UNIVERSITAS
GADJAH MADA
SILIKA MESOPORI TERFOSFATASI DARI ABU DAUN SALAK TERIMPREGNASI KALSIUM OKSIDA SEBAGAI KATALIS FUNGSI
GANDA UNTUK KONVERSI SATU LANGKAH MINYAK GORENG SAWIT BEKAS MENJADI BIODIESEL
Adelia Indah Lestari, Prof. Dr.rer.nat. Karna Wijaya, M.Eng. ; Akhmad Syoufian, S.Si., Ph.D.
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

DAFTAR PUSTAKA

Abdul Raqeeb, M., 2015, Biodiesel Production from Waste Cooking Oil, *J.Chem. Pharm. Res*, 7, 670–681.

Adam, F., Appaturi, J.N., and Iqbal, A., 2012, The Utilization of Rice Husk Silica as a Catalyst: Review and Recent Progress, *Catal Today*, 190, 2–14.

Aghel, B., Gouran, A., Parandi, E., Jumeh, B.H., and Nodeh, H.R., 2022, Production of Biodiesel from High Acidity Waste Cooking Oil Using Nano GO@MgO Catalyst in a Microreactor, *Renew Energy*, 200, 294–302.

Ajala, O.E., Aberuagba, F., Odetoye, T.E., and Ajala, A.M., 2015, Biodiesel: Sustainable Energy Replacement to Petroleum-Based Diesel Fuel – A Review, *ChemBioEng Reviews*, 2, 145–156.

Alhassan, F.H., Rashid, U., and Taufiq-Yap, Y.H., 2015, Synthesis of Waste Cooking Oil-Based Biodiesel Via Effectual Recyclable Bi-Functional $Fe_2O_3MnOSO_4^{2-}/ZrO_2$ Nanoparticle Solid Catalyst, *Fuel*, 142, 38–45.

Al-Saadi, A., Mathan, B., and He, Y., 2020, Esterification and Transesterification Over $SrO–ZnO/Al_2O_3$ as a Novel Bifunctional Catalyst for Biodiesel Production, *Renew Energy*, 158, 388–399.

Aneu, 2022, *Preparation and Characterization of SO_4/SiO_2 and KF/SiO_2 Catalysts and Its Application in Biodiesel Synthesis from Waste of Palm Oil,* Program Studi Doktor Kimia Departemen Kimia Fakultas Matematika Dan Ilmu Pengetahuan Alam, Universitas Gadjah Mada, Yogyakarta.

Aneu, A., Pratika, R.A., Hasanudin, Gea, S., Wijaya, K., and Oh, W.C., 2023, Silica-Based Catalysts for Biodiesel Production: A Brief Review, *Silicon*, 15, 5037–5047.

Aneu, A., Wijaya, K., and Syoufian, A., 2022, Porous Silica Modification with Sulfuric Acids and Potassium Fluorides as Catalysts for Biodiesel Conversion from Waste Cooking Oils, *Journal of Porous Materials*, 29, 1321–1335.

Aneu, A., Wijaya, K., and Syoufian, A., 2021, Silica-Based Solid Acid Catalyst with Different Concentration of H_2SO_4 and Calcination Temperature: Preparation and Characterization, *Silicon*, 13, 2265–2270.

Ani, J.U., Okoro, U.C., Aneke, L.E., Onukwuli, O.D., Obi, I.O., Akpomie, K.G., and Ofomatah, A.C., 2019, Application of Response Surface Methodology for Optimization of Dissolved Solids Adsorption By Activated Coal, *Appl Water Sci*, 9.

Anwar, R., Al Kape, A., Lusi, M., Voutsas, E., Cammarata, A., Rafferty, A., and Sofianos, M.V., 2025, Boosting the Thermochemical Energy Storage Performance of Limestone by Adding Mayenite, *J Energy Storage*, 114.

UNIVERSITAS
GADJAH MADA
SILIKA MESOPORI TERFOSFATASI DARI ABU DAUN SALAK TERIMPREGNASI KALSIUM OKSIDA SEBAGAI KATALIS FUNGSI
GANDA UNTUK KONVERSI SATU LANGKAH MINYAK GORENG SAWIT BEKAS MENJADI BIODIESEL
Adelia Indah Lestari, Prof. Dr.rer.nat. Karna Wijaya, M.Eng. ; Akhmad Syoufian, S.Si., Ph.D.
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Ashine, F., Kiflie, Z., Prabhu, S.V., Tizazu, B.Z., Varadharajan, V., Rajasimman, M., Joo, S.W., Vasseghian, Y., and Jayakumar, M., 2023, Biodiesel Production from Argemone Mexicana Oil Using Chicken Eggshell Derived CaO Catalyst, *Fuel*, 332.

Barroso-Martín, I., Infantes-Molina, A., Fini, F.J., Ballesteros-Plata, D., Rodríguez-Castellón, E., and Moretti, E., 2020, Silica-Related Catalysts for CO_2 Transformation into Methanol and Dimethyl Ether, *Catalysts 2020, Vol. 10, Page 1282*, 10, 1282.

Basumatary, S.F., Brahma, Sona, Hoque, M., Das, B.K., Selvaraj, M., Brahma, Sujata, and Basumatary, S., 2023, Advances in CaO-Based Catalysts for Sustainable Biodiesel Synthesis, *Green Energy and Resources*, 1.

Bayramoglu, M., Korkut, I., Ergan, B. T., 2020, Reusability and Regeneration of Solid Catalysts Used in Ultrasound Assisted Biodiesel Production, *Journal of Chemistry*, 45, 342-347.

Bharti, P., Singh, B., and Dey, R.K., 2019, Process Optimization of Biodiesel Production Catalyzed by CaO Nanocatalyst Using Response Surface Methodology, *J Nanostructure Chem*, 9, 269–280.

Boey, P.L., Maniam, G.P., and Hamid, S.A., 2011, Performance of Calcium Oxide as a Heterogeneous Catalyst in Biodiesel Production: A review, *Chemical Engineering Journal*, 168, 15–22.

Boz, N., Degirmenbasi, N., and Kalyon, D.M., 2015, Esterification and Transesterification of Waste Cooking Oil Over Amberlyst 15 and Modified Amberlyst 15 Catalysts, *Appl Catal B*, 165, 723–730.

Burmana, A.D., Manurung, R., Iriany, Ernst, B., Bentalib, A.S., Benguerba, Y., and Affila, 2025, Catalyst Reuse in Biomass-Based Biodiesel: Life Cycle and Economic Implications for a Circular Bioenergy Economy, *Biomass Bioenergy*, 201, 108071.

Changmai, B., Chhangte, V., Bhagat, R., Ingle, A.P., and Rokhum, S.L., 2020, Widely Used Catalysts in Biodiesel Production: A Review, *ChemRxiv*, 10, 41625.

Chen, G., Shan, R., Li, S., and Shi, J., 2015, A Biomimetic Silicification Approach to Synthesize $CaO–SiO_2$ Catalyst for the Transesterification of Palm Oil into Biodiesel, *Fuel*, 153, 48–55.

Chen, W.H., Du, J.T., Lee, K.T., Ong, H.C., Park, Y.K., and Huang, C.C., 2021, Pore Volume Upgrade of Biochar from Spent Coffee Grounds by Sodium Bicarbonate During Torrefaction, *Chemosphere*, 275, 129999.

Chozhavendhan, S., Singh, V. P., Kumar, P. R., Devi, K. G., 2020, A Review on Influencing Parameters of Biodiesel Production and Purification Processes, *Current Research in Green and Sustainable Chemistry*, 1–2, 1–6.

UNIVERSITAS
GADJAH MADA
SILIKA MESOPORI TERFOSFATASI DARI ABU DAUN SALAK TERIMPREGNASI KALSIUM OKSIDA SEBAGAI KATALIS FUNGSI
GANDA UNTUK KONVERSI SATU LANGKAH MINYAK GORENG SAWIT BEKAS MENJADI BIODIESEL
Adelia Indah Lestari, Prof. Dr.rer.nat. Karna Wijaya, M.Eng. ; Akhmad Syoufian, S.Si., Ph.D.
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Cjlowder, S. V, Jensen, K.L., Stephenson, W.R., and Vardeman, S.B., 1988, An Interactive Program for the Analysis of Data from Two-Level Factorial Experiments via Probability Plotting, *J. Qual. Technol*, 20, 2.

Corma, A., 1995, Inorganic Solid Acids and Their Use in Acid-Catalyzed Hydrocarbon Reactions, *Chem Rev*, 95, 559–614.

Danish, Baloch, M.A., Mahmood, N., and Zhang, J.W., 2019, Effect of Natural Resources, Renewable Energy and Economic Development on CO_2 Emissions in BRICS Countries, *Science of the Total Environment*, 678, 632–638.

De, S., Aguilar-Tapia, A., Ould-Chikh, S., Zitolo, A., Hazemann, J.L., Shterk, G., Ramirez, A., and Gascon, J., 2022, Pure Silica-Supported Transition Metal Catalysts for the Non-Oxidative Dehydrogenation of Ethane: Confinement Effects on The Stability, *J Mater Chem A Mater*, 10, 9445–9456.

Doniavi, A., Hosseini, G., and Ranjbary, G., 2016, Prediction and Optimization of Mechanical Properties of St52 in Gas Metal Arc Weld Using Response Surface Methodology and ANOVA, *International Journal of Engineering*, 29.

Dou, B., Zhao, L., Zhang, Hua, Wu, K., and Zhang, Hao, 2021, Renewable Hydrogen Production from Chemical Looping Steam Reforming of Biodiesel Byproduct Glycerol by Mesoporous Oxygen Carriers, *Chemical Engineering Journal*, 416, 127612.

Elgharbawy, A.S., Sadik, W.A., Sadek, O.M., and Kasaby, M.A., 2021, Maximizing Biodiesel Production from High Free Fatty Acids Feedstocks Through Glycerolysis Treatment, *Biomass Bioenergy*, 146, 105997.

Elias, S., Rabiu, A.M., Okeleye, B.I., Okudoh, V., and Oyekola, O., 2020, Bifunctional Heterogeneous Catalyst for Biodiesel Production from Waste Vegetable Oil, *Appl. Sci*, 9, 3153.

Elkelawy, M., Bastawissi, H.A.E., Esmaeil, K.K., Radwan, A.M., Panchal, H., Sadasivuni, K.K., Suresh, M., and Israr, M., 2020, Maximization of Biodiesel Production from Sunflower and Soybean Oils and Prediction of Diesel Engine Performance and Emission Characteristics Through Response Surface Methodology, *Fuel*, 266.

Enguilo Gonzaga, V., Romero, R., Gómez-Espinosa, R.M., Romero, A., Martínez, S.L., and Natividad, R., 2021, Biodiesel Production from Waste Cooking Oil Catalyzed by a Bifunctional Catalyst, *ACS Omega*, 6, 24092–24105.

Farobie, O., Sutarlan, I.F.I., Sucahyo, L., Bayu, A., and Hartulistiyoso, E., 2023, Biodiesel Production from Crude Palm Oil Under Subcritical Methanol Conditions: Experimental Investigation and Kinetic Model, *Bioresour Technol Rep*, 22, 101441.

UNIVERSITAS
GADJAH MADA
SILIKA MESOPORI TERFOSFATASI DARI ABU DAUN SALAK TERIMPREGNASI KALSIUM OKSIDA SEBAGAI KATALIS FUNGSI
GANDA UNTUK KONVERSI SATU LANGKAH MINYAK GORENG SAWIT BEKAS MENJADI BIODIESEL
Adelia Indah Lestari, Prof. Dr.rer.nat. Karna Wijaya, M.Eng. ; Akhmad Syoufian, S.Si., Ph.D.
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Filonchyk, M., Peterson, M., Zhang, L., Hurynovich, V., and He, Y., 2024, Greenhouse Gases Emissions and Global Climate Change: Examining the Influence of CO_2, CH_4, and N_2O, *Science of The Total Environment*, 935, 173359.

Fitria, A., Trisunaryanti, W., Triyono, and Santoso, I., 2024, Synthesis, Characterization and Performance of Ni/Mesoporous Silica - NH_2/Mesoporous Silica and Ni-NH_2/Mesoporous Silica as Bifunctional Catalyst in One Step Conversion of Waste Palm Oil to Biodiesel, *Communications in Science and Technology*, 9, 430–441.

Foon Cheng, S. and Hock Chuah, C., 2004, Kinetics Study on Transesterification ff Palm Oil, *J. Oil Palm Res*, 16, 2.

Gao, Y., Sun, W., Yang, W., and Li, Q., 2017, Creation of Pd/Al_2O_3 Catalyst by a Spray Process for Fixed Bed Reactors and Its Effective Removal of Aqueous Bromate, *Sci Rep*, 7.

Ghasemi, I., Haghighi, M., Bekhradinassab, E., and Ebrahimi, A., 2024, Ultrasound-assisted dispersion of bifunctional CaO-ZrO2 nanocatalyst over acidified kaolin for production of biodiesel from waste cooking oil, *Renew Energy*, 225, 120287.

Gonzaga, V.E., Romero, R., María Gómez-Espinosa, R., Romero, A., Martínez, S.L., and Natividad, R., 2021, Biodiesel Production from Waste Cooking Oil Catalyzed by a Bifunctional Catalyst, *ACS Omega*, 6, 24092–24105.

Helmer, M. and Plane, J.M.C., 1993, A Study of The Reaction NaO_2+ O → NaO+ O_2: Implications for The Chemistry of Sodium in The Upper Atmosphere, *Journal of Geophysical Research: Atmospheres*, 98, 23207–23222.

Huang, H., Zhao, J., Guo, X., Deng, B., Chen, Y., and Huang, X., 2022, Study on Reducing Carbon Dioxide and Harmful Emissions of Diesel-Ignited Natural Gas Engine, *Chemosphere*, 306, 135586.

Huljana, M., 2019, Sintesis Silika dari Abu Sekam Padi dengan Metode Sol-gel, *Prosiding Seminar Nasional Sains dan Teknologi Terapan*.

Ihsan, R., Naeem, A., Farooq, M., Saeed, T., Noman, M., Abid, G., and Malik, T., 2025, One-Pot Conversion of Non-Edible Oil into Sustainable Biodiesel Using Novel Bifunctional Heterogeneous Catalyst, *Renew Energy*, 238, 121939.

Ijeoma, K. and Prisca, U., 2015, Characterization of the Chemical Properties of Some Selected Refined Vegetable Oils Commonly Sold in Nigeria, *Br J Appl Sci Technol*, 5, 538–546.

Imoisili, P.E., Ukoba, K.O., and Jen, T.C., 2020, Synthesis and Characterization of Amorphous Mesoporous Silica from Palm Kernel Shell Ash, *Boletín de la Sociedad Española de Cerámica y Vidrio*, 59, 159–164.

SILIKA MESOPORI TERFOSFATASI DARI ABU DAUN SALAK TERIMPREGNASI KALSIUM OKSIDA SEBAGAI KATALIS FUNGSI
GANDA UNTUK KONVERSI SATU LANGKAH MINYAK GORENG SAWIT BEKAS MENJADI BIODIESEL
Adelia Indah Lestari, Prof. Dr.rer.nat. Karna Wijaya, M.Eng. ; Akhmad Syoufian, S.Si., Ph.D.
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Istadi, I., Anggoro, D.D., Buchori, L., Rahmawati, D.A., Intaningrum, D., 2015, Active Acid Catalyst of Sulphated Zinc Oxide for Transesterification of Soybean Oil with Methanol to Biodiesel, *Procedia Environ. Sci*. 23, 385–393,

Iswara, A.P., 2021, Study of Impact of SP-36 Fertilizer Production Process on the Environment Using Life Cycle Assessment (LCA) Method, *Eco. Env & Cons*, 27, 262.

Ivanovski, K., Hailemariam, A., and Smyth, R., 2021, The Effect of Renewable and Non-Renewable Energy Consumption on Economic Growth: Non-parametric evidence, *J Clean Prod*, 286, 124956.

Janajreh, I., Elsamad, T., Aljaberi, A., and Diouri, M., 2015, Transesterification of Waste Cooking Oil: Kinetic Study and Reactive Flow Analysis, *Energy Procedia*, 75, 547–553.

Kadapure, S.A., Kirti, P., Singh, S., Kokatnur, S., Hiremath, N., Variar, A., Shaikh, S., and Chittaragi, R., 2018, Studies on Process Optimization of Biodiesel Production from Waste Cooking and Palm Oil, *International Journal of Sustainable Engineering*, 11, 167–172.

Kai, M.F., Sanchez, F., Hou, D.S., and Dai, J.G., 2023, Nanoscale Insights into the Interfacial Characteristics Between Calcium Silicate Hydrate and Silica, *Appl Surf Sci*, 616, 156478.

Keera, S.T., El Sabagh, S.M., and Taman, A.R., 2018, Castor Oil Biodiesel Production and Optimization, *Egyptian Journal of Petroleum*, 27, 979–984.

Keluo, C., Zhang, T., Xiaohui, C., and Liang, X., 2018, Model Construction of Micro-Pores in Shale: A Case Study of Silurian Longmaxi Formation Shale in Dianqianbei Area, SW China, *PED*, 45, 412–421.

Khan, M.R., Singh, H.N., and Singh, W.R., 2025, Sustainable Biodiesel Synthesis Using Bamboo Leaves Ash Doped with Anser Cygnoides Eggshell Derived CaO (BLA@SiO_2-CaO) Green Catalyst: Characterization and Optimization Study, *Biomass Bioenergy*, 198, 107815.

Kim, W., Shin, W., Lee, K. J., Cho, Y., Kim, H. S., Filimonov, I. N., 2025, 2,3-Butanediol Dehydration Catalyzed by Silica-Supported Alkali Phosphates, *Applied Catalysis A: General*, 25, 148-163.

Lam, M. K., Jamalluddin, N. A., Lee, K. T., 2019, Production of Biodiesel Using Palm Oil, *Biomass*, 539–574.

Lee, D.W. and Lee, K.Y., 2014, Heterogeneous Solid Acid Catalysts for Esterification of Free Fatty Acids, *Catalysis Surveys from Asia*, 18, 55–74.

Lee, H. V., Juan, J.C., and Taufiq-Yap, Y.H., 2015, Preparation and Application of Binary Acid–Base CaO–La_2O_3 Catalyst for Biodiesel Production, *Renew Energy*, 74, 124–132.

UNIVERSITAS
GADJAH MADA
SILIKA MESOPORI TERFOSFATASI DARI ABU DAUN SALAK TERIMPREGNASI KALSIUM OKSIDA SEBAGAI KATALIS FUNGSI
GANDA UNTUK KONVERSI SATU LANGKAH MINYAK GORENG SAWIT BEKAS MENJADI BIODIESEL
Adelia Indah Lestari, Prof. Dr.rer.nat. Karna Wijaya, M.Eng. ; Akhmad Syoufian, S.Si., Ph.D.
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Long, X., Deng, X., Lv, X., Wu, Q., Jin, H., Lu, F., Yang, J., and Huang, R., 2024, Study on The Mechanism of Vacuum Carbothermal Reduction of $Ca_3(PO4)_2$ Enhanced by SiO_2, *Vacuum*, 230.

Made, I. and Putra, W.A., 2017, Production of Biodiesel from Waste Cooking Oil by Transesterification Reaction Using CaO/Natural Zeolite Catalysts, *Cakra Kimia*, 5, 2.

Maharani, A. and Leni, M., 2018, Optimasi Pengendalian Flow Control DEA Absorber Menggunakan Proportional Integral Derivative (PID) Control Dengan Metode Respon Surface Methodology (RSM), *JTKU*, 2, 152–162.

Mahendran, L., Ravichandran, A., and Ballamurugan, A.M., 2022, Organic and Inorganic Template-Assisted Synthesis of Silica Nanotubes and Evaluation of Their Properties, *Appl Biochem Biotechnol*, 194, 167–175.

Mahmudah, R., Saviola, A.J., Sudiono, S., Prasetyo, N., and Wijaya, K., 2024, An Effective Synthesis of Phosphated Silica (PO4/SÍO2) Catalyst and its Performance for Converting Ethanol into Diethyl Ether (DEE), *Solid State Phenomena*. Trans Tech Publications Ltd, pp. 77–86.

Mansir, N., Teo, S.H., Rabiu, I., and Taufiq-Yap, Y.H., 2018, Effective Biodiesel Synthesis from Waste Cooking Oil and Biomass Residue Solid Green Catalyst, *Chem. Eng. J*, 347, 137–144.

Marinković, D.M. and Pavlović, S.M., 2023, Recent Advances in Waste-Based and Natural Zeolitic Catalytic Materials for Biodiesel Production, *Hem Ind*, 77, 5–38.

Marwaha, A., Dhir, A., Mahla, S.K., and Mohapatra, S.K., 2018, An Overview of Solid Base Heterogeneous Catalysts for Biodiesel Production, *Catalysis reviews*, 60, 594–628.

Mat, R., Samsudin, R.A., Mohamed, M., and Johari, A., 2012, Solid Catalysts and theirs Application in Biodiesel Production, *Bulletin of Chemical Reaction Engineering & Catalysis*, 7, 142–149.

Mathimani, T., Le, TT., Salmen, S. H., Alharbi., Jhanani, G. K., 2024, Process Optimization of One-step Direct Transesterification and Dual-step Extraction-Transesterification of The Chlorococcum-Nannochloropsis Consortium for Biodiesel Production, *Environmental Research*, 240, 117580.

Modupe Abati, S., Bamisaye, A., Abidemi Adaramaja, A., Rapheal Ige, A., Adegoke, K.A., Olurotimi Ogunbiyi, E., Abidemi Idowu, M., Olabintan, A.B., and Saleh, T.A., 2024, Biodiesel Production from Spent Vegetable Oil with Al_2O_3 and Fe_2O_3-Biobased Heterogenous Nanocatalysts: Comparative and Optimization Studies, *Fuel*, 364, 130847.

Mohammed Hello, K. and Kadhim Hlial, E., 2019, Modification of Silica with Sulfuric Acid and Phosphoric Acid for Cellulose Hydrolysis, In, *Journal of Physics: Conference Series*. Institute of Physics Publishing.

UNIVERSITAS
GADJAH MADA
SILIKA MESOPORI TERFOSFATASI DARI ABU DAUN SALAK TERIMPREGNASI KALSIUM OKSIDA SEBAGAI KATALIS FUNGSI
GANDA UNTUK KONVERSI SATU LANGKAH MINYAK GORENG SAWIT BEKAS MENJADI BIODIESEL
Adelia Indah Lestari, Prof. Dr.rer.nat. Karna Wijaya, M.Eng. ; Akhmad Syoufian, S.Si., Ph.D.
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Montgomery, D.C. and Wiley, J., 2013, *Design and Analysis of Experiments*, 8th ed, Wiley.

Muhammad, G., Potchamyou Ngatcha, A.D., Lv, Y., Xiong, W., El-Badry, Y.A., Asmatulu, E., Xu, J., and Alam, M.A., 2022, Enhanced Biodiesel Production from Wet Microalgae Biomass Optimized Via Response Surface Methodology and Artificial Neural Network, *Renew Energy*, 184, 753–764.

Mulyatun, M., Istadi, I., and Widayat, W., 2023, Synthesis and Characterization of Physically Mixed V_2O_5.CaO as Bifunctional Catalyst for Methyl Ester Production from Waste Cooking Oil, *International Journal of Renewable Energy Development*, 12, 381–389.

Nainggolan, B., Susanti, N., and Juniar, A., 2016, Jurnal Pendidikan Kimia, Bajoka, Nainggolan, *Chem. Educ*, 8, 1.

Nanthagopal, K., Ashok, B., Saravanan, B., Patel, D., Sudarshan., Ramasamy, A. R., An assessment on The Effects of 1-Pentanol and 1-Butanol as additives with Calophyllum Inophyllum Biodiesel, *Energy Conversion and Management*, 158, 70–80.

Naseef, H.H. and Tulaimat, R.H., 2025, Transesterification and Esterification for Biodiesel Production: A Comprehensive Review of Catalysts and Palm Oil Feedstocks, *Energy Conversion and Management: X*, 100931.

Nirmala, N. and Dawn, S.S., 2021, Optimization of Chlorella Variabilis Lipid Transesterification Using Response Surface Methodology and Analytical Characterization of Biodiesel, *Renew Energy*, 179, 1663–1673.

Ooi, H.K., Koh, X.N., Ong, H.C., Lee, H.V., Mastuli, M.S., Taufiq-Yap, Y.H., Alharthi, F.A., Alghamdi, A.A., and Mijan, N.A., 2021, Progress on Modified Calcium Oxide Derived Waste-Shell Catalysts for Biodiesel Production, *Catalysts 2021, Vol. 11, Page 194*, 11, 194.

Osman, A.I., Chen, L., Yang, M., Msigwa, G., Farghali, M., Fawzy, S., Rooney, D.W., and Yap, P.S., 2023, Cost, Environmental Impact, and Resilience of Renewable Energy Under a Changing Climate: A Review, *Environ Chem Lett*, 21, 741–764.

Parida, S., Harveer, Pali, S., Chaturvedi, A., Sharma, Abhishek, Dhinesh Balasubramanian, Ramegouda, R., Viet, Tran, D., Van, Nguyen, G., Femilda, Shobanabai, J.J., Edwin, and Varuvel, G., 2024, Production of Biodiesel from Waste Fish Fat Through Ultrasound-Assisted Transesterification Using Petro-Diesel as Cosolvent and Optimization of Process Parameters Using Response Surface Methodology, Environ. *Sci. Pollut. Res*, 31, 25524–25537.

Podila, S., Driss, H., Zaman, S.F., Alhamed, Y.A., Alzahrani, A.A., Daous, M.A., and Petrov, L.A., 2016, Hydrogen Generation by Ammonia Decomposition Using CO/MgO–La_2O_3 Catalyst: Influence of Support Calcination Atmosphere, *J Mol Catal A Chem*, 414, 130–139.

SILIKA MESOPORI TERFOSFATASI DARI ABU DAUN SALAK TERIMPREGNASI KALSIUM OKSIDA SEBAGAI KATALIS FUNGSI
GANDA UNTUK KONVERSI SATU LANGKAH MINYAK GORENG SAWIT BEKAS MENJADI BIODIESEL
Adelia Indah Lestari, Prof. Dr.rer.nat. Karna Wijaya, M.Eng. ; Akhmad Syoufian, S.Si., Ph.D.
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Pratika, R.A., Nafisah, Z., Yuliana, Y., Syarpin, S., Iqbal, R.M., Ysrafil, Y., and Wijaya, K., 2024, Conversion of Used Cooking Oil into Biodiesel by Utilizing Zirconia Catalyst as Acid Catalyst (SO_4/ZrO_2) and Base Catalyst (ZrO_2/CaO), *Arab J Sci Eng*.

Pratika, R.A., Wijaya, K., and Trisunaryanti, W., 2021, Hydrothermal Treatment of SO_4/TiO_2 and TiO_2/CaO as Heterogeneous Catalysts for The Conversion of Jatropha Oil into Biodiesel, *J Environ Chem Eng*, 9, 106547.

Pratika, R.A., Wijaya, K., Utami, M., Mulijani, S., Patah, A., Alarifi, S., Ram Mani, R., Kumar Yadav, K., Ravindran, B., Chung, W.J., Chang, S.W., and Munusamy-Ramanujam, G., 2023, The Potency of Hydrothermally Prepared Sulfated Silica ($SO_4/SiO2$) as a Heterogeneous Acid Catalyst for Ethanol Dehydration into Diethyl Ether, *Chemosphere*, 341, 139822.

Puhan, D., Casford, M.T.L., and Davies, P.B., 2023, Evaluation of Structural and Compositional Changes of a Model Monoaromatic Hydrocarbon in a Benchtop Hydrocracker Using GC, FTIR, and NMR Spectroscopy, *ACS Omega*, 8, 35988–36000.

Rajak, U., Chaurasiya, P. K., Nashine, P., Verma, M., Kota, T.R., Verma, T.N., 2020, Financial Assessment, Performance and Emission Analysis of Moringa oleifera and Jatropha curcas Methyl Ester Fuel Blends in A Single-Cylinder Diesel Engine, *Energy Conversion and Management*, 224, 113362.

Ramli, A., Farooq, M., Naeem, A., Khan, S., Hummayun, M., Iqbal, A., Ahmed, S., Ali Shah, L., Ramli, A., Farooq, M., Naeem, A., Khan, S., Hummayun, M., Iqbal, A., Ahmed, S., and Ali Shah, L., 2017, Bifunctional Heterogeneous Catalysts for Biodiesel Production using Low Cost Feedstocks: A Future Perspective, *Front. Energy Res*, 1, 285–308.

Rezania, S., Oryani, B., Park, J., Hashemi, B., Yadav, K.K., Kwon, E.E., Hur, J., and Cho, J., 2019, Review on Transesterification of Non-Edible Sources for Biodiesel Production with a Focus on Economic Aspects, Fuel Properties and by-Product Applications, *Energy Convers Manag*, 201, 112155.

Sakti La Ore, M., Wijaya, K., Trisunaryanti, W., Saputri, W.D., Heraldy, E., Yuwana, N.W., Hariani, P.L., Budiman, A., and Sudiono, S., 2020, The Synthesis of SO_4/ZrO_2 and Zr/CaO Catalysts Via Hydrothermal Treatment and Their Application for Conversion of Low-Grade Coconut Oil into Biodiesel, *J Environ Chem Eng*, 8, 104205.

Sentanuhady, J., Hasan, W.H., and Muflikhun, M.A., 2022, Recent Progress on the Implementation of Renewable Biodiesel Fuel for Automotive and Power Plants: Raw Materials Perspective, *Advances in Materials Science and Engineering*, 2022.

SILIKA MESOPORI TERFOSFATASI DARI ABU DAUN SALAK TERIMPREGNASI KALSIUM OKSIDA SEBAGAI KATALIS FUNGSI
GANDA UNTUK KONVERSI SATU LANGKAH MINYAK GORENG SAWIT BEKAS MENJADI BIODIESEL
Adelia Indah Lestari, Prof. Dr.rer.nat. Karna Wijaya, M.Eng. ; Akhmad Syoufian, S.Si., Ph.D.
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Setyaningsih, S., Utami, M., Syoufian, A., Heraldy, E., Yuwono, N.W., and Wijaya, K., 2022, Synthesis of SO_4^{2-} /ZrO_2 Solid Acid and Na_2O/ZrO_2 Solid Base Catalysts Using Hydrothermal Method for Biodiesel Production from Low-Grade Crude Palm Oil, *Indonesian Journal of Chemistry*, 22, 17–34.

Shimizu, M., Tsushima, Y., and Arai, S., 2017, Electrochemical Na-Insertion/Extraction Property of Ni-Coated Black Phosphorus Prepared by an Electroless Deposition Method, *ACS Omega*, 2, 4306–4315.

Sholikha, I., K, F.W., Dewi Sri Utami, E., and Dewi Widyaningsih, dan, 2010, *Sintesis dan Karakterisasi Silika Gel dari Limbah Abu Sekam Padi (Oryza Sativa) dengan Variasi Konsentrasi Pengasaman*, Fakultas MIPA, Universitas Negeri Yogyakarta, Yogyakarta.

Syukri, S., Ferdian, F., Rilda, Y., Putri, Y.E., Efdi, M., Septiani, U., 2021, Synthesis of Graphene Oxide Enriched Natural Kaolinite Clay and Its Application For Biodiesel Production, *Int. J. Renew Energy Dev*. 10, 307–315,

da Silva, K.R.N., Corazza, M.Z., and Raposo, J.L., 2018, Renewable Energy Sources: A Sustainable Strategy for Biodiesel Productions, *Green Energy and Technology*, 0, 1–31.

da Silva, P.M.M., Gonçalves, M.A., da Luz Corrêa, A.P., da Luz, P.T.S., Zamian, J.R., da Rocha Filho, G.N., and da Conceição, L.R.V., 2023, Preparation and Characterization of A Novel Efficient Catalyst Based on Molybdenum Oxide Supported Over Graphene Oxide for Biodiesel Synthesis, *Renew Energy*, 211, 126–139.

Simbi, I., Aigbe, U.O., Oyekola, O., and Osibote, O.A., 2022, Optimization of Biodiesel Produced from Waste Sunflower Cooking Oil Over Bi-Functional Catalyst, *Results in Engineering*, 13, 100374.

Simpen, I.N., Negara, I.M.S., and Ratnayani, O., 2021, Physicochemical Characteristics of Heterogeneous CaO-Base Catalysts and Their Utilization for Continuous Conversion of Used Cooking Oil into Biodiesel, *J. Chem*, 15, 2.

Singh, D., Sharma, D., Soni, S.L., Sharma, S., Kumar Sharma, P., and Jhalani, A., 2020, A Review on Feedstocks, Production Processes, And Yield for Different Generations of Biodiesel, *Fuel*, 262, 116553.

Singh, L.P., Bhattacharyya, S.K., Kumar, R., Mishra, G., Sharma, U., Singh, G., and Ahalawat, S., 2014, Sol-Gel Processing of Silica Nanoparticles and Their Applications, *Adv Colloid Interface Sci*, 214, 17–37.

Söyler, H., Balki, M.K., and Sayin, C., 2023, Determination of Optimum Parameters for Esterification in High Free Fatty Acid Olive Oil and Ultrasound-Assisted Biodiesel Production, *Biomass Convers Biorefin*, 13, 12043–12056.

UNIVERSITAS
GADJAH MADA
SILIKA MESOPORI TERFOSFATASI DARI ABU DAUN SALAK TERIMPREGNASI KALSIUM OKSIDA SEBAGAI KATALIS FUNGSI
GANDA UNTUK KONVERSI SATU LANGKAH MINYAK GORENG SAWIT BEKAS MENJADI BIODIESEL
Adelia Indah Lestari, Prof. Dr.rer.nat. Karna Wijaya, M.Eng. ; Akhmad Syoufian, S.Si., Ph.D.
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Sugashini, S. and Begum, K.M.M.S., 2013, Optimization Using Central Composite Design (CCD) for the Biosorption of Cr (VI) Ions by Cross Linked Chitosan Carbonized Rice Husk (CCACR), *Clean Technol Environ Policy*, 15, 293–302.

Sulaiman, S., Jamal, P., Farrah, A., and Zik, A., 2018, Thermally Produced Nano Catalyst for Biodiesel Production: A Review, *Journal of Advanced Research in Fluid Mechanics and Thermal Sciences Journal homepage*, 52, 139–147.

Syazwani, N.O., Lokman Ibrahim, M., Wahyudiono, Kanda, H., Goto, M., and Taufiq-Yap, Y.H., 2017, Esterification of High Free Fatty Acids in Supercritical Methanol Using Sulfated Angel Wing Shells as Catalyst, *Journal of Supercritical Fluids*, 124, 1–9.

Tabatabaei, M. and Aghbashlo, M., 2019, Biodiesel: *From Production to Combustion*, 1 st ed, Vol.8, Springer.

Tan, Y.H., Abdullah, M.O., and Nolasco Hipolito, C., 2016, Comparison of Biodiesel Production between Homogeneous and Heterogeneous Base Catalysts, *Applied Mechanics and Materials*, 833, 71–77.

Tao, Feng., 2014, *Metal Nanoparticles for Catalysis : Advances and Applications, Royal Society of Chemistry*.

Triawan, Agus.D., Yudha, Salprima.S., and Falahudin, A., 2021, Electron Microscope and Diffraction Study of Snake Fruit (Salacca zalacca (Gaert.) Voss) Peels, In, *Journal of Physics: Conference Series*. IOP Publishing Ltd.

Trisunaryanti, W., 2018, Material Katalis Dan Karakternya.

Triyono, Trisunaryanti, W., Purbonegoro, J., and Aksanti, S.I., 2024, Effect of cobalt impregnation methods on Parangtritis sand towards catalysts activity in hydrocracking of degummed low-quality Ujung Kulon Malapari oil into biohydrocarbons, *Reaction Kinetics, Mechanisms and Catalysis*, 137, 303–321.

Ulfa, M., 2017, Mesoporous Carbon in the Global World, *JKPK (Jurnal Kimia dan Pendidikan Kimia)*, 2, 54.

Verma, P. and Sharma, M.P., 2016, Comparative Analysis of Effect of Methanol and Ethanol on Karanja Biodiesel Production and Its Optimisation, *Fuel*, 180, 164–174.

Wahyudin, W., Tambunan, A.H., Purwanti, N., Joelianingsih, J., and Nabetani, H., 2018, Tinjauan Perkembangan Proses Katalitik Heterogen dan non-Katalitik untuk Produksi Biodiesel, *Jurnal Keteknikan Pertanian*, 6, 123–130.

Wang, Z. and Huang, J., 2017, Brønsted-Lewis Acids for Efficient Conversion of Renewables,99–135.

UNIVERSITAS
GADJAH MADA
SILIKA MESOPORI TERFOSFATASI DARI ABU DAUN SALAK TERIMPREGNASI KALSIUM OKSIDA SEBAGAI KATALIS FUNGSI
GANDA UNTUK KONVERSI SATU LANGKAH MINYAK GORENG SAWIT BEKAS MENJADI BIODIESEL
Adelia Indah Lestari, Prof. Dr.rer.nat. Karna Wijaya, M.Eng. ; Akhmad Syoufian, S.Si., Ph.D.
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Wijaya, K., Saputri, W.D., Taufik, I., Aziz, A., Wangsa, &, Heraldy, & E., Hakim, L., Suseno, A., and Utami, M., 2022, Mesoporous Silica Preparation Using Sodium Bicarbonate as Template and Application of the Silica for Hydrocracking of Used Cooking Oil into Biofuel, *Silicon*, 9, 14.

Wijaya, Karna., 2016, Nanomaterial: Aplikasinya dalam Pembuatan Biofuel, 225.

Wirawan, S.S., Solikhah, M.D., Setiapraja, H., and Sugiyono, A., 2024, Biodiesel implementation in Indonesia: Experiences and future perspectives, *Renewable and Sustainable Energy Reviews*, 189, 113911.

Wiyata, I.Y. and W Broto, R.T., 2021, Pembuatan Biodiesel Minyak Goreng Bekas dengan Memanfaatkan Limbah Cangkang Telur Bebek sebagai Katalis CaO, *Ind. Eng. Chem*, 2, 1.

Wong, Y.C., Tan, Y.P., Taufiq-Yap, Y.H., and Ramli, I., 2015, An Optimization Study for Transesterification of Palm Oil Using Response Surface Methodology (RSM), *Sains Malays*, 44, 281–290.

Xia, S., Tao, J., Zhao, Y., Men, Y., Chen, C., Hu, Y., Zhu, G., Chu, Y., Yan, B., and Chen, G., 2024, Application of waste derived magnetic acid-base bifunctional CoFe/biochar/CaO as an efficient catalyst for biodiesel production from waste cooking oil, *Chemosphere*, 350, 141104.

Xu, L., Zhang, J., Ding, J., Liu, T., Shi, G., Li, X., Dang, W., Cheng, Y., and Guo, R., 2020, Pore Structure and Fractal Characteristics of Different Shale Lithofacies in the Dalong Formation in the Western Area of the Lower Yangtze Platform, *Minerals 2020, Vol. 10, Page 72*, 10, 72.

Yusuff, A.S. and Owolabi, J.O., 2019, Synthesis and Characterization of Alumina Supported Coconut Chaff Catalyst for Biodiesel Production from Waste Frying Oil, *S Afr J Chem Eng*, 30, 42–49.

Zaimah, S., 2020, *Pemanfaatan Katalis Heterogen $KHSO_4$/CaO Turunan Cangkang Telur Dalam Sintesis Biodiesel Dari Minyak Jelantah*, Fakultas Sains dan Teknologi, Universitas Islam Negeri Walisongo, Semarang.

Zhang, H., Li, H., Hu, Y., Venkateswara Rao, K.T., Xu, C. (Charles), and Yang, S., 2019, Advances in Production of Bio-Based Ester Fuels with Heterogeneous Bifunctional Catalysts, *Renewable and Sustainable Energy Reviews*, 114, 109296.

Zhao, C.-X. and Middelberg, A.P.J., 2013, Microfluidic Synthesis of Monodisperse Hierarchical Silica Particles with Raspberry-like Morphology, RSC Advances, 15, 24102–24116.

Zhou, Y.Y., Li, X. xuan, and Chen, Z. xing, 2012, Rapid Synthesis of Well-Ordered Mesoporous Silica from Sodium Silicate, *Powder Technol*, 226, 239–245.

UNIVERSITAS
GADJAH MADA
SILIKA MESOPORI TERFOSFATASI DARI ABU DAUN SALAK TERIMPREGNASI KALSIUM OKSIDA SEBAGAI KATALIS FUNGSI
GANDA UNTUK KONVERSI SATU LANGKAH MINYAK GORENG SAWIT BEKAS MENJADI BIODIESEL
Adelia Indah Lestari, Prof. Dr.rer.nat. Karna Wijaya, M.Eng. ; Akhmad Syoufian, S.Si., Ph.D.
Universitas Gadjah Mada, 2025 | Diunduh dari http://etd.repository.ugm.ac.id/

Zhu, J., Lin, T., Niu, S., Zhang, Y., Han, K., Wang, Y., Yu, H., Liu, J., Zheng, Y., Liu, S., Geng, J., Yang, Z., Liang, B., Zhang, H., Sun, X., 2024, Synthesis of HNTs-Ca/Zn Catalyst for Biodiesel Production from Acidulated Palm Oil: Optimized by GA-BP, *Industrial Crops and Products*, 213, 118450.