

DAFTAR PUSTAKA

- Adepoju, T.F., Ibeh, M.A., Babatunde, E.O., and Asquo, A.J., 2020, Methanolysis of CaO based catalyst derived from egg shell-snail shell-wood ash mixed for fatty acid methylester (FAME) synthesis from a ternary mixture of *Irvingia gabonensis* -*Pentaclethra macrophylla* - *Elais guineensis* oil blend: An application of simple, *Fuel*, 275, 117997.
- Aisien, F.A. and Aisien, E.T., 2023, Modeling and optimization of transesterification of rubber seed oil using sulfonated CaO derived from giant African land snail (*Achatina fulica*) catalyst by response surface methodology, *Renew. Energy*, 207, 137–146.
- Akkarawatkhoosith, N., Bangjang, T., Kaewchada, A., and Jaree, A., 2023, Biodiesel production from rice bran oil fatty acid distillate via supercritical hydrolysis–esterification–transesterification in a microreactor, *Energy Reports*, 9, 5299–5305.
- Akream, N.S., Hamd, M.I., Gheni, S.A., Al-Sudani, F.T., Mohammed, A.E., Mohammed, H.R., Ali, M.M., Ahmed, S.M.R., Türköz Karakullukçu, N., and Tahah, A.K., 2024, High-yield activated carbon based ZnO-Ce bifunctional catalyst for production of biodiesel from waste cooking oil, *Energy Convers. Manag.*, 321, 119054.
- Al-Hamamre, Z., Alnaief, M., Yamin, J., Altarawneh, I., Sandouqa, A., Hammouri, R., Nasr, A., Maleki, H., and Shawabkeh, R.A., 2025, Synthesis, characterization, and performance evaluation of different sulfonated lignin-based carbon catalysts for upgrading waste vegetable oil to biodiesel, *Energy Convers. Manag.*, 325, 119381.
- Alhassan, F.H., Rashid, U., and Taufiq-yap, Y.H., 2015, Synthesis of waste cooking oil-based biodiesel via effectual recyclable bi-functional $\text{Fe}_2\text{O}_3/\text{MnO}_2/\text{SO}_4/\text{ZrO}_2$ nanoparticle solid catalyst, *FUEL*, 142, 38–45.
- Amal, R., Nadeem, R., Intisar, A., Rouf, H., Hussain, D., and Kousar, R., 2024, An insight into the catalytic properties and process optimization of Fe, Ni doped eggshell derived CaO for a green biodiesel synthesis from waste chicken fat, *Catal. Commun.*, 187, .
- Amal, R. and Usman, M., 2024, A review of breakthroughs in biodiesel production with transition and non-transition metal-doped CaO nano-catalysts, *Biomass and Bioenergy*, 184, 107158.
- Amenaghawon, A.N., Obahiagbon, K., Isesele, V., and Usman, F., 2022, Optimized biodiesel production from waste cooking oil using a functionalized bio-based heterogeneous catalyst, *Clean. Eng. Technol.*, 8, 100501.
- Aminah, S., Johari, M., Abdillah, M., Farid, A., Ayoub, M., Adilla, N., and Andou, Y., 2024, Environmental Technology & Innovation Optimization and kinetic studies for biodiesel production from dairy waste scum oil via microwave assisted transesterification, *Environ. Technol. Innov.*, 34, 103580.
- Annal, U.N., Sahaya, M., John, A., Gurusamy, R., Sahaya, P., Kumar, M., Afzal, M., Khurana, P., and Durai, M., 2025, Journal Pre-proof, *Biocatal. Agric. Biotechnol.*, 103545.
- Ansari, M., Jamali, H., Ghanbari, R., Ehrampoush, M.H., Zamani, P., and Hatami, B., 2025, Heterogeneous solid acid catalysts for sustainable biodiesel production from wastewater-derived sludge: A systematic and critical review, *Chem. Eng. J. Adv.*, 22, 100718.
- Ao, S., Gouda, S.P., Selvaraj, M., Boddula, R., Al-Qahtani, N., Mohan, S., and Rokhum, S.L.,

- 2024, Active sites engineered biomass-carbon as a catalyst for biodiesel production: Process optimization using RSM and life cycle assessment, *Energy Convers. Manag.*, 300, 117956.
- Asfaw, B.T., Gari, M.T., and Jayakumar, M., 2025, Transesterification of biodiesel from non-edible oils using heterogeneous base catalysts: A comprehensive review of potential renewable biomass feedstocks, *Chem. Eng. J.*, 511, 162028.
- Asikin-mijan, N. and Abdulkareem-alsultan, G., 2020, Biomass and Bioenergy Biodiesel production via simultaneous esterification and transesterification of chicken fat oil by mesoporous sulfated Ce supported activated carbon, *Biomass and Bioenergy*, 141, 105714.
- Asikin-Mijan, N., Taufiq-Yap, Y.H., and Lee, H. V., 2015, Synthesis of clamshell derived $\text{Ca}(\text{OH})_2$ nano-particles via simple surfactant-hydration treatment, *Chem. Eng. J.*, 262, 1043–1051.
- Asmono, S.L., Rahmawati, Arifiana, N.B., and Suharjono, 2024, Phytohormone and amino acid content in golden apple snail (*Pomacea canaliculata* L.) extract which fermented at several effective microorganism 4 (EM4) concentrations, *IOP Conf. Ser. Earth Environ. Sci.*, 1338, 012008.
- Banga, S. and Pathak, V. V., 2023, Biodiesel production from waste cooking oil: A comprehensive review on the application of heterogenous catalysts, *Energy Nexus*, 10, 100209.
- Basheer, A. and Arivarasu, A., 2020, Materials Today: Proceedings Synthesis and characterization of reusable heteropoly acid nanoparticles for one step biodiesel production from high acid value waste cooking oil – Performance and emission studies, *Mater. Today Proc.*, 22, 383–392.
- Basumatary, S., Nath, B., Das, B., Kalita, P., and Basumatary, B., 2021, Utilization of renewable and sustainable basic heterogeneous catalyst from *Heteropanax fragrans* (Kessuru) for effective synthesis of biodiesel from *Jatropha curcas* oil, *Fuel*, 286, 119357.
- 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 Resour.*, 1, 100032.
- Benedetti, B., Caponigro, V., and Ardini, F., 2022, Experimental Design Step by Step: A Practical Guide for Beginners, *Crit. Rev. Anal. Chem.*, 52, 1015–1028.
- Bezerra, M.A., Santelli, R.E., Oliveira, E.P., Villar, L.S., and Escalera, L.A., 2008, Response surface methodology (RSM) as a tool for optimization in analytical chemistry, *Talanta*, 76, 965–977.
- Bhuyan, A. and Ahmaruzzaman, M., 2025, One-pot fabrication of a stable POM/MIL-101(Fe) hybrid catalyst supported on a chitosan biopolymer matrix: A study on biodiesel production through RSM optimization, experimental studies, and mechanistic insight, *Renew. Energy*, 241, 122360.
- Birla, A., Singh, B., Upadhyay, S.N., and Sharma, Y.C., 2012, Kinetics studies of synthesis of biodiesel from waste frying oil using a heterogeneous catalyst derived from snail shell,

Bioresour. Technol., 106, 95–100.

- Borah, M.J., Das, A., Das, V., Bhuyan, N., and Deka, D., 2019, Transesterification of waste cooking oil for biodiesel production catalyzed by Zn substituted waste egg shell derived CaO nanocatalyst, *Fuel*, 242, 345–354.
- Boro, J., Konwar, L.J., and Deka, D., 2014, Transesterification of non edible feedstock with lithium incorporated egg shell derived CaO for biodiesel production, *Fuel Process. Technol.*, 122, 72–78.
- Buasri, A., Kamsuwan, J., Dokput, J., Buakao, P., Horthong, P., and Loryuenyong, V., 2024, Green synthesis of metal oxides (CaO-K₂O) catalyst using golden apple snail shell and cultivated banana peel for production of biofuel from non-edible *Jatropha Curcas* oil (JCO) via a central composite design (CCD), *J. Saudi Chem. Soc.*, 28, 101836.
- Chai, M., Tu, Q., Lu, M., and Yang, Y.J., 2014, Esterification pretreatment of free fatty acid in biodiesel production, from laboratory to industry, *Fuel Process. Technol.*, 125, 106–113.
- Chanthon, N., Munbupphachart, N., Ngaosuwan, K., Kiatkittipong, W., Wongsawaeng, D., Mens, W., Rokhum, S.L., and Assabumrungrat, S., 2023, Metal loading on CaO/Al₂O₃ pellet catalyst as a booster for transesterification in biodiesel production, *Renew. Energy*, 218, 119336.
- Charlena, Suparto, I.H., and Putri, D.K., 2015, Synthesis of Hydroxyapatite from Rice Fields Snail Shell (*Bellamya javanica*) through Wet Method and Pore Modification Using Chitosan, *Procedia Chem.*, 17, 27–35.
- Chellappan, S., Nair, V., Sajith, V., and Aparna, K., 2018, Synthesis, optimization and characterization of biochar based catalyst from sawdust for simultaneous esterification and transesterification, *Chinese J. Chem. Eng.*, 26, 2654–2663.
- Chingakham, C., David, A., and Sajith, V., 2019, Fe₃O₄ nanoparticles impregnated eggshell as a novel catalyst for enhanced biodiesel production, *Chinese J. Chem. Eng.*, 27, 2835–2843.
- Comuzzo, P. and Battistutta, F., 2018, *Acidification and pH Control in Red Wines*, Elsevier Inc.
- Cui, W., Wang, X., Han, S., Guo, W., Meng, N., Li, J., Sun, B., and Zhang, X., 2024, Research progress of tartaric acid stabilization on wine characteristics, *Food Chem. X*, 23, 101728.
- Dendouga, B., Sakri, A., Bouremel, C., Boudaoud, Y., and Berkani, M., 2025, Enhancing transesterification of used soybean frying oil using CaO.ZnO (10 %) NiO (8 %) catalyst: Response surface optimization and characterization, *Biomass and Bioenergy*, 193, 107582.
- Devaraj, K., Veerasamy, M., Aathika, S., Mani, Y., Thanarasu, A., Dhanasekaran, A., and Subramanian, S., 2019, Study on effectiveness of activated calcium oxide in pilot plant biodiesel production, *J. Clean. Prod.*, 225, 18–26.
- Dhawane, S.H., Kumar, T., and Halder, G., 2015, Central composite design approach towards optimization of flamboyant pods derived steam activated carbon for its use as heterogeneous catalyst in transesterification of *Hevea brasiliensis* oil, *Energy Convers. Manag.*, 100, 277–287.

- Díaz-Muñoz, L.L., Reynel-Ávila, H.E., Mendoza-Castillo, D.I., Bonilla-Petriciolet, A., and Jáuregui-Rincón, J., 2022, Preparation and Characterization of Alkaline and Acidic Heterogeneous Carbon-Based Catalysts and Their Application in Vegetable Oil Transesterification to Obtain Biodiesel, *Int. J. Chem. Eng.*, 2022, 7056220.
- Ding, J., Qu, S., Lv, E., Lu, J., and Yi, W., 2020, Mini review of biodiesel by integrated membrane separation technologies that enhanced esterification/transesterification, *Energy and Fuels*, 34, 15614–15633.
- El-Gendy, N.S., Deriase, S.F., and Hamdy, A., 2014, The optimization of biodiesel production from waste frying corn oil using snails shells as a catalyst, *Energy Sources, Part A Recover. Util. Environ. Eff.*, 36, 623–637.
- 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.
- Fadhil, A.B., Al-Tikrity, E.T.B., and Khalaf, A.M., 2018, Transesterification of non-edible oils over potassium acetate impregnated CaO solid base catalyst, *Fuel*, 234, 81–93.
- Falowo, O.A., Oladipo, B., Sofiri, S.O., and Ojumu, T. V., 2025, Ferric sulfate modified bifunctional catalyst for methyl esters production from microwave-assisted intensification of *Delonix regia* and waste cooking oil mixture, *Energy Convers. Manag.*, 327, 119588.
- Farooq, M. and Ramli, A., 2015, Biodiesel production from low FFA waste cooking oil using heterogeneous catalyst derived from chicken bones, *Renew. Energy*, 76, 362–368.
- Farooq, M., Ramli, A., and Subbarao, D., 2013, Biodiesel production from waste cooking oil using bifunctional heterogeneous solid catalysts, *J. Clean. Prod.*, 59, 131–140.
- Ferreira, A.G.A., Paula Lima, W.X., and Rial, R.C., 2024, Nuclear magnetic resonance (NMR) applications in biodiesel characterization and quality – A review, *Microchem. J.*, 207, 112226.
- Fiala, K., Rublaim, A., and Leasing, R., 2025, Boosting wet yeast-based biodiesel production by in-situ transesterification using a novel acid-base bifunctional carbon-based catalyst derived from spent coffee ground and cement residue, *Renew. Energy*, 241, 122341.
- Fitria, A., Trisunaryanti, W., Triyono, and Santoso, I., 2024, Synthesis, characterization and performance of Ni/mesoporous silica - NH₂/mesoporous silica and Ni-NH₂/mesoporous silica as bifunctional catalyst in one step conversion of waste palm oil to biodiesel, *Commun. Sci. Technol.*, 9, 430–441.
- Foroutan, R., Mohammadi, R., Esmaeili, H., Mirzaee Bektashi, F., and Tamjidi, S., 2020, Transesterification of waste edible oils to biodiesel using calcium oxide@magnesium oxide nanocatalyst, *Waste Manag.*, 105, 373–383.
- Fu, J., Wen, X., Xu, Z., Guo, Y., Ke, C., and Xu, J., 2024, Influence of crystalline phase structure of rare earth oxides on active oxygen and basic sites, *Solid State Sci.*, 158, 107738.
- Ghosh, N., Patra, M., and Halder, G., 2024, Current advances and future outlook of heterogeneous catalytic transesterification towards biodiesel production from waste cooking

oil, *Sustain. Energy Fuels*, 8, 1105–1152.

- Gonçalves, M.A., Santos, H.C.L. dos, da Silva, M.A.R., da Cas Viegas, A., da Rocha Filho, G.N., and da Conceição, L.R.V., 2024, Biodiesel production from waste cooking oil using an innovative magnetic solid acid catalyst based on Ni–Fe ferrite: RSM-BBD optimization approach, *J. Ind. Eng. Chem.*, 135, 270–285.
- Hasni, K., Ilham, Z., Dharma, S., and Varman, M., 2017, Optimization of biodiesel production from *Brucea javanica* seeds oil as novel non-edible feedstock using response surface methodology, *Energy Convers. Manag.*, 149, 392–400.
- Helmi, M. and Hemmati, A., 2021, Synthesis of magnetically solid base catalyst of NaOH/Chitosan-Fe₃O₄ for biodiesel production from waste cooking oil: Optimization, kinetics and thermodynamic studies, *Energy Convers. Manag.*, 248, 114807.
- Helmi, M., Tahvildari, K., Hemmati, A., Aberoomand azar, P., and Safekordi, A., 2021, Phosphomolybdic acid/graphene oxide as novel green catalyst using for biodiesel production from waste cooking oil via electrolysis method: Optimization using with response surface methodology (RSM), *Fuel*, 287, 119528.
- Hernández-Martínez, M.A., Rodriguez, J.A., Chavez-Esquivel, G., Ángeles-Beltrán, D., and Tavazón-Pozos, J.A., 2023, Canola oil transesterification for biodiesel production using potassium and strontium supported on calcium oxide catalysts synthesized from oyster shell residues, *Next Mater.*, 1, 100033.
- Hosseinzadeh-bandbafha, H., Li, C., Chen, X., and Peng, W., 2022, Managing the hazardous waste cooking oil by conversion into bioenergy through the application of waste-derived green catalysts : A review, *J. Hazard. Mater.*, 424, 127636.
- Hu, S., Guan, Y., Wang, Y., and Han, H., 2011, Nano-magnetic catalyst KF/CaO-Fe₃O₄ for biodiesel production, *Appl. Energy*, 88, 2685–2690.
- Huang, W., Tang, S., Zhao, H., and Tian, S., 2013, Activation of commercial CaO for biodiesel production from rapeseed oil using a novel deep eutectic solvent, *Ind. Eng. Chem. Res.*, 52, 11943–11947.
- 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.
- Joorasty, M., Hemmati, A., and Rahbar-Kelishami, A., 2021, NaOH/clinoptilolite-Fe₃O₄ as a novel magnetic catalyst for producing biodiesel from *Amygdalus scoparia* oil: Optimization and kinetic study, *Fuel*, 303, 121305.
- Jung, K., Kim, D., Kim, H., and Shin, H., 2011, Optimization of combined (acid D thermal) pretreatment for fermentative hydrogen production from *Laminaria japonica* using response surface methodology (RSM), *Int. J. Hydrogen Energy*, 36, 9626–9631.
- Karkal, S.S., Rathod, D.R., Jamadar, A.S., Mamatha, S.S., and Kudre, T.G., 2023, Production optimization, scale-up, and characterization of biodiesel from marine fishmeal plant oil using *Portunus sanguinolentus* crab shell derived heterogeneous catalyst, *Biocatal. Agric.*

Biotechnol., 47, 102571.

- Karmakar, B. and Halder, G., 2019, Progress and future of biodiesel synthesis: Advancements in oil extraction and conversion technologies, *Energy Convers. Manag.*, 182, 307–339.
- Kathumbi, L.K., Home, P.G., Raude, J.M., and Gathitu, B.B., 2022, Performance of Citric Acid as a Catalyst and Support Catalyst When Synthesized with NaOH and CaO in Transesterification of Biodiesel from Black Soldier Fly Larvae Fed on Kitchen Waste, *Fuels*, 3, 295–315.
- 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@SiO₂-CaO) green catalyst: Characterization and optimization study, *Biomass and Bioenergy*, 198, 107815.
- Kingkam, W., Nuchdang, S., Phalakornkule, C., Suwanmanee, U., and Rattanaphra, D., 2024, Synergistic effect of La₂O₃-Al₂O₃ based catalysts for efficient biodiesel production, *J. Ind. Eng. Chem.*, 143, 197–212.
- Kosuru, S.M.Y., Delhiwala, Y., Koorla, P.B., and Mekala, M., 2024, A review on the biodiesel production: Selection of catalyst, Pre-treatment, Post treatment methods, *Green Technol. Sustain.*, 2, 100061.
- Krishnamurthy, K.N., Sridhara, S.N., and Ananda Kumar, C.S., 2020, Optimization and kinetic study of biodiesel production from Hydnocarpus wightiana oil and dairy waste scum using snail shell CaO nano catalyst, *Renew. Energy*, 146, 280–296.
- Kudre, T.G., Bhaskar, N., and Sakhare, P.Z., 2017, Optimization and characterization of biodiesel production from rohu (*Labeo rohita*) processing waste, *Renew. Energy*, 113, 1408–1418.
- Laskar, I.B., Rajkumari, K., Gupta, R., Chatterjee, S., Paul, B., and Rokhum, L., 2018, Waste snail shell derived heterogeneous catalyst for biodiesel production by the transesterification of soybean oil, *RSC Adv.*, 8, 20131–20142.
- Lee, H. V., Yunus, R., Juan, J.C., and Taufiq-Yap, Y.H., 2011, Process optimization design for jatropha-based biodiesel production using response surface methodology, *Fuel Process. Technol.*, 92, 2420–2428.
- Li, X., Xie, G., Gu, X., Zhang, G., Da, Y., Wang, Y., Liang, H., Li, Y., and Wang, B., 2024, A tartaric acid (TA)-coated iron-based biochar as heterogeneous fenton catalyst for enhanced degradation of dibutyl phthalate, *Environ. Pollut.*, 362, 124976.
- Liu, H., Liu, C., and Huang, J., 2023, Characterization of the shell proteins in two freshwater snails *Pomacea canaliculata* and *Cipangopaludina chinensis*, *Int. J. Biol. Macromol.*, 242, 124524.
- Luiz Caleffo Piva Bigão, V., Ruiz Brandão da Costa, B., Joaquim Mangabeira da Silva, J., Spinosa De Martinis, B., and Tapia-Blácido, D.R., 2024, Use of statistical design of experiments (DoE) in Forensic Analysis: A tailored review, *Forensic Chem.*, 37, 100554.
- Macheli, L., Malefane, M.E., and Jewell, L.L., 2025, Waste-derived calcium oxide catalysts in biodiesel production: Exploring various waste sources, deactivation challenges, and

- improvement strategies, *Bioresour. Technol. Reports*, 29, 102021.
- Madhu, D., Chavan, S.B., Singh, V., Singh, B., and Sharma, Y.C., 2016, An economically viable synthesis of biodiesel from a crude *Milletia pinnata* oil of Jharkhand, India as feedstock and crab shell derived catalyst, *Bioresour. Technol.*, 214, 210–217.
- Madhuvilakku, R., Mariappan, R., Jeyapal, S., Sundar, S., and Piraman, S., 2013, Transesterification of palm oil catalyzed by fresh water bivalve mollusk (*margaritifera falcata*) shell as heterogeneous catalyst, *Ind. Eng. Chem. Res.*, 52, 17407–17413.
- Maleki, B., Singh, B., Eamaeili, H., Venkatesh, Y.K., Talesh, S.S.A., and Seetharaman, S., 2023, Transesterification of waste cooking oil to biodiesel by walnut shell/sawdust as a novel, low-cost and green heterogeneous catalyst: Optimization via RSM and ANN, *Ind. Crops Prod.*, 193, 116261.
- Malins, K., Kampars, V., Brinks, J., Neibolte, I., and Murnieks, R., 2015, Synthesis of activated carbon based heterogenous acid catalyst for biodiesel preparation, *Appl. Catal. B Environ.*, 176–177, 553–558.
- Mansir, N., Teo, S.H., Rashid, U., Saiman, M.I., Tan, Y.P., Alsultan, G.A., and Taufiq-Yap, Y.H., 2018, Modified waste egg shell derived bifunctional catalyst for biodiesel production from high FFA waste cooking oil. A review, *Renew. Sustain. Energy Rev.*, 82, 3645–3655.
- Mardhiah, H.H., Ong, H.C., Masjuki, H.H., Lim, S., and Lee, H. V., 2017, A review on latest developments and future prospects of heterogeneous catalyst in biodiesel production from non-edible oils, *Renew. Sustain. Energy Rev.*, 67, 1225–1236.
- Mazaheri, H., Ong, H.C., Masjuki, H.H., Amini, Z., Harrison, M.D., Wang, C.T., Kusumo, F., and Alwi, A., 2018, Rice bran oil based biodiesel production using calcium oxide catalyst derived from *Chicoreus brunneus* shell, *Energy*, 144, 10–19.
- Mendonça, I.M., Paes, O.A.R.L., Maia, P.J.S., Souza, M.P., Almeida, R.A., Silva, C.C., Duvoisin, S., and de Freitas, F.A., 2019, New heterogeneous catalyst for biodiesel production from waste tucumã peels (*Astrocaryum aculeatum* Meyer): Parameters optimization study, *Renew. Energy*, 130, 103–110.
- Milano, J., Ong, H.C., Masjuki, H.H., Silitonga, A.S., Chen, W.H., Kusumo, F., Dharma, S., and Sebayang, A.H., 2018, Optimization of biodiesel production by microwave irradiation-assisted transesterification for waste cooking oil-*Calophyllum inophyllum* oil via response surface methodology, *Energy Convers. Manag.*, 158, 400–415.
- Mirzayanti, Y.W., Ningsih, E., Ni'am, A.C., Al-Muttaqii, M., Awaludin, A., Sukono, I.M., Noorsy, I.N., Asri, N.P., Chern, J.M., and Ma'sum, Z., 2025, Enhanced biofuel production from *Nannochloropsis* sp. via microwave-assisted extraction in-Situ transesterification using CaO/hydrotalcite catalyst, *Case Stud. Chem. Environ. Eng.*, 11, 101234.
- Morgenstern, M., Cline, J., Meyer, S., and Cataldo, S., 2006, Determination of the kinetics of biodiesel production using proton nuclear magnetic resonance spectroscopy (¹H NMR), *Energy and Fuels*, 20, 1350–1353.
- Mulyatun, M., Prameswari, J., Istadi, I., and Widayat, W., 2024, Synthesis Method Effect on the

Catalytic Performance of Acid–Base Bifunctional Catalysts for Converting Low-Quality Waste Cooking Oil to Biodiesel, *Catal. Letters*, 154, 4837–4855.

- Mustafa, G., Singh, B., Prasad, G., and Dey, R.K., 2025, Sustainable biodiesel production from waste cooking oil using highly effective CaO / hectorite catalyst : Process optimization , kinetic and thermodynamic studies ., *Sustain. Chem. One World*, 5, 100034.
- Muthukumaran, C., Praniesh, R., Navamani, P., Swathi, R., Sharmila, G., and Manoj Kumar, N., 2017, Process optimization and kinetic modeling of biodiesel production using non-edible Madhuca indica oil, *Fuel*, 195, 217–225.
- Nahas, R.I., 2012, Natural antioxidants as food and beverage ingredients, Woodhead Publishing Limited.
- Naseef, H.H. and Tulaimat, R.H., 2025, Transesterification and esterification for biodiesel production: A comprehensive review of catalysts and palm oil feedstocks, Elsevier Ltd.
- Nath, B., Kalita, P., Das, B., and Basumatary, S., 2020, Highly efficient renewable heterogeneous base catalyst derived from waste Sesamum indicum plant for synthesis of biodiesel, *Renew. Energy*, 151, 295–310.
- Niju, S., Meera Sheriffa Begum, K.M., and Anantharaman, N., 2016, Enhancement of biodiesel synthesis over highly active CaO derived from natural white bivalve clam shell Enhancement of biodiesel synthesis over highly active CaO, *Arab. J. Chem.*, 9, 633–639.
- Nunes, A.L.B. and Castilhos, F., 2020, Chemical interesterification of soybean oil and methyl acetate to FAME using CaO as catalyst, *Fuel*, 267, 117264.
- Osagiede, C.A. and Aisien, F.A., 2024, Biochar-based bi-functional catalyst derived from rubber seed shell and eggshell for biodiesel production from waste cooking oil, *Fuel*, 358, 130076.
- Pandit, P.R. and Fulekar, M.H., 2017, Egg shell waste as heterogeneous nanocatalyst for biodiesel production : Optimized by response surface methodology, *J. Environ. Manage.*, 198, 319–329.
- Parveen, S., Chakraborty, A., Chanda, D.K., Pramanik, S., Barik, A., and Aditya, G., 2020, Microstructure Analysis and Chemical and Mechanical Characterization of the Shells of Three Freshwater Snails, *ACS Omega*, 5, 25757–25771.
- Peranginangin, S., Br, H., Violetha, Y., Nainggolan, M., Sarito, N., and Wijoyo, H., 2024, Case Studies in Chemical and Environmental Engineering Fatty acid methyl ester (FAME) production from sludge solid waste as K₂O / SiO₂ catalyst, *Case Stud. Chem. Environ. Eng.*, 10, 100933.
- Perea, A., Kelly, T., and Hangun-Balkir, Y., 2016, Utilization of waste seashells and Camelina sativa oil for biodiesel synthesis, *Green Chem. Lett. Rev.*, 9, 27–32.
- Perumal, G., Magendradass, D., and Munusamy, R., 2025, Chemical Engineering Research and Design Optimization and kinetic studies on novel Mg (HPW12O₄₀)/ SiO₂ mesoporous solid catalysts for biodiesel production from Bauhinia variegata seed oil, *Chem. Eng. Res. Des.*, 218, 824–838.

- Pham, E.C. and Nguyen, D. Van, 2024, Optimization of ultrasound-assisted biodiesel production from python fat oil using response surface methodology, *Energy Nexus*, 16, 100331.
- Phewphong, S., Roschat, W., Pholsupho, P., Moonsin, P., Promarak, V., and Yoosuk, B., 2022, Biodiesel production process catalyzed by acid-treated golden apple snail shells (*Pomacea canaliculata*)-derived cao as a high-performance and green catalyst, *Eng. Appl. Sci. Res.*, 49, 36–46.
- Piker, A., Tabah, B., Perkasa, N., and Gedanken, A., 2016, A green and low-cost room temperature biodiesel production method from waste oil using egg shells as catalyst, *Fuel*, 182, 34–41.
- Prajapati, N., Kodgire, P., and Singh Kachhwaha, S., 2022, Comparison of RSM Based FFD and CCD Methods for Biodiesel Production Using Microwave Technique, *Mater. Today Proc.*, 62, 6985–6991.
- Ramdhani, D.A., Trisunaryanti, W., and Triyono, 2023, Study of green and sustainable heterogeneous catalyst produced from Javanese *Moringa oleifera* leaf ash for the transesterification of *Calophyllum inophyllum* seed oil, *Commun. Sci. Technol.*, 8, 124–133.
- Rhithuparna, D., Ghosh, N., Khatoon, R., Rokhum, S.L., and Halder, G., 2024, Evaluating the commercial potential of *Cocos nucifera* derived biochar catalyst in biodiesel synthesis from Kanuga oil: Optimization, kinetics, thermodynamics, and process cost analysis, *Process Saf. Environ. Prot.*, 183, 859–874.
- Roschat, W., Siritanon, T., Yoosuk, B., and Promarak, V., 2016, Biodiesel production from palm oil using hydrated lime-derived CaO as a low-cost basic heterogeneous catalyst, *Energy Convers. Manag.*, 108, 459–467.
- Rozina, Ahmad, M., Elnaggar, A.Y., Keat Teong, L., Sultana, S., Zafar, M., Munir, M., Hussein, E.E., and Zain Ul Abidin, S., 2022, Sustainable and eco-friendly synthesis of biodiesel from novel and non-edible seed oil of *Monotheca buxifolia* using green nano-catalyst of calcium oxide, *Energy Convers. Manag. X*, 13, 100142.
- Ruatpuia, J.V.L., Changmai, B., Pathak, A., Alghamdi, L.A., Kress, T., Halder, G., Wheatley, A.E.H., and Rokhum, S.L., 2023, Green biodiesel production from *Jatropha curcas* oil using a carbon-based solid acid catalyst: A process optimization study, *Renew. Energy*, 206, 597–608.
- Sahar, Sadaf, S., Iqbal, J., Ullah, I., Bhatti, H.N., Nouren, S., Habib-ur-Rehman, Nisar, J., and Iqbal, M., 2018, Biodiesel production from waste cooking oil: An efficient technique to convert waste into biodiesel, *Sustain. Cities Soc.*, 41, 220–226.
- Sahu, S., Saikia, K., Gurunathan, B., Dhakshinamoorthy, A., and Rokhum, S.L., 2023, Green synthesis of CaO nanocatalyst using watermelon peels for biodiesel production, *Mol. Catal.*, 547, 113342.
- Sathish, S., Supriya, S., Andal, P., Prabu, D., Aravind kumar, J., Rajasimman, M., Ansar, S., and Rezanisa, S., 2022, Effective utilization of *azolla filiculoides* for biodiesel generation using graphene oxide nano catalyst derived from agro-waste, *Fuel*, 329, 125412.

- Shajan, X.S. and Mahadevan, C., 2004, On the growth of calcium tartrate tetrahydrate single crystals, *Bull. Mater. Sci.*, 27, 327–331.
- Sharma, A., Kodgire, P., and Kachhwaha, S.S., 2019, Biodiesel production from waste cotton-seed cooking oil using microwave-assisted transesterification: Optimization and kinetic modeling, *Renew. Sustain. Energy Rev.*, 116, 109394.
- 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 Eng.*, 13, 100374.
- Singh, W.R. and Singh, H.N., 2024, CCD-RSM optimization of biodiesel production from waste cooking oil using *Angulyagra oxytropis* and *Bellamya crassa* snail shell-based heterogeneous catalysts, *Fuel*, 378, .
- Sitthithanaboon, W., Reddy, H.K., Muppaneni, T., Ponnusamy, S., Punsuvon, V., Holguim, F., Dungan, B., and Deng, S., 2015, Single-step conversion of wet *Nannochloropsis gaditana* to biodiesel under subcritical methanol conditions, *Fuel*, 147, 253–259.
- Sonawane, S.S., Nandre, S.J., Ahire, R.R., and Shitole, S.J., 2014, Study of structural and physical properties of calcium tartrate crystals grown by single diffusion technique, *Der Pharma Chem.*, 6, 33–38.
- Syazwani, O.N., Teo, S.H., Islam, A., and Taufiq-Yap, Y.H., 2017, Transesterification activity and characterization of natural CaO derived from waste venus clam (*Tapes belcheri* S.) material for enhancement of biodiesel production, *Process Saf. Environ. Prot.*, 105, 303–315.
- Tan, Q., Leng, Y., Wang, J., Huang, C., and Yuan, Y., 2016, Correlation and prediction of the solubility of the racemic tartaric acid-ethanol-water system with the NRTL model, *J. Mol. Liq.*, 216, 476–483.
- Tan, Y.H., Abdullah, M.O., Kansedo, J., Mubarak, N.M., Chan, Y.S., and Nolasco-Hipolito, C., 2019, Biodiesel production from used cooking oil using green solid catalyst derived from calcined fusion waste chicken and fish bones, *Renew. Energy*, 139, 696–706.
- Tang, Y., Xu, J., Zhang, J., and Lu, Y., 2013, Biodiesel production from vegetable oil by using modified CaO as solid basic catalysts, *J. Clean. Prod.*, 42, 198–203.
- Teo, S.H., Islam, A., Ng, C.H., Mansir, N., Ma, T., Thomas Choong, S.Y., and Taufiq-Yap, Y.H., 2018, Methoxy-functionalized mesostructured stable carbon catalysts for effective biodiesel production from non-edible feedstock, *Chem. Eng. J.*, 334, 1851–1868.
- Teo, S.H., Taufiq-Yap, Y.H., Rashid, U., and Islam, A., 2015, Hydrothermal effect on synthesis, characterization and catalytic properties of calcium methoxide for biodiesel production from crude *Jatropha curcas*, *RSC Adv.*, 5, 4266–4276.
- Tran, T.T.V., Kaiprommarat, S., Kongparakul, S., Reubroycharoen, P., Guan, G., Nguyen, M.H., and Samart, C., 2016, Green biodiesel production from waste cooking oil using an environmentally benign acid catalyst, *Waste Manag.*, 52, 367–374.
- Trisupakitti, S., Ketwong, C., Senajuk, W., Phukapak, C., and Wiriyampaiwong, S., 2018,

- Golden apple cherry snail shell as catalyst for heterogeneous transesterification of biodiesel, *Brazilian J. Chem. Eng.*, 35, 1283–1291.
- Triyono, Trisunaryanti, W., Aksanti, S.I., and Purbonegoro, J., 2024, High performance of a base catalyst from Moringa leaves ash for biodiesel conversion of low-grade Bali Malapari oil, *React. Kinet. Mech. Catal.*, 137, 2037–2063.
- Vanisree, G.S. and Aparna, K., 2025, Ultrasound-assisted biodiesel production using engineered *Cycas circinalis* seed shell-derived heterogeneous catalyst, *Therm. Sci. Eng. Prog.*, 59, 103335.
- Wahba, M.A., 2024, Unveiling significant changes in optical, magnetic, and visible-light photocatalytic performance of CuFe_2O_4 nanocompositions through chelating agent modulation, *Ceram. Int.*, 51, 4329–4342.
- Xia, S., Li, J., Chen, G., Tao, J., Li, W., and Zhu, G., 2022, Magnetic reusable acid-base bifunctional Co doped Fe_2O_3 – CaO nanocatalysts for biodiesel production from soybean oil and waste frying oil, *Renew. Energy*, 189, 421–434.
- Xia, S., Tao, J., Zhao, Y., Men, Y., Chen, C., Hu, Y., Zhu, G., Chu, Y., Yan, B., and Chen, G., 2024, Chemosphere 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.
- Yaakoubi, I. El, Borji, A., Ettalibi, O., Kouar, J., Abouliatim, Y., Hlaibi, M., and Kamil, N., 2025, One-pot conversion *Allium sativum* peels into a cost-effective carbon-based heterogeneous acid catalyst for renewable biodiesel production using palm oil refining by-products, *Energy Convers. Manag.*, 327, 119551.
- Yan, S., Kim, M., Salley, S.O., and Ng, K.Y.S., 2009, Oil transesterification over calcium oxides modified with lanthanum, *Appl. Catal. A Gen.*, 360, 163–170.
- Yang, J., Cong, W. jie, Zhu, Z., Miao, Z. diao, Wang, Y.T., Nelles, M., and Fang, Z., 2023, Microwave-assisted one-step production of biodiesel from waste cooking oil by magnetic bifunctional SrO – ZnO /MOF catalyst, *J. Clean. Prod.*, 395, 136182.
- Yin, J., Zhong, P., Chen, C., Li, Y., and Chen, G., 2025, Optimization of laser-based glass frit bonding for optoelectronic packaging using response surface methodology, *Opt. Laser Technol.*, 181, 111678.
- 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, *Renew. Sustain. Energy Rev.*, 114, 109296.
- Zhang, Y., Niu, S., Xia, S., Liu, S., and Liu, J., 2023, One-step conversion of acidified oil to biodiesel by novel bifunctional $\text{SrZr}_{1-x}\text{Fe}_x\text{O}_3$ catalyst, *Renew. Energy*, 217, 119139.