UNIVERSITAS
GADJAH MADA
Analisis Profil Suhu Pirolisis Sekam Padi (Oryza sativa L.) Serta Produksi Biochar Dan Asap Cair Dengan Variasi Rasio Massa Bahan Baku Dan Waktu
Hazel Kianda Alfarabi, Makbul Hajad, S.T.P., M.Eng., Ph.D., IPP.; Prof. Dr. Ir. Bambang Purwantana, M.Agr.; Sri Mar
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

DAFTAR PUSTAKA

Kementerian ESDM. (2023). *Laporan Kinerja Kementerian Energi dan Sumber Daya Mineral Tahun 2022*. Jakarta: Kementerian Energi dan Sumber Daya Mineral Republik Indonesia.

Republik Indonesia. (2014). *Peraturan Pemerintah Republik Indonesia Nomor 79 Tahun 2014 tentang Kebijakan Energi Nasional*. Sekretariat Negara. Jakarta.

Aini, N. A., Jamilatun, S., & Pitoyo, J. (2022). PIROLISIS BIOMASSA: REVIEW. *Agroindustrial Technology Journal*, *6*(1), 89. https://doi.org/10.21111/atj.v6i1.7559

Akhtar, J., & Saidina, A. N. (2012). A review on operating parameters for optimum liquid oil yield in biomass pyrolysis. *Renewable and Sustainable Energy Reviews*, *16*(7), 5101–5109. https://doi.org/10.1016/j.rser.2012.05.033

Alami-Milani, M., Aghaei-Gharachorlou, P., Davar, R., Rashidpour, A., Torabian, S., & Farhangi-Abriz, S. (2024). Biochar solutions: Slow and fast pyrolysis effects on chromium stress in rapeseed roots. *Plant Physiology and Biochemistry*, *216*, 109197. https://doi.org/10.1016/j.plaphy.2024.109197

Alizad, F. O., & Eskicioglu, C. (2025). Hydrothermal liquefaction *vs.* fast/flash pyrolysis for biomass-to-biofuel conversion: New insights and comparative review of liquid biofuel yield, composition, and properties. *Green Chemistry*, *27*(24), 7009–7041. https://doi.org/10.1039/D5GC01314C

Altıkat, A., Alma, M. H., Altıkat, A., Bilgili, M. E., & Altıkat, S. (2024). A Comprehensive Study of Biochar Yield and Quality Concerning Pyrolysis Conditions: A Multifaceted Approach. *Sustainability*, *16*(2), 937. https://doi.org/10.3390/su16020937

Amelia, T., & Astuti, U. P. (2023). *Komposisi Biochar dan Suhu Pembakaran Pirolisis Terhadap Kadar Air Biochar*. *6*(2623).

Anca-Couce, A., Mehrabian, R., Scharler, R., & Obernberger, I. (2014). Kinetic scheme of biomass pyrolysis considering secondary charring reactions. *Energy Conversion and Management*, *87*, 687–696. https://doi.org/10.1016/j.enconman.2014.07.061

Asmunandar, A., Goembira, F., Raharjo, S., & Yuliarningsih, R. (2023). *Evaluasi Pengaruh Suhu dan Waktu Pirolisis Biochar Bambu Betung (Dendrocalamus asper)*.

Ayanoğlu, A., & Yumrutaş, R. (2016). Rotary kiln and batch pyrolysis of waste tire to produce gasoline and diesel like fuels. *Energy Conversion and Management*, *111*, 261–270. https://doi.org/10.1016/j.enconman.2015.12.070

Aysu, T., & Küçük, M. M. (2014). Biomass pyrolysis in a fixed-bed reactor: Effects of pyrolysis parameters on product yields and characterization of products. *Energy*, *64*, 1002–1025. https://doi.org/10.1016/j.energy.2013.11.053

Babler, M. U., Phounglamcheik, A., Amovic, M., Ljunggren, R., & Engvall, K. (2017). Modeling and pilot plant runs of slow biomass pyrolysis in a rotary kiln. *Applied Energy*, *207*, 123–133. https://doi.org/10.1016/j.apenergy.2017.06.034

Bakar, R. A., Yahya, R., & Gan, S. N. (2016). Production of High Purity Amorphous Silica from Rice Husk. *Procedia Chemistry*, *19*, 189–195. https://doi.org/10.1016/j.proche.2016.03.092

UNIVERSITAS
GADJAH MADA
Analisis Profil Suhu Pirolisis Sekam Padi (Oryza sativa L.) Serta Produksi Biochar Dan Asap Cair Dengan Variasi Rasio Massa Bahan Baku Dan Waktu
Hazel Kianda Alfarabi, Makbul Hajad, S.T.P., M.Eng., Ph.D., IPP.; Prof. Dr. Ir. Bambang Purwantana, M.Agr.; Sri Mar
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Basu, P. (2010). *Biomass gasification and pyrolysis: Practical design and theory*. Academic Press.

Biswas, B., Pandey, N., Bisht, Y., Singh, R., Kumar, J., & Bhaskar, T. (2017). Pyrolysis of agricultural biomass residues: Comparative study of corn cob, wheat straw, rice straw and rice husk. *Bioresource Technology*, *237*, 57–63. https://doi.org/10.1016/j.biortech.2017.02.046

Bojanovský, J., Máša, V., Hudák, I., Skryja, P., & Hopjan, J. (2022). Rotary Kiln, a Unit on the Border of the Process and Energy Industry—Current State and Perspectives. *Sustainability*, *14*(21), 13903. https://doi.org/10.3390/su142113903

Bridgwater, A. V. (2012). Review of fast pyrolysis of biomass and product upgrading. *Biomass and Bioenergy*, *38*, 68–94. https://doi.org/10.1016/j.biombioe.2011.01.048

Budaraga, I. K., Marlida, Y., & Bulanin, U. (2016). *Antioxidant Properties of Liquid Smoke Production Variation of Pyrolysis Temperature Raw and Different Concentration*.

Campuzano, F., Brown, R. C., & Martínez, J. D. (2019). Auger reactors for pyrolysis of biomass and wastes. *Renewable and Sustainable Energy Reviews*, *102*, 372–409. https://doi.org/10.1016/j.rser.2018.12.014

Chen, L., Yang, K., Huang, J., Liu, P., Yang, J., Pan, Y., Qi, F., & Jia, L. (2022). Experimental and kinetic study on flash pyrolysis of biomass via on-line photoionization mass spectrometry. *Applications in Energy and Combustion Science*, *9*, 100057. https://doi.org/10.1016/j.jaecs.2022.100057

Dewangan, A., Pradhan, D., & Singh, R. K. (2016). Co-pyrolysis of sugarcane bagasse and low-density polyethylene: Influence of plastic on pyrolysis product yield. *Fuel*, *185*, 508–516. https://doi.org/10.1016/j.fuel.2016.08.011

Dhyani, V., & Bhaskar, T. (2018). A comprehensive review on the pyrolysis of lignocellulosic biomass. *Renewable Energy*, *129*, 695–716. https://doi.org/10.1016/j.renene.2017.04.035

Djurdjevic, M., Papuga, S., & Kolundzija, A. (2024). Analysis of the thermal behavior of a fixed bed reactor during the pyrolysis process. *Hemijska Industrija*, *78*(1), 29–40. https://doi.org/10.2298/HEMIND221217024D

Duryat, D., Bintoro, A., Asmarahman, C., Riniarti, M., & Imron, I. (2024). Biochar Sebagai Pembenah Tanah Untuk Pertanian Regeneratif Pada Lahan Gapoktanhut Pujo Makmur Kecamatan Padang Cermin Kabupaten Tanggamus. *Repong Damar: Jurnal Pengabdian Kehutanan dan Lingkungan*, *3*(2), 129–143. https://doi.org/10.23960/rdj.v3i2.9907

Faisal, M., Gani, A., Mulana, F., Desvita, H., & Kamaruzzaman, S. (2020). EFFECTS OF PYROLYSIS TEMPERATURE ON THE COMPOSITION OF LIQUID SMOKE DERIVED FROM OIL PALM EMPTY FRUIT BUNCHES. *Rasayan Journal of Chemistry*, *13*(01), 514–520. https://doi.org/10.31788/RJC.2020.1315507

Ghozali, I. (2018). *Aplikasi Analisis Multivariate dengan Program IBM SPSS 25 (Edisi 9)*. Badan Penerbit Universitas Diponegoro (UNDIP).

Gobel, A. P., & Arief, A. T. (2022). Teknologi Pirolisis Pembuatan Asap Cair dari Sekam Padi. *Prima Abdika : Jurnal Pengabdian Masyarakat*, *2*(4), 427–434. https://doi.org/10.37478/abdika.v2i4.2201

UNIVERSITAS
GADJAH MADA
Analisis Profil Suhu Pirolisis Sekam Padi (Oryza sativa L.) Serta Produksi Biochar Dan Asap Cair Dengan Variasi Rasio Massa Bahan Baku Dan Waktu
Hazel Kianda Alfarabi, Makbul Hajad, S.T.P., M.Eng., Ph.D., IPP.; Prof. Dr. Ir. Bambang Purwantana, M.Agr.; Sri Mar
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Gonnella, G., Ischia, G., Fambri, L., & Fiori, L. (2022). Thermal Analysis and Kinetic Modeling of Pyrolysis and Oxidation of Hydrochars. *Energies*, *15*(3), 950. https://doi.org/10.3390/en15030950

Goularte, M. D. P., De Sousa, Á. F., Cholant, C., Romano, L., Labidi, J., Missio, A. L., Acosta, A., & Gatto, D. A. (2025). Pyrolysis of Rice Husk for the Production of Bioactive Compounds with Potential in Green Chemistry and Sustainable Agriculture. *Molecules*, *30*(13), 2754. https://doi.org/10.3390/molecules30132754

Guedes, R. E., Luna, A. S., & Torres, A. R. (2018). Operating parameters for bio-oil production in biomass pyrolysis: A review. *Journal of Analytical and Applied Pyrolysis*, *129*, 134–149. https://doi.org/10.1016/j.jaap.2017.11.019

Habibi, M. I. A., Aldiansyah, M. R., Ahmad, N., Cantona, M. E., Jannah, N. Z., & Alhikami, A. F. (2025). *A Study Of Bio-Oil Derived From Rice Husk Using Pyrolysis As A Potential Gasoline Additive*. *08*.

Hagemann, N., Conte, P., Leifeld, J., Giger, R., Bucheli, T., Schmidt, H.-P., & Grafmüller, J. (2023). *Impact of biomass ash content on biochar carbon speciation and stability*. https://doi.org/https://doi.org/10.5194/egusphere-egu23-17040

Hainur, A., Puspita, R., Alizar, U., Egi Agustian, & Anny Sulaswatty. (2023). Pengaruh Temperatur Pirolisis Terhadap Karakteristik Biochar dari Limbah Padat Agroindustri Teh. *INSOLOGI: Jurnal Sains dan Teknologi*, *2*(6), 1173–1183. https://doi.org/10.55123/insologi.v2i6.3059

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis* (Eighth edition). Cengage.

Harits, M. A., & Syuriadi, A. (2024). *Analisis Pengaruh Variasi Massa Terhadap Yield dan Kualitas Bio Oil Menggunakan Biomassa Duckweed Pada Proses Pirolisis*.

Hasan, M. M., Rasul, M. G., Jahirul, M. I., & Khan, M. M. K. (2023). Characterization of pyrolysis oil produced from organic and plastic wastes using an auger reactor. *Energy Conversion and Management*, *278*, 116723. https://doi.org/10.1016/j.enconman.2023.116723

Hasan, M. M., Rasul, M. G., Khan, M. M. K., Ashwath, N., & Jahirul, M. I. (2021). Energy recovery from municipal solid waste using pyrolysis technology: A review on current status and developments. *Renewable and Sustainable Energy Reviews*, *145*, 111073. https://doi.org/10.1016/j.rser.2021.111073

Hasan, M. M., Wang, X. S., Mourant, D., Gunawan, R., Yu, C., Hu, X., Kadarwati, S., Gholizadeh, M., Wu, H., Li, B., Zhang, L., & Li, C.-Z. (2017). Grinding pyrolysis of Mallee wood: Effects of pyrolysis conditions on the yields of bio-oil and biochar. *Fuel Processing Technology*, *167*, 215–220. https://doi.org/10.1016/j.fuproc.2017.07.004

Hasibuan, R., & Pardede, H. M. (2023). Pengaruh Suhu dan Waktu Pirolisis terhadap Karakteristik Arang dari Tempurung Kelapa. *Jurnal Teknik Kimia USU*, *12*(1), 46–53. https://doi.org/10.32734/jtk.v12i1.8534

Herrera, K., Morales, L. F., Tarazona, N. A., Aguado, R., & Saldarriaga, J. F. (2022). Use of Biochar from Rice Husk Pyrolysis: Part A: Recovery as an Adsorbent in the Removal of Emerging Compounds. *ACS Omega*, *7*(9), 7625–7637. https://doi.org/10.1021/acsomega.1c06147

UNIVERSITAS
GADJAH MADA
Analisis Profil Suhu Pirolisis Sekam Padi (Oryza sativa L.) Serta Produksi Biochar Dan Asap Cair Dengan Variasi Rasio Massa Bahan Baku Dan Waktu
Hazel Kianda Alfarabi, Makbul Hajad, S.T.P., M.Eng., Ph.D., IPP.; Prof. Dr. Ir. Bambang Purwantana, M.Agr.; Sri Mar
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Iskandar, T., & Rofiatin, U. (2017). KARAKTERISTIK BIOCHAR BERDASARKAN JENIS BIOMASSA DAN PARAMETER PROSES PYROLISIS. *Jurnal Teknik Kimia*, *12*(1). https://doi.org/10.33005/tekkim.v12i1.843

Islam, M. N., Ali, M. H., & Ahmad, I. (2017). Fıxed bed slow pyrolysıs of bıomass solıd waste for bıo-char. *IOP Conference Series: Materials Science and Engineering*, *206*, 012014. https://doi.org/10.1088/1757-899X/206/1/012014

Jagodzińska, K., Czerep, M., Kudlek, E., Wnukowski, M., Pronobis, M., & Yang, W. (2020). Torrefaction of Agricultural Residues: Effect of Temperature and Residence Time on the Process Products Properties. *Journal of Energy Resources Technology*, *142*(7), 070912. https://doi.org/10.1115/1.4046275

Jahirul, M. I., Rasul, M. G., Schaller, D., Khan, M. M. K., Hasan, M. M., & Hazrat, M. A. (2022). Transport fuel from waste plastics pyrolysis – A review on technologies, challenges and opportunities. *Energy Conversion and Management*, *258*, 115451. https://doi.org/10.1016/j.enconman.2022.115451

Jamilatun, S., Pitoyo, J., Amelia, S., Ma'arif, A., Hakika, D. C., & Mufandi, I. (2022). Experimental Study on The Characterization of Pyrolysis Products from Bagasse (Saccharum Officinarum L.): Bio-oil, Biochar, and Gas Products. *Indonesian Journal of Science and Technology*, *7*(3), 565–582. https://doi.org/10.17509/ijost.v7i3.51566

Jaya, J. D., Zulmi, A., Wahyudi, D., Kartika, K., Wati, H., Yuliana, N., & Kholis, N. (2016). OPTIMASI PEMBUATAN ASAP CAIR DARI SEKAM PADI DAN APLIKASINYA SEBAGAI PUPUK TANAMAN HIDROPONIK. *Jurnal Teknologi Agro-Industri*, *2*(2), 28–32. https://doi.org/10.34128/jtai.v2i2.17

Jayamini, H. P. A., Dassanayake, K. M. M., Senavirathna, G. R. U., & Liyanage, D. (2024). Design and Development of a Pyrolysis Reactor to Produce Biochar at Industrial Scale. *Engineer: Journal of the Institution of Engineers, Sri Lanka*, *57*(1), 31–44. https://doi.org/10.4038/engineer.v57i1.7637

Jayanudin, J., Suhendi, A., Uyun, J., & Supriatna, A. H. (2012). PENGARUH SUHU PIROLISIS DAN UKURAN TEMPURUNG KELAPA TERHADAP RENDEMEN DAN KARAKTERISTIK ASAP CAIR SEBAGAI PENGAWET ALAMI. *Teknika: Jurnal Sains dan Teknologi*, *8*(1), 46. https://doi.org/10.36055/tjst.v9i1.6686

Jiang, K., Xing, R., Luo, Z., Huang, W., Yi, F., Men, Y., Zhao, N., Chang, Z., Zhao, J., Pan, B., & Shen, G. (2024). Pollutant emissions from biomass burning: A review on emission characteristics, environmental impacts, and research perspectives. *Particuology*, *85*, 296–309. https://doi.org/10.1016/j.partic.2023.07.012

Jiang, T.-J., Morgan, H. M., & Tsai, W.-T. (2024). Optimization of Vertical Fixed-Bed Pyrolysis for Enhanced Biochar Production from Diverse Agricultural Residues. *Materials*, *17*(12), 3030. https://doi.org/10.3390/ma17123030

Joni Munarso, S., & Mulyawanti, I. (2023). Effect of Adsorbent from Activated Rice Husk Charcoal on The Characteristics of Crude Palm Oil (CPO); A Preliminary Study. *IOP Conference Series: Earth and Environmental Science*, *1172*(1), 012054. https://doi.org/10.1088/1755-1315/1172/1/012054

Lewandowski, W. M., Januszewicz, K., & Kosakowski, W. (2019). Efficiency and proportions of waste tyre pyrolysis products depending on the reactor type—A

UNIVERSITAS
GADJAH MADA
Analisis Profil Suhu Pirolisis Sekam Padi (Oryza sativa L.) Serta Produksi Biochar Dan Asap Cair Dengan Variasi Rasio Massa Bahan Baku Dan Waktu
Hazel Kianda Alfarabi, Makbul Hajad, S.T.P., M.Eng., Ph.D., IPP.; Prof. Dr. Ir. Bambang Purwantana, M.Agr.; Sri Mar
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

review. *Journal of Analytical and Applied Pyrolysis*, *140*, 25–53. https://doi.org/10.1016/j.jaap.2019.03.018

Loc, N. X., & Phuong, D. T. M. (2024). Optimizing biochar production: A review of recent progress in lignocellulosic biomass pyrolysis. *Frontiers of Agricultural Science and Engineering*, *0*(0), 0. https://doi.org/10.15302/J-FASE-2024597

Maulinda, L., Husin, H., Arahman, N., Rosnelly, C. M., & Syukri, M. (2023). *The Influence of Pyrolysis Time and Temperature on the Composition and Properties of Bio-Oil Prepared from Tanjong Leaves (Mimusops elengi)*.

Mierzwa-Hersztek, M., Gondek, K., Jewiarz, M., & Dziedzic, K. (2019). Assessment of energy parameters of biomass and biochars, leachability of heavy metals and phytotoxicity of their ashes. *Journal of Material Cycles and Waste Management*, *21*(4), 786–800. https://doi.org/10.1007/s10163-019-00832-6

Montgomery, D. C. (Ed.). (2013). *Design and analysis of experiments* (Eighth edition). John Wiley & Sons, Inc.

Moulia, M. N., Rahayu, D., Ahmad, S. R., & Suliyanto, H. (2025). Kajian Kualitas Briket Sekam Padi sebagai Bahan Bakar Alternatif. *Jurnal Teknotan*, *19*(2), 77–80. https://doi.org/10.24198/jt.vol19n2.1

Nadia, L. S., Lejap, T. Y. T., & Rahmanto, L. (2023). Pengaruh Pengolahan Pangan terhadap Kadar air Bahan Pangan. *Journal of Innovative Food Technology and Agricultural Product*, 5–8. https://doi.org/10.31316/jitap.vi.5780

Nasywa, J., & Sa'diyah, K. (2023a). PENGARUH JUMLAH MASSA UMPAN SEKAM PADI TERHADAP KUALITAS ASAP CAIR PADA PROSES PIROLISIS. *DISTILAT: Jurnal Teknologi Separasi*, *8*(3), 559–566. https://doi.org/10.33795/distilat.v8i3.500

Nasywa, J., & Sa'diyah, K. (2023b). PENGARUH JUMLAH MASSA UMPAN SEKAM PADI TERHADAP KUALITAS ASAP CAIR PADA PROSES PIROLISIS. *DISTILAT: Jurnal Teknologi Separasi*, *8*(3), 559–566. https://doi.org/10.33795/distilat.v8i3.500

Nina, Y., Iskandar, T., & Anggraini, A. (2018). *eUREKA : Jurnal Penelitian Mahasiswa Teknik Sipil dan Teknik Kimia, 2(2), 2018, page 265-272*.

Niu, Y., Lv, Y., Lei, Y., Liu, S., Liang, Y., Wang, D., & Hui, S. (2019). Biomass torrefaction: Properties, applications, challenges, and economy. *Renewable and Sustainable Energy Reviews*, *115*, 109395. https://doi.org/10.1016/j.rser.2019.109395

Nuryadi, N., Tutut, D. A., Utami, E. S., & Budiantara, M. (2017). *Dasar Dasar Statistik Penelitian*.

Okukenle, P. O., Ajayi, Olasunkanmi. O., Bolarinwa, Olayinka. O., Alayande, I. O., & Fatai, M. A. (2020). Effect of Oven Drying and Reactor Temperature on Rice Husk Pyrolysis in a Fixed Bed Reactor. *International Journal of Progressive Sciences and Technologies*, *19(1)*, 260-265. https://doi.org/http://dx.doi.org/10.52155/ijpsat.v19.1.1613

Oni, B. A., Oziegbe, O., & Olawole, O. O. (2019). Significance of biochar application to the environment and economy. *Annals of Agricultural Sciences*, *64*(2), 222–236. https://doi.org/10.1016/j.aoas.2019.12.006

UNIVERSITAS
GADJAH MADA
Analisis Profil Suhu Pirolisis Sekam Padi (Oryza sativa L.) Serta Produksi Biochar Dan Asap Cair Dengan Variasi Rasio Massa Bahan Baku Dan Waktu
Hazel Kianda Alfarabi, Makbul Hajad, S.T.P., M.Eng., Ph.D., IPP.; Prof. Dr. Ir. Bambang Purwantana, M.Agr.; Sri Mar
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Pahnila, M., Koskela, A., Sulasalmi, P., & Fabritius, T. (2023). A Review of Pyrolysis Technologies and the Effect of Process Parameters on Biocarbon Properties. *Energies*, *16*(19), 6936. https://doi.org/10.3390/en16196936

Papuga, S., Savković, J., Djurdjevic, M., & Ciprioti, S. V. (2024). Effect of Feed Mass, Reactor Temperature, and Time on the Yield of Waste Polypropylene Pyrolysis Oil Produced via a Fixed-Bed Reactor. *Polymers*, *16*(10), 1302. https://doi.org/10.3390/polym16101302

Parvari, E., Mahajan, D., & Hewitt, E. L. (2025). A Review of Biomass Pyrolysis for Production of Fuels: Chemistry, Processing, and Techno-Economic Analysis. *Biomass*, *5*(3), 54. https://doi.org/10.3390/biomass5030054

Pode, R. (2016). Potential applications of rice husk ash waste from rice husk biomass power plant. *Renewable and Sustainable Energy Reviews*, *53*, 1468–1485. https://doi.org/10.1016/j.rser.2015.09.051

Pratama, A. S. C., & Sa'diyah, K. (2023). PENGARUH JENIS BIOMASSA TERHADAP KARAKTERISTIK ASAP CAIR MELALUI METODE PIROLISIS. *DISTILAT: Jurnal Teknologi Separasi*, *8*(1), 36–44. https://doi.org/10.33795/distilat.v8i1.260

Pratiwi, I. (2022). *Rancang Bangun Alat Konversi Limbah Plastik Menjadi Bahan Bakar Melalui Pirolisis*.

Prolapita, C. O., & Safitra, C. I. N. H. (2021). Formulasi dan Uji Mutu Fisik Sediaan Body Scrub dari Arang Aktif Sekam Padi (Oryza sativa). *Program Pendidikan Diploma Farmasi, Akademi Farmasi Mitra Sehat Mandiri Sidoarjo*. https://doi.org/https://doi.org/10.25026/mpc.v13i1.469

Puspita, V., Syakur, S., & Darusman, D. (2021). Karakteristik Biochar Pada Dua Temperatur Pirolisis. *Jurnal Mahasiswa Pertanian*, *6(4):732-739*.

Putri, D. Q. A., & Chumaidi, A. (2023). SINTESA DPR (DISPROPORTIONATED ROSIN) DARI GUM ROSIN GRADE X SECARA BATCH. *DISTILAT: Jurnal Teknologi Separasi*, *7*(2), 302–309. https://doi.org/10.33795/distilat.v7i2.244

Qolbi, R. N., Safiq, D., Sudarti, S., & Sudarti, K. (2019). Analisis Konsep Fisika pada Teknologi 'PIROLISIS' untuk Pengolahan Limbah Tandan Kosong Kelapa Sawit sebagai Sumber Energi Terbarukan. *Jurnal Ilmiah Wahana Pendidikan*, *10*(11D), 124–130. https://doi.org/https://jurnal.peneliti.net/index.php/JIWP/article/view/13050

Quan, C., Gao, N., & Song, Q. (2016). Pyrolysis of biomass components in a TGA and a fixed-bed reactor: Thermochemical behaviors, kinetics, and product characterization. *Journal of Analytical and Applied Pyrolysis*, *121*, 84–92. https://doi.org/10.1016/j.jaap.2016.07.005

Ramadhan, F., Syuriadi, A., & Sukandi, A. (2024a). *Pengaruh Variasi Suhu dan Berat Biomassa Terhadap Yield dan Kualitas Bio-oil Menggunakan Biomassa Sekam Padi pada Proses Pirolisis*.

Ramadhan, F., Syuriadi, A., & Sukandi, A. (2024b). *Pengaruh Variasi Suhu dan Berat Biomassa Terhadap Yield dan Kualitas Bio-oil Menggunakan Biomassa Sekam Padi pada Proses Pirolisis*.

Rangel, M. D. C., Mayer, F. M., Carvalho, M. D. S., Saboia, G., & De Andrade, A. M. (2023). Selecting Catalysts for Pyrolysis of Lignocellulosic Biomass. *Biomass*, *3*(1), 31–63. https://doi.org/10.3390/biomass3010003

UNIVERSITAS
GADJAH MADA
Analisis Profil Suhu Pirolisis Sekam Padi (Oryza sativa L.) Serta Produksi Biochar Dan Asap Cair Dengan Variasi Rasio Massa Bahan Baku Dan Waktu
Hazel Kianda Alfarabi, Makbul Hajad, S.T.P., M.Eng., Ph.D., IPP.; Prof. Dr. Ir. Bambang Purwantana, M.Agr.; Sri Mar
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Razali, N. M., & Wah, Y. B. (2011). *Power comparisons of Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors and Anderson-Darling tests*.

Rezanezhad, S., Nazanezhad, N., & Asadpur, G. (2013). *Isolation of Nanocellulose from Rice Waste via Ultrasonication*.

Riandis, J. A., Setyawati, A. R., & Sanjaya, A. S. (2021). PENGOLAHAN SAMPAH PLASTIK DENGAN METODE PIROLISIS MENJADI BAHAN BAKAR MINYAK. *Jurnal Chemurgy*, *5*(1), 8. https://doi.org/10.30872/cmg.v5i1.4755

Ridhuan, K., Irawan, D., & Inthifawzi, R. (2019). Proses Pembakaran Pirolisis dengan Jenis Biomassa dan Karakteristik Asap Cair yang Dihasilkan. *Turbo : Jurnal Program Studi Teknik Mesin*, *8*(1). https://doi.org/10.24127/trb.v8i1.924

Ridhuan, K., Irawan, D., & Zanaria, Y. (2020). Kajian Tekno-Ekonomi Produksi Reaktor Pirolisis dalam Menghasilkan Bioarang dan Asap Cair. *Turbo : Jurnal Program Studi Teknik Mesin*, *8*(2). https://doi.org/10.24127/trb.v8i2.1079

Ridhuan, K., Khusaini, F., & Ridwan, R. (2022a). Optimasi kinerja reaktor pirolysis biomassa dengan penambahan pipa udara. *Turbo : Jurnal Program Studi Teknik Mesin*, *11*(1). https://doi.org/10.24127/trb.v11i1.2121

Ridhuan, K., Khusaini, F., & Ridwan, R. (2022b). Optimasi kinerja reaktor pirolysis biomassa dengan penambahan pipa udara. *Turbo : Jurnal Program Studi Teknik Mesin*, *11*(1). https://doi.org/10.24127/trb.v11i1.2121

Rodriguez, J. A., Lustosa Filho, J. F., Melo, L. C. A., De Assis, I. R., & De Oliveira, T. S. (2020). Influence of pyrolysis temperature and feedstock on the properties of biochars produced from agricultural and industrial wastes. *Journal of Analytical and Applied Pyrolysis*, *149*, 104839. https://doi.org/10.1016/j.jaap.2020.104839

Sahraeni, S., Harjanto, H., Firman, F., & Ahnaf, S. K. (2023). *KARAKTERISTIK CRUDE ASAP CAIR HASIL PIROLISIS GAMBUT BERBENTUKAN KATALIS ZEOLIT ALAM TERAKTIVASI*.

Seri, M., & Feni, S. P. (2017a). PENGARUH SUHU, WAKTU, DAN KADAR AIR BAHAN BAKU TERHADAP PIROLISIS SERBUK PELEPAH KELAPA SAWIT. *Jurnal Teknik Kimia USU*, *6*(2), 35–40. https://doi.org/10.32734/jtk.v6i2.1581

Seri, M., & Feni, S. P. (2017b). PENGARUH SUHU, WAKTU, DAN KADAR AIR BAHAN BAKU TERHADAP PIROLISIS SERBUK PELEPAH KELAPA SAWIT. *Jurnal Teknik Kimia USU*, *6*(2), 35–40. https://doi.org/10.32734/jtk.v6i2.1581

Setianingsih, T., Purwonugroho, D., & Prananto, Y. P. (2021). Influence of Pyrolysis Parameters Using Microwave toward Structural Properties of ZnO/CNS Intermediate and Application of ZnCr2O4/CNS Final Product for Dark Degradation of Pesticide in Wet Paddy Soil. *ChemEngineering*, *5*(3), 58. https://doi.org/10.3390/chemengineering5030058

Shen, Y. (2017). Rice husk silica derived nanomaterials for sustainable applications. *Renewable and Sustainable Energy Reviews*, *80*, 453–466. https://doi.org/10.1016/j.rser.2017.05.115

Stoll, A. (2017). The SAGE Encyclopedia Of Communication Research Methods. In *The SAGE Encyclopedia Of Communication Research Methods*.

Sulhatun, R. (2019). *Pyrotechology 4 in 1 Prinsip Dasar teknologi Pirolisa Biomassa*. Unimal Press.

UNIVERSITAS
GADJAH MADA
Analisis Profil Suhu Pirolisis Sekam Padi (Oryza sativa L.) Serta Produksi Biochar Dan Asap Cair Dengan Variasi Rasio Massa Bahan Baku Dan Waktu
Hazel Kianda Alfarabi, Makbul Hajad, S.T.P., M.Eng., Ph.D., IPP.; Prof. Dr. Ir. Bambang Purwantana, M.Agr.; Sri Mar
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Sulhatun, S. (2012). *PEMANFAATAN ASAP CAIR BERBASIS CANGKANG SAWIT SEBABAGAI BAHAN PENGAWET ALTERNATIVE*.

Supriningrum, N., & Risaldi, J. (2016). *Karakterisasi dan Skrining Fitokimia Daun Kerehau (Callicarpa longifolia Lamk.)*.

Syahputri, S. A., Irawan Rusnadi, & Ida Febriana. (2024). Pirolisis Campuran Biji Jarak Dan Biji Kapuk Dengan Katalis Zeolit Menjadi Syngas Dan Biochar. *Jurnal Redoks*, *9*(2), 163–176. https://doi.org/10.31851/redoks.v9i2.16418

Syamsiro, M., Saptoadi, H., Norsujianto, T., Noviasri, P., Cheng, S., Alimuddin, Z., & Yoshikawa, K. (2014). Fuel Oil Production from Municipal Plastic Wastes in Sequential Pyrolysis and Catalytic Reforming Reactors. *Energy Procedia*, *47*, 180–188. https://doi.org/10.1016/j.egypro.2014.01.212

Syauqiah, I., Nurandini, D., Prihatini, N. S., & Jamiyaturrasidah, J. (2021). KINETIC STUDIES OF Cu ADSORPTION FROM SASIRANGAN LIQUID WASTE USING RICE HUSK ACTIVATED CARBON. *Konversi*, *10*(2). https://doi.org/10.20527/k.v10i2.11660

Tabal, A., Belyazid, O., Dahman, H., Berrich, E., Jeguirim, M., El Achaby, M., El Harfi, K., & Aboulkas, A. (2024). Intermediate pyrolysis of Ficus nitida wood in a fixed-bed reactor: Effect of pyrolysis parameters on bio-oil and bio-char yields and properties. *Comptes Rendus. Chimie*, *26*(S1), 7–23. https://doi.org/10.5802/crchim.253

Tran Sy, N., Huynh Van, T., Chiem, N. H., Nguyen Van, C., & Mitsunori, T. (2022). Rice husk and melaleuca biochar additions reduce soil CH4 and N2O emissions and increase soil physicochemical properties. *F1000Research*, *10*, 1128. https://doi.org/10.12688/f1000research.74041.2

Tripathi, M., Sahu, J. N., & Ganesan, P. (2016). Effect of process parameters on production of biochar from biomass waste through pyrolysis: A review. *Renewable and Sustainable Energy Reviews*, *55*, 467–481. https://doi.org/10.1016/j.rser.2015.10.122

Ungureanu, N., Vlăduț, N.-V., Biriș, S.-Ștefan, Gheorghiță, N.-E., & Ionescu, M. (2025a). Biomass Pyrolysis Pathways for Renewable Energy and Sustainable Resource Recovery: A Critical Review of Processes, Parameters, and Product Valorization. *Sustainability*, *17*(17), 7806. https://doi.org/10.3390/su17177806

Ungureanu, N., Vlăduț, N.-V., Biriș, S.-Ștefan, Gheorghiță, N.-E., & Ionescu, M. (2025b). Biomass Pyrolysis Pathways for Renewable Energy and Sustainable Resource Recovery: A Critical Review of Processes, Parameters, and Product Valorization. *Sustainability*, *17*(17), 7806. https://doi.org/10.3390/su17177806

Uzun, B., Bruckman, V. J., & Varol, E. A. (2016). *Pyrolysis: A Sustainable Way From Biomass to Biofuels and Biochar* (Vols. 239–265). Cambridge University Press.

Vieira, F. R., Romero Luna, C. M., Arce, G. L. A. F., & Ávila, I. (2020a). Optimization of slow pyrolysis process parameters using a fixed bed reactor for biochar yield from rice husk. *Biomass and Bioenergy*, *132*, 105412. https://doi.org/10.1016/j.biombioe.2019.105412

Vieira, F. R., Romero Luna, C. M., Arce, G. L. A. F., & Ávila, I. (2020b). Optimization of slow pyrolysis process parameters using a fixed bed reactor for biochar yield from rice husk. *Biomass and Bioenergy*, *132*, 105412. https://doi.org/10.1016/j.biombioe.2019.105412

UNIVERSITAS
GADJAH MADA
Analisis Profil Suhu Pirolisis Sekam Padi (Oryza sativa L.) Serta Produksi Biochar Dan Asap Cair Dengan Variasi Rasio Massa Bahan Baku Dan Waktu
Hazel Kianda Alfarabi, Makbul Hajad, S.T.P., M.Eng., Ph.D., IPP.; Prof. Dr. Ir. Bambang Purwantana, M.Agr.; Sri Mar
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Weber, K., & Quicker, P. (2018). Properties of biochar. *Fuel*, *217*, 240–261. https://doi.org/10.1016/j.fuel.2017.12.054

Wijayanti, H., Ratnasari, D., & Hakim, R. (2020). Studi Kinetika Pirolisis Sekam Padi untuk Menghasilkan Bio-oil sebagai Energi Alternatif. *Buletin Profesi Insinyur*, *3*(2), 83–88. https://doi.org/10.20527/bpi.v3i2.67

Yan, Q., Toghiani, H., Yu, F., Cai, Z., & Zhang, J. (2011). Effects of Pyrolysis Conditions on Yield of Bio-Chars from Pine Chips. *Forest Products Journal*, *61*(5), 367–371. https://doi.org/10.13073/0015-7473-61.5.367

Yanti, E., Ginting, Z., Muarif, A., Bahri, S., & Dewi, R. (2025). PENGARUH TEMPERATUR DAN WAKTU PIROLISIS PADA PEMBUATAN ASAP CAIR (Liquid Smoked) DARI LIMBAH PADAT NILAM (Pogostemon CablinBenth). *Chemical Engineering Journal Storage (CEJS)*, *5*(1), 80–87. https://doi.org/10.29103/cejs.v5i1.21159

Yates, J. G., & Lettieri, P. (2016). *Fluidized-Bed Reactors: Processes and Operating Conditions* (Vol. 26). Springer International Publishing. https://doi.org/10.1007/978-3-319-39593-7

Yorgun, S., & Yıldız, D. (2015). Slow pyrolysis of paulownia wood: Effects of pyrolysis parameters on product yields and bio-oil characterization. *Journal of Analytical and Applied Pyrolysis*, *114*, 68–78. https://doi.org/10.1016/j.jaap.2015.05.003

Zaki, M., Mamat, R., & Susanto, H. (2020). *Potential And Utilization Of Biomass For Heat Energy In Indonesia: A Review*. *9*(10).

Zeng, K., Flamant, G., Gauthier, D., & Guillot, E. (2015). Solar Pyrolysis of Wood in a Lab-scale Solar Reactor: Influence of Temperature and Sweep Gas Flow Rate on Products Distribution. *Energy Procedia*, *69*, 1849–1858. https://doi.org/10.1016/j.egypro.2015.03.163