

DAFTAR PUSTAKA

- Al-Rubaye, A. F., Hameed, I. H., & Kadhim, M. J. (2017). A Review: Uses of Gas Chromatography-Mass Spectrometry (GC-MS) Technique for Analysis of Bioactive Natural Compounds of Some Plants. *International Journal of Toxicological and Pharmacological Research*, 9(01). <https://doi.org/10.25258/ijtpr.v9i01.9042>
- Alemu, T., & Getachew Alemu, A. (2024). Recent Developments in Catalysts for Biodiesel Production Applications. *Advanced Biodiesel - Technological Advances, Challenges, and Sustainability Considerations*, 1–18. <https://doi.org/10.5772/intechopen.109483>
- Angelia, D., Prestasindi, G., Permatasari, W., Redjeki, S., & Surabaya, K. (2022). Kinetics Transesterification Reaction Of Waste Cooking Oil Into Biodiesel With Modified CaO. *Jurnal Teknik Kimia*, 16(2), 93–100.
- Anggoro, D. D. (2019). *Buku Ajar Teori dan Aplikasi Rekayasa Zeolit* (Nomor 1). https://www.researchgate.net/profile/Didi-Anggoro-2/publication/321094902_Teori_dan_Aplikasi_Rekayas_Zeolit/links/5b58306ca6fdccf0b2f35495/Teori-dan-Aplikasi-Rekayas-Zeolit.pdf
- Asriza, R. O., & Andre, V. (2018). Katalis CaO Dari Cangkang Siput Gonggong (*Strombus canarium*). *Prosiding Seminar Nasional Penelitian & Pengabdian Pada Masyarakat, October*, 1–3.
- Asrori, M. R., Sutrisno, S., Wijaya, W. (2020). Prosiding Seminar Nasional Kimia dan Pembelajarannya 2020 Sinergi Kimia dan Pendidikan Kimia untuk Menyiapkan Generasi di Era Disruptif Jurusan Kimia Fakultas Matematika dan Ilmu Pengetahuan Alam Universitas Negeri Malang. *Prosiding Seminar Nasional Kimia dan Pembelajarannya, July 2021*, 179–196.
- Atikah, W. S. (2017). Karakterisasi Zeolit Alam Gunung Kidul Teraktivasi Sebagai Media Adsorben Pewarna Tekstil. *Arena Tekstil*, 32(1), 17–24. <https://doi.org/10.31266/at.v32i1.2650>
- Azizah, N., Asrifah, R. D., Lukito, H., Wicaksono, A. P., & Nugroho, N. E. (2024). Penggunaan Zeolit Alam Teraktivasi dan Karbon Aktif dalam Menurunkan Kesadahan Air Di Kalurahan Girisuko, Kapanewon Panggang, Kabupaten Gunungkidul, DIY. *Prosiding Seminar Nasional Teknik Lingkungan Kebumihan SATU BUMI*, 5(1), 282–289. <https://doi.org/10.31315/psb.v5i1.11665>
- Baile, P., Fernández, E., Vidal, L., & Canals, A. (2019). Zeolites and zeolite-based materials in extraction and microextraction techniques. *Analyst*, 144(2), 366–387. <https://doi.org/10.1039/c8an01194j>
- Borges, L. D., & de Macedo, J. L. (2016). Solid-state dealumination of zeolite Y: Structural characterization and acidity analysis by calorimetric measurements. *Microporous and Mesoporous Materials*, 236, 85–93. <https://doi.org/10.1016/j.micromeso.2016.08.031>

- Cerón Ferrusca, M., Romero, R., Martínez, S. L., Ramírez-Serrano, A., & Natividad, R. (2023). Biodiesel Production from Waste Cooking Oil: A Perspective on Catalytic Processes. *Processes*, *11*(7). <https://doi.org/10.3390/pr11071952>
- Chen, X., Tao, J., Sun, P., Yu, F., Li, B., & Dun, L. (2022). Effect of calcination on the adsorption of Chifeng zeolite on Pb²⁺ and Cu²⁺. *International Journal of Low-Carbon Technologies*, *17*(March), 462–468. <https://doi.org/10.1093/ijlct/ctac006>
- Darmawan, F. I., & Susila, I. W. (2013). Proses produksi biodiesel dari minyak jelantah dengan metode dry-wash system. *Jtm*, *2*(1), 80–87.
- Drelinkiewicz, A., Lalik, E., & Kosydar, R. (2014). Organo-sulfonic acids doped polyaniline – based solid acid catalysts for the formation of bio-esters in transesterification and esterification reactions. *Fuel*, *116*, 760–771. <https://doi.org/10.1016/j.fuel.2013.08.079>
- El-Arish, N. A. S., Zaki, R. S. R. M., Miskan, S. N., Setiabudi, H. D., & Jaafar, N. F. (2022). Adsorption of Pb(II) from aqueous solution using alkaline-treated natural zeolite: Process optimization analysis. *Total Environment Research Themes*, *3–4*(October), 100015. <https://doi.org/10.1016/j.totert.2022.100015>
- Endalew, A. K., Kiros, Y., & Zanzi, R. (2011). Inorganic heterogeneous catalysts for biodiesel production from vegetable oils. *Biomass and Bioenergy*, *35*(9), 3787–3809. <https://doi.org/10.1016/j.biombioe.2011.06.011>
- Fadlelmoula, A., Pinho, D., Carvalho, V. H., Catarino, S. O., & Minas, G. (2022). Fourier Transform Infrared (FTIR) Spectroscopy to Analyse Human Blood over the Last 20 Years: A Review towards Lab-on-a-Chip Devices. *Micromachines*, *13*(2). <https://doi.org/10.3390/mi13020187>
- Fatimah, S., Ragadhita, R., Al Husaeni, D. F., & Nandiyanto, A. B. D. (2022). How to Calculate Crystallite Size from X-Ray Diffraction (XRD) using Scherrer Method. *ASEAN Journal of Science and Engineering*, *2*(1), 65–76. <https://doi.org/10.17509/ajse.v2i1.37647>
- Fitriana, N., & Rusmini, D. (2019). Pembuatan Zeolit Alam Teraktivasi HCl dan Karakterisasinya. *UNESA Journal of Chemistry*, *8*(1), 17–19.
- Garcia-Basabe, Y., Rodriguez-Iznaga, I., De Menorval, L. C., Llewellyn, P., Maurin, G., Lewis, D. W., Binions, R., Autie, M., & Ruiz-Salvador, A. R. (2010). Step-wise dealumination of natural clinoptilolite: Structural and physicochemical characterization. *Microporous and Mesoporous Materials*, *135*(1–3), 187–196. <https://doi.org/10.1016/j.micromeso.2010.07.008>
- Hao, C., Guo, G., & An, S. (2024). Highly efficient photocatalytic decarboxylation of fatty acids to alkanes enabled by photothermal conversion effect. *Fuel*, *367*(December 2023), 131392. <https://doi.org/10.1016/j.fuel.2024.131392>
- Hart, A., & Wood, J. (2025). Methodological review of zeolite synthesis from

- industrial waste and natural clays and the fabrication of hierarchical pore structures. *Next Materials*, 9(May), 101113. <https://doi.org/10.1016/j.nxmte.2025.101113>
- Helwani, Z., Aziz, N., Kim, J., & Othman, M. R. (2015). Improving the yield of *Jatropha curcas*'s FAME through sol-gel derived meso-porous hydrotalcites. *Renewable Energy*, 86, 68–74. <https://doi.org/10.1016/j.renene.2015.07.094>
- Hoekman, S. K., Broch, A., Robbins, C., Cenicerros, E., & Natarajan, M. (2012). Review of biodiesel composition, properties, and specifications. *Renewable and Sustainable Energy Reviews*, 16(1), 143–169. <https://doi.org/10.1016/j.rser.2011.07.143>
- Inspire SGS. (2020). *Methanol: Properties and Uses*. March.
- Jamil, F., Al-Haj, L., Al-Muhtaseb, A. H., Al-Hinai, M. A., Baawain, M., Rashid, U., & Ahmad, M. N. M. (2018). Current scenario of catalysts for biodiesel production: A critical review. *Reviews in Chemical Engineering*, 34(2), 267–297. <https://doi.org/10.1515/revce-2016-0026>
- Joshi, D. D. (2012). Herbal Drugs and Fingerprints. *Herbal Drugs and Fingerprints*. <https://doi.org/10.1007/978-81-322-0804-4>
- Kalista, N. N., Kartasasmita, R. E., Wibowo, M. S., & Estiaty, L. M. (2017). Karakterisasi Dan Pemurnian Zeolit Alam Lampung Sebagai Kandidat Antidotum Keracunan Timbal. *Acta Pharmaceutica Indonesia*, 42(2), 84–91. <https://doi.org/10.5614/api.v42i2.5656>
- Khaleque, A., Alam, M. M., Hoque, M., Mondal, S., Haider, J. Bin, Xu, B., Jahir, M. A. H., Karmakar, A. K., Zhou, J. L., Ahmed, M. B., & Moni, M. A. (2020). Zeolite synthesis from low-cost materials and environmental applications: A review. *Environmental Advances*, 2(August). <https://doi.org/10.1016/j.envadv.2020.100019>
- Khan, H., Yerramilli, A. S., D'Oliveira, A., Alford, T. L., Boffito, D. C., & Patience, G. S. (2020). Experimental methods in chemical engineering: X-ray diffraction spectroscopy—XRD. *Canadian Journal of Chemical Engineering*, 98(6), 1255–1266. <https://doi.org/10.1002/cjce.23747>
- Kukobat, R., Škrbić, R., Massiani, P., Baghdad, K., Launay, F., Sarno, M., Cirillo, C., Senatore, A., Salčin, E., & Atlagić, S. G. (2022). Thermal and structural stability of microporous natural clinoptilolite zeolite. *Microporous and Mesoporous Materials*, 341(July). <https://doi.org/10.1016/j.micromeso.2022.112101>
- Kumar, A., Bhayana, S., Singh, P. K., Tripathi, A. D., Paul, V., Balodi, V., & Agarwal, A. (2025). Valorization of used cooking oil: challenges, current developments, life cycle assessment and future prospects. In *Discover Sustainability* (Vol. 6, Nomor 1). Springer International Publishing. <https://doi.org/10.1007/s43621-025-00905-7>

- Kurniawan, E., & Perdana, F. (2022). Proses Transesterifikasi Limbah Minyak Goreng Bekas Menggunakan Katalis Cao Dari Limbah Cangkang Bekicot (*Achatina Fulica*). *Jurnal Inovasi Teknik Kimia*, 7(1), 9. <https://doi.org/10.31942/inteka.v7i1.5579>
- Lani, N. S., Ngadi, N., Inuwa, I. M., Opotu, L. A., Zakaria, Z. Y., & Widayat, W. (2022). Influence of desilication route of ZSM-5 zeolite in mesoporous zeolite supported calcium oxide catalyst for biodiesel production. *Microporous and Mesoporous Materials*, 343(August), 112153. <https://doi.org/10.1016/j.micromeso.2022.112153>
- Las, T., Firdiyono, F., & Hendrawan, A. (2011). Adsorpsi Unsur Pengotor Larutan Natrium Silikat Menggunakan Zeolit Alam Karangnunggal. *Jurnal Kimia VALENSI*, 2(2), 368–378. <https://doi.org/10.15408/jkv.v2i2.199>
- Lawan, I., Garba, Z. N., Zhou, W., Zhang, M., & Yuan, Z. (2020). Synergies between the microwave reactor and CaO/zeolite catalyst in waste lard biodiesel production. *Renewable Energy*, 145, 2550–2560. <https://doi.org/10.1016/j.renene.2019.08.008>
- Lesbani, A., Susi, Y., Verawaty, M., & Mohadi, R. (2015). *Calcium Oxide Decomposed From Chicken 's and Goat 's Bones as Catalyst For Converting Discarded Cooking Oil to be Biodiesel Calcium Oxide Decomposed From Chicken 's and Goat 's Bones as Catalyst For Converting Discarded Cooking Oil to be Biodiesel*. April 2016. <https://doi.org/10.13170/aijst.4.1.2124>
- Liu, X., He, H., Wang, Y., Zhu, S., & Piao, X. (2008). *Transesterification of soybean oil to biodiesel using CaO as a solid base catalyst*. 87, 216–221. <https://doi.org/10.1016/j.fuel.2007.04.013>
- Maneerung, T., Kawi, S., Dai, Y., & Wang, C. H. (2016). Sustainable biodiesel production via transesterification of waste cooking oil by using CaO catalysts prepared from chicken manure. *Energy Conversion and Management*, 123, 487–497. <https://doi.org/10.1016/j.enconman.2016.06.071>
- Marwaha, A., Rosha, P., Mohapatra, S. K., Mahla, S. K., & Dhir, A. (2018). Waste materials as potential catalysts for biodiesel production: Current state and future scope. *Fuel Processing Technology*, 181(September), 175–186. <https://doi.org/10.1016/j.fuproc.2018.09.011>
- McCormick, R., & Moriarty, K. (2023). *Biodiesel Handling and Use Guide: Sixth Edition*. 1–54. www.nrel.gov/publications.
- Mierczynski Pawel, I., Szkudlarek, L., Chalupka, K., Maniukiewicz, W., Wahono, S. K., Vasilev, K., & Szykowska-Jozwik, M. I. (2021). The effect of the activation process and metal oxide addition (CaO, MgO, SrO) on the catalytic and physicochemical properties of natural zeolite in transesterification reaction. *Materials*, 14(9). <https://doi.org/10.3390/ma14092415>
- Mu'arifatussolikah, S. (2024). Sintesis Dan Karakterisasi CaO/Zeolit Alam

Menggunakan Metode Sonikasi Sebagai Katalis Reaksi Transesterifikasi Minyak Jarak.

- Neolaka, Y. A. B., & Kalla, E. B. S. (2024). Analisis bibliometric adsorpsi Pb (II) menggunakan adsorben berbasis zeolite alam. *Jurnal Beta Kimia*, 4, 68–76. <https://ejurnal.undana.ac.id/index.php/jbk/article/view/15461><https://ejurnal.undana.ac.id/index.php/jbk/article/download/15461/6593>
- Nichols, L. (2020). 2.5E: GC Parameters. *Organic Chemistry Lab Techniques*, 88–91. [https://chem.libretexts.org/Courses/SUNY_Oneonta/Chem_221%3A_Organic_Chemistry_I_\(Bennett\)/2%3ALab_Textbook_\(Nichols\)/02%3A_Chromatography/2.05%3A_Gas_Chromatography_\(GC\)/2.5E%3A_GC_Parameters](https://chem.libretexts.org/Courses/SUNY_Oneonta/Chem_221%3A_Organic_Chemistry_I_(Bennett)/2%3ALab_Textbook_(Nichols)/02%3A_Chromatography/2.05%3A_Gas_Chromatography_(GC)/2.5E%3A_GC_Parameters)
- Oko, S., Mustafa, Kurniawan, A., Alwathan, & Rahmadani. (2024). *Pembuatan biodiesel dari minyak jelantah dengan katalis zeolite terimpregnasi koh*. 68–73.
- Özkan, F. Ç., & Becer, M. (2019). Effect of The Acid Type on The Natural Zeolite Structure. In *Journal of The Turkish Chemical Society* (Vol. 2, Nomor 2, hal. 69–74). <https://dergipark.org.tr/en/pub/jotcsb/issue/45604/481900>
- Palčić, A., & Valtchev, V. (2020). Analysis and control of acid sites in zeolites. *Applied Catalysis A: General*, 606(May 2020), 117795. <https://doi.org/10.1016/j.apcata.2020.117795>
- Pavia, D. L., Lampman, G. M., Kriz, G. S., & Vyvyan, J. R. (2000). Chapter 6 Furans and benzo[b]furans. In *Tetrahedron Organic Chemistry Series* (Vol. 20, Nomor C). [https://doi.org/10.1016/S1460-1567\(00\)80010-0](https://doi.org/10.1016/S1460-1567(00)80010-0)
- Putra, I. M. W. A. (2017). Pembuatan dan Karakterisasi Katalis CaO/Zeorlit Alam. *Jurnal Media Sains*, 1(1), 12–18. <https://doi.org/10.36002/jms.v1i1.190>
- Rinaudo, M. G., Collins, S. E., & Morales, M. R. (2024). Eggshell Waste Valorization into CaO/CaCO₃ Solid Base Catalysts †. *Engineering Proceedings*, 67(1), 2–6. <https://doi.org/10.3390/engproc2024067036>
- Rodríguez-Iznaga, I., Shelyapina, M. G., & Petranovskii, V. (2022). Ion Exchange in Natural Clinoptilolite: Aspects Related to Its Structure and Applications. *Minerals*, 12(12). <https://doi.org/10.3390/min12121628>
- Ropp, R. C. (2003). Solid State Chemistry. In *Solid State Chemistry*. <https://doi.org/10.1016/B978-0-444-51436-3.X5000-7>
- Salim, I., Bukorpioper, T. S., Kimia, P. S., Cenderawasi, U., Alam, Z., & Goreng, M. (2023). *Penggunaan Zeolit Alam Hasil Destruksi dengan Asam Klorida Untuk Adsorpsi Minyak Jelantah*. 9(1), 182–189. <https://doi.org/10.31605/saintifik.v9i1.568>
- Sartika, A., Nurhayati, & Muhdarina. (2015). Esterifikasi Minyak Goreng Bekas Dengan Katalis CaO Dari Cangkang Kerang Darah : Variasi Kondisi

- Esterifikasi. *Jurnal Kimia*, 2(1), 178–185.
- Sene, R., Moradi, G. R., & Sharifnia, S. (2017). Sono-dispersion of TiO₂ nanoparticles over clinoptilolite used in photocatalytic hydrogen production: Effect of ultrasound irradiation during conventional synthesis methods. *Ultrasonics Sonochemistry*, 37, 490–501. <https://doi.org/10.1016/j.ultsonch.2017.02.006>
- Serrano, D. P., Aguado, J., & Escola, J. M. (2011). Hierarchical zeolites: Materials with improved accessibility and enhanced catalytic activity. In *Catalysis* (Vol. 23). <https://doi.org/10.1039/9781849732772-00253>
- Shankar, A. A., Pentapati, P. R., & Prasad, R. K. (2017). Biodiesel synthesis from cottonseed oil using homogeneous alkali catalyst and using heterogeneous multi walled carbon nanotubes: Characterization and blending studies. *Egyptian Journal of Petroleum*, 26(1), 125–133. <https://doi.org/10.1016/j.ejpe.2016.04.001>
- Sharma, A., Kodgire, P., & Kachhwaha, S. S. (2020). Investigation of ultrasound-assisted KOH and CaO catalyzed transesterification for biodiesel production from waste cotton-seed cooking oil: Process optimization and conversion rate evaluation. *Journal of Cleaner Production*, 259, 120982. <https://doi.org/10.1016/j.jclepro.2020.120982>
- Shell, F. E., & Extract, R. H. (2024). *Karakterisasi Biodiesel dari Minyak Jelantah Menggunakan Katalis CaO / SiO₂ dari Ekstrak Cangkang Telur dan Sekam Padi* Characterization of Biodiesel from Waste Cooking Oil Using CaO / SiO₂ Catalyst. 6(2), 120–129.
- Singh, D., Sharma, D., Soni, S. L., Sharma, S., & Kumari, D. (2019). Chemical compositions, properties, and standards for different generation biodiesels: A review. *Fuel*, 253(May), 60–71. <https://doi.org/10.1016/j.fuel.2019.04.174>
- Syani, F. (2014). *Sintesis Zeolit Berbasis Silika Sekam Padi dengan Metode Elektrokimia sebagai Katalis Transesterifikasi Minyak Kelapa*. Universitas Lampung.
- Szkudlarek, Ł., Chałupka-Śpiewak, K., Maniukiewicz, W., Nowosielska, M., Albińska, J., Szykowska-Jóźwik, M. I., & Mierczyński, P. (2024). CaO catalysts supported on ZSM-5 zeolite for biodiesel production via transesterification of rapeseed oil. *Applied Catalysis O: Open*, 194(July), 206999. <https://doi.org/10.1016/j.apcato.2024.206999>
- Szkudlarek, Ł., Chałupka-Śpiewak, K., Maniukiewicz, W., Nowosielska, M., Szykowska-Jóźwik, M. I., & Mierczyński, P. (2024). Biodiesel Production by Methanolysis of Rapeseed Oil—Influence of SiO₂/Al₂O₃ Ratio in BEA Zeolite Structure on Physicochemical and Catalytic Properties of Zeolite Systems with Alkaline Earth Oxides (MgO, CaO, SrO). *International Journal of Molecular Sciences*, 25(7). <https://doi.org/10.3390/ijms25073570>

- Tan, Y. H., Abdullah, M. O., Kansedo, J., Mubarak, N. M., Chan, Y. S., & Nolasco-Hipolito, C. (2019). Biodiesel production from used cooking oil using green solid catalyst derived from calcined fusion waste chicken and fish bones. *Renewable Energy*, *139*(November 2014), 696–706. <https://doi.org/10.1016/j.renene.2019.02.110>
- Tanirbergenova, S. K., Aitugan, A. N., Tugelbayeva, D. A., Zhylybayeva, N. ., Tazhu, K., Moldazhanova, G. M., & Mansurov, Z. A. (2025). *Effect of Acid Treatment on the Structure of Natural Zeolite from the Shankanay Deposit*. <https://www.preprints.org/manuscript/202505.2097/v1>
- Taufiqurrahmi, N., Mohamed, A. R., & Bhatia, S. (2011). Nanocrystalline zeolite beta and zeolite y as catalysts in used palm oil cracking for the production of biofuel. *Journal of Nanoparticle Research*, *13*(8), 3177–3189. <https://doi.org/10.1007/s11051-010-0216-8>
- Ulfa, S. N. S., & Samik, S. (2023). Artikel Review: Pemanfaatan Katalis Zeolit Alam Teraktivasi Dalam Sintesis Biodiesel Dengan Metode Esterifikasi Dan Transesterifikasi. *Unesa Journal of Chemistry*, *11*(3), 165–181. <https://doi.org/10.26740/ujc.v11n3.p165-181>
- Utami, I. (2017). Aktivasi zeolit sebagai adsorben gas CO₂. *Jurnal Teknik Kimia*, *11*(2), 51–55.
- Verma, P., Sharma, M. P., & Dwivedi, G. (2016). Impact of alcohol on biodiesel production and properties. *Renewable and Sustainable Energy Reviews*, *56*, 319–333. <https://doi.org/10.1016/j.rser.2015.11.048>
- Wang, B., Wang, B., Shukla, S. K., & Wang, R. (2023). Enabling Catalysts for Biodiesel Production via Transesterification. *Catalysts*, *13*(4). <https://doi.org/10.3390/catal13040740>
- Yusuff, A. S., Adeniyi, O. D., Olutoye, M. A., & Akpan, U. G. (2018). Development and characterization of a composite anthill-chicken eggshell catalyst for biodiesel production from waste frying oil. *International Journal of Technology*, *9*(1), 110–119. <https://doi.org/10.14716/ijtech.v9i1.1166>
- Yusuff, A. S., Ishola, N. B., Gbadamosi, A. O., Azeez, T. M., & Onibonoje, M. O. (2023). An artificial intelligence approach to model and optimize biodiesel production from used cooking oil using CaO incorporated zeolite catalyst. *Energy Conversion and Management: X*, *20*(July), 100452. <https://doi.org/10.1016/j.ecmx.2023.100452>
- Zainal, N. A., Zulkifli, N. W. M., Gulzar, M., & Masjuki, H. H. (2018). A review on the chemistry, production, and technological potential of bio-based lubricants. *Renewable and Sustainable Energy Reviews*, *82*(September 2017), 80–102. <https://doi.org/10.1016/j.rser.2017.09.004>
- Zangeneh, F. T., Sahebdehfar, S., & Ravanchi, M. T. (2011). Conversion of carbon dioxide to valuable petrochemicals: An approach to clean development

mechanism. *Journal of Natural Gas Chemistry*, 20(3), 219–231.
[https://doi.org/10.1016/S1003-9953\(10\)60191-0](https://doi.org/10.1016/S1003-9953(10)60191-0)

Zhang, J., Tang, X., Yi, H., Yu, Q., Zhang, Y., Wei, J., & Yuan, Y. (2022). Synthesis, characterization and application of Fe-zeolite: A review. *Applied Catalysis A: General*, 630 (August 2021), 118467.
<https://doi.org/10.1016/j.apcata.2021.118467>