fungi Pretreatment of Lignocellulosic Biomass for Anaerobic Digestion: Impact of Glucose Supplementation. *Process Biochem*, 51, 1784-1792. <https://doi.org/10.1016/j.procbio.2016.02.003>
- Rueda-Duran, C. A., Ortiz-Sanchez, M., & Cardona-Alzate, C. A. (2022). Detailed economic assessment of polylactic acid production by using glucose platform: sugarcane bagasse, coffee cut stems, and plantain peels as possible raw materials. *Biomass Conversion and Biorefinery*, 12(10), 4419–4434. <https://doi.org/10.1007/s13399-022-02501-5>
- Sakimoto, K., Kanna, M., & Matsumura, Y. (2017). Kinetic Model of Cellulose Degradation Using Simultaneous Saccharification and Fermentation. *Biomass and Bioenergy*, 99, 116–121. <https://doi.org/10.1016/j.biombioe.2017.02.016>
- Saputra, B. Y. E., Fahmi, M. F., & Widjaja, T. (2022). Fraksinasi Lignoselulosa dari TKKS dengan Metode Steam Explosion Pretreatment Disertai Penambahan Asam Formiat. *JURNAL TEKNIK ITS Vol. 11, No. 2 (2022), 2337-3539 (2301-9271 Print)*.
- Schroeder, D. V. (2021). *An introduction to thermal Physics*. Oxford University Press, USA.
- Semnas, P., & Ft Unila, S. (2018). *Pengaruh Konsentrasi SnCl₂ dan Temperatur Polimerisasi pada Sintesis Poli Laktida dengan Metode Ring-Opening Polymerization* (Vol. 1).
- Serhan, M., Sprowls, M., Jackemeyer, D., Long, M., Perez, I. D., Maret, W., Tao, N., & Forzani, E. (2019). Total iron measurement in human serum with a smartphone.

AIChE Annual Meeting, Conference Proceedings, 2019-November.
<https://doi.org/10.1039/x0xx00000x>

Shabrinah Itsnani, N., & Widjanarko, S. B. (2017). *OPTIMASI PROSES EKSTRAKSI PEKTIN DARI KULIT DAN JERAMI NANGKA (Artocarpus heterophyllus) MENGGUNAKAN KURVA RESPON PERMUKAAN Optimization of Pectin Extraction from Jackfruit (Artocarpus heterophyllus) Rind and Rags (Vol. 5, Issue 4).*

Sharma, H., dkk. (2019). Biological Pretreatment of Lignocellulosic Biomass of Biofuels and Bioproducts: An Overview. *Waste Biomass Valor*, 10, 235-251.
<https://doi.org/10.1007/s12649-017-0059-y>

Sinnot, R. K. (1999). Coulson & Richardson's Chemical Engineering Volume 6 Third Edition. Oxford: Butterworth-Heinemann.

Stelte, W. (2013). *Steam explosion for biomass pre-treatment Energy & Climate Centre for Renewable Energy and Transport Section for Biomass Steam explosion for biomass pre-treatment Resultat Kontrakt (RK) Report.*
<https://doi.org/10.13140/RG.2.2.23822.95041>

Sugiharto, H., Yafi, B. A., Nurkhamidah, S., & Susianto, D. (2021). Desain Pabrik Kimia Poly Lactid Acid (PLA) dari Bonggol Jagung. In *Journal of Fundamentals and Applications of Chemical Engineering (Vol. 02, Issue 01).*

Theodorou, A., Raptis, V., Baltzaki, C. I. M., Manios, T., Harmandaris, V., & Velonia, K. (2023). Synthesis and Modeling of Poly(L-lactic acid) via Polycondensation of L-Lactic Acid. *Polymers*, 15(23). <https://doi.org/10.3390/polym15234569>

Total Corbion. (n.d.). *PLA bioplastics for a brighter future (Biobased, Compostable, Innovative).* www.lca.plasticseurope.org

Tu, Q., Fu, S., Zhan, H., Chai, X., & Lucia, L. A. (2008). Kinetic modeling of formic acid pulping of bagasse. *Journal of Agricultural and Food Chemistry*, 56(9), 3097–3101. <https://doi.org/10.1021/jf0729659>

Ulrich, G. D. (1984). *A Guide to Chemical Engineering Process Design and Economics.* New York: John Wiley & Sons, Inc.

Undang-Undang nomor 36 Tahun 2008, pasal 17 tentang “Pajak Penghasilan”. www.alibaba.com, diakses pada 1 Mei 2025. www.matche.com, diakses pada 06 Agustus 2024. www.mhhe.com, diakses pada 1 Mei 2025. www.ojk.go.id, diakses

pada 1 Maret 2025. www.bi.go.id, diakses pada 1 Maret 2025.

- Wang, K., Chen, J., Sun, S. N., & Sun, R. C. (2015). Steam Explosion. In *Pretreatment of Biomass: Processes and Technologies* (pp. 75–104). Elsevier Inc. <https://doi.org/10.1016/B978-0-12-800080-9.00006-2>
- Wibowo, S., Efiyanti, L., & Pari, G. (2017). *Characterization of Palm Fruit Empty Bunches Bio-Oil with the Addition of Ni/NZA Catalyst Using Free Fall Pyrolysis Method*.
- Wee, Y.-J., dkk. (2005). Biotechnological Production of Lactic Acid and Its Recent Applications. *Food Technol. Biotechnol*, 44(2), 163–172. ISSN 1330-9862.
- Yankov, D. (2022). Fermentative Lactic Acid Production From Lignocellulosic Feedstocks: From Source to Purified Product. *Frontiers in Chemistry*, 10, 1–34. <https://doi.org/10.3389/fchem.2022.823005>
- Yaws, C. L. (2006). *Yaws Handbook of Thermodynamic Properties*. Gulf Publishing Company.
- Yoo, D. K., Kim, D., & Lee, D. S. (2005). Reaction Kinetics for the Synthesis of Oligomeric Poly(lactic acid). In *Macromolecular Research* (Vol. 13, Issue 1).
- Zhang, M., Qi, W., Liu, R., Su, R., Wu, S., & He, Z. (2010). Fractionating lignocellulose by formic acid: Characterization of major components. *Biomass and Bioenergy*, 34(4), 525–532. <https://doi.org/10.1016/j.biombioe.2009.12.018>
- Zhao, X., & Liu, D. (2010). Chemical and thermal characteristics of lignins isolated from Siam weed stem by acetic acid and formic acid delignification. *Industrial Crops and Products*, 32(3), 284–291. <https://doi.org/10.1016/j.indcrop.2010.05.003>
- Zheng, L., Geng, Z., & Zhen, W. (2019). Preparation, characterization, and reaction kinetics of poly (lactic acid)/amidated graphene oxide nanocomposites based on reactive extrusion process. *Journal of Polymer Research*, 26(3). <https://doi.org/10.1007/s10965-019-1722-8>
- Zulnazri. (2017). *HIDROLISIS SELULOSA DARI TANDAN KOSONG KELAPA SAWIT UNTUK MEMPRODUKSI CELLULOSE NANOCRYSTALS DENGAN METODE SONIKASI-HIDROTERMAL*.