

REFERENCES

-
-
- [1] Singh R, Kumar A, Chandra Sharma Y. Biodiesel Production from Microalgal Oil Using Barium-Calcium-Zinc Mixed Oxide Base Catalyst: Optimization and Kinetic Studies. *Energy and Fuels* 2019;33:1175–84. <https://doi.org/10.1021/acs.energyfuels.8b03461>.
- [2] Guerra-Zubiaga DA, Mamun A Al, Gonzalez-Badillo G. An energy consumption approach in a manufacturing process using design of experiments. *Int J Comput Integr Manuf* 2018;31:1067–77. <https://doi.org/10.1080/0951192X.2018.1493234>.
- [3] Luo X, Ge X, Cui S, Li Y. Value-added processing of crude glycerol into chemicals and polymers. *Bioresour Technol* 2016;215:144–54. <https://doi.org/10.1016/j.biortech.2016.03.042>.
- [4] Babajide O. Sustaining Biodiesel Production via Value-Added Applications of Glycerol. *Journal of Energy* 2013;2013:1–7. <https://doi.org/10.1155/2013/178356>.
- [5] Bagheri S, Julkapli NM, Yehye WA. Catalytic conversion of biodiesel derived raw glycerol to value added products. *Renewable and Sustainable Energy Reviews* 2015;41:113–27. <https://doi.org/10.1016/j.rser.2014.08.031>.
- [6] Xiu S, Shahbazi A. Bio-oil production and upgrading research: A review. *Renewable and Sustainable Energy Reviews* 2012;16:4406–14. <https://doi.org/10.1016/j.rser.2012.04.028>.
- [7] Kim J-K, Yim ES, Jeon CH, Jung C-S, Han BH. COLD PERFORMANCE OF VARIOUS BIODIESEL FUEL BLENDS AT LOW TEMPERATURE. *International Journal of Automotive Technology* 2012;13:293–300. <https://doi.org/10.1007/s12239-012-0027-2>.
- [8] Zhengqi Jiao B, Tsai C-S, Johnson T, Alexander Yoshizumi C. Estimating the Energy and Emissions Impacts of a Commuter Rail System in North Carolina Miaojun Pang, MEM-Energy and Environment Xinyi (Wendy) Wen, MEM-Energy and Environment &

MEng. 2024.

- [9] Saifuddin N, Refal H, Kumaran P. Rapid purification of glycerol by-product from biodiesel production through combined process of microwave assisted acidification and adsorption via chitosan immobilized with yeast. *Research Journal of Applied Sciences, Engineering and Technology* 2014;7:593–602. <https://doi.org/10.19026/rjaset.7.295>.
- [10] García JI, García-Marín H, Pires E. Glycerol based solvents: Synthesis, properties and applications. *Green Chemistry* 2014;16:1007–33. <https://doi.org/10.1039/c3gc41857j>.
- [11] Chilakamarry CR, Sakinah AMM, Zularisam AW, Sirohi R, Khilji IA, Reddy VJ, et al. Bioconversion of Glycerol into Biofuels—Opportunities and Challenges. *Bioenergy Res* 2022;15:46–61. <https://doi.org/10.1007/s12155-021-10353-6>.
- [12] Ayoub M, Abdullah AZ. Critical review on the current scenario and significance of crude glycerol resulting from biodiesel industry towards more sustainable renewable energy industry. *Renewable and Sustainable Energy Reviews* 2012;16:2671–86. <https://doi.org/10.1016/j.rser.2012.01.054>.
- [13] Pagliaro M. Properties, Applications, History, and Market. *Glycerol*, Elsevier; 2017, p. 1–21. <https://doi.org/10.1016/b978-0-12-812205-1.00001-1>.
- [14] Prasad Agarwal G. *Glycerol*. n.d.
- [15] Christoph R, Schmidt B, Steinberner U, Dilla W, Karinen R. *Glycerol*. Ullmann's Encyclopedia of Industrial Chemistry, Wiley-VCH Verlag GmbH & Co. KGaA; 2006. https://doi.org/10.1002/14356007.a12_477.pub2.
- [16] Dashnau JL, Nucci N V., Sharp KA, Vanderkooi JM. Hydrogen bonding and the cryoprotective properties of glycerol/water mixtures. *Journal of Physical Chemistry B* 2006;110:13670–7. <https://doi.org/10.1021/jp0618680>.
- [17] Epure V, Griffon M, Pollet E, Avérous L. Structure and properties of glycerol-plasticized chitosan obtained by mechanical kneading. *Carbohydr Polym* 2011;83:947–52.

- <https://doi.org/10.1016/j.carbpol.2010.09.003>.
- [18] Tan HW, Abdul Aziz AR, Aroua MK. Glycerol production and its applications as a raw material: A review. *Renewable and Sustainable Energy Reviews* 2013;27:118–27. <https://doi.org/10.1016/j.rser.2013.06.035>.
- [19] Santibáñez C, Teresa Varnero M, Bustamante M. RESIDUAL GLYCEROL FROM BIODIESEL MANUFACTURING, WASTE OR POTENTIAL SOURCE OF BIOENERGY: A REVIEW. vol. 71. n.d.
- [20] Viana MB, Freitas A V., Leitão RC, Pinto GAS, Santaella ST. Anaerobic digestion of crude glycerol: a review. *Environmental Technology Reviews* 2012;1:81–92. <https://doi.org/10.1080/09593330.2012.692723>.
- [21] Figure 2. Bench top microwave reactor for open vessel organic synthesis. TABLE 1. CONVERSION OF POLYGLYCEROL AND THEIR OLIGOMERS Polyglycerol oligomer A B C D E (%) (%) (%) (%) (%) TABLE 2. COMPOSITION OF PREPARED POLYGLYCEROL COMPARED WITH THAT OF A COMMERCIAL PRODUCT Oligomer Prepared polyglycerol Commercial polyglycerol (%) (unbleached) (%). n.d.
- [22] Nomanbhay S, Hussein R, Ong MY. Sustainability of biodiesel production in Malaysia by production of bio-oil from crude glycerol using microwave pyrolysis: A review. *Green Chem Lett Rev* 2018;11:135–57. <https://doi.org/10.1080/17518253.2018.1444795>.
- [23] Kaur J, Sarma AK, Jha MK, Gera P. Valorisation of crude glycerol to value-added products: Perspectives of process technology, economics and environmental issues. *Biotechnology Reports* 2020;27. <https://doi.org/10.1016/j.btre.2020.e00487>.
- [24] Behr A, Eilting J, Irawadi K, Leschinski J, Lindner F. Improved utilisation of renewable resources: New important derivatives of glycerol. *Green Chemistry* 2008;10:13–30. <https://doi.org/10.1039/b710561d>.
- [25] Kosamia NM, Samavi M, Uprety BK, Rakshit SK. Valorization of biodiesel byproduct

- crude glycerol for the production of bioenergy and biochemicals. *Catalysts* 2020;10.
<https://doi.org/10.3390/catal10060609>.
- [26] Chong CC, Aqsha A, Ayoub M, Sajid M, Abdullah AZ, Yusup S, et al. A review over the role of catalysts for selective short-chain polyglycerol production from biodiesel derived waste glycerol. *Environ Technol Innov* 2020;19.
<https://doi.org/10.1016/j.eti.2020.100859>.
- [27] Nda-Umar UI, Ramli I, Taufiq-Yap YH, Muhamad EN. An overview of recent research in the conversion of glycerol into biofuels, fuel additives and other bio-based chemicals. *Catalysts* 2019;9. <https://doi.org/10.3390/catal9010015>.
- [28] Liu L, Ye XP, Bozell JJ. A comparative review of petroleum-based and bio-based acrolein production. *ChemSusChem* 2012;5:1162–80. <https://doi.org/10.1002/cssc.201100447>.
- [29] Chai SH, Wang HP, Liang Y, Xu BQ. Sustainable production of acrolein: Investigation of solid acid–base catalysts for gas-phase dehydration of glycerol. *Green Chemistry* 2007;9:1130–6. <https://doi.org/10.1039/b702200j>.
- [30] Painter RM, Pearson DM, Waymouth RM. Selective catalytic oxidation of glycerol to dihydroxyacetone. *Angewandte Chemie - International Edition* 2010;49:9456–9. <https://doi.org/10.1002/anie.201004063>.
- [31] Hu W, Knight D, Lowry B, Varma A. Selective oxidation of glycerol to dihydroxyacetone over Pt-Bi/C catalyst: Optimization of catalyst and reaction conditions. *Ind Eng Chem Res*, vol. 49, 2010, p. 10876–82. <https://doi.org/10.1021/ie1005096>.
- [32] Viswanadham N, Saxena SK. Etherification of glycerol for improved production of oxygenates. *Fuel*, vol. 103, 2013, p. 980–6. <https://doi.org/10.1016/j.fuel.2012.06.057>.
- [33] Pinto BP, De Lyra JT, Nascimento JAC, Mota CJA. Ethers of glycerol and ethanol as bioadditives for biodiesel. *Fuel* 2016;168:76–80.
<https://doi.org/10.1016/j.fuel.2015.11.052>.

- [34] Roslan NA, Abidin SZ, Ideris A, Vo DVN. A review on glycerol reforming processes over Ni-based catalyst for hydrogen and syngas productions. *Int J Hydrogen Energy* 2020;45:18466–89. <https://doi.org/10.1016/j.ijhydene.2019.08.211>.
- [35] Pirzadi Z, Meshkani F, Vo DVN. Enhanced Biomass-Derived Glycerol Conversion to Syngas in the CO₂ Reforming Process: Influence of the Nickel Loading Method on Physicochemical Properties and Catalytic Performance. *Energy and Fuels* 2024;38:5248–62. <https://doi.org/10.1021/acs.energyfuels.3c04762>.
- [36] Ben ZY, Samsudin H, Yhaya MF. Glycerol: Its properties, polymer synthesis, and applications in starch based films. *Eur Polym J* 2022;175. <https://doi.org/10.1016/j.eurpolymj.2022.111377>.
- [37] Ebadipour N, Paul S, Katryniok B, Dumeignil F. Alkaline-based catalysts for glycerol polymerization reaction: A review. *Catalysts* 2020;10:1–22. <https://doi.org/10.3390/catal10091021>.
- [38] Ferreira P, Fonseca IM, Ramos AM, Vital J, Castanheiro JE. Esterification of glycerol with acetic acid over dodecamolybdophosphoric acid encaged in USY zeolite. *Catal Commun* 2009;10:481–4. <https://doi.org/10.1016/j.catcom.2008.10.015>.
- [39] Patel A, Singh S. A green and sustainable approach for esterification of glycerol using 12-tungstophosphoric acid anchored to different supports: Kinetics and effect of support. *Fuel* 2014;118:358–64. <https://doi.org/10.1016/j.fuel.2013.11.005>.
- [40] Yin AY, Guo XY, Dai WL, Fan KN. The synthesis of propylene glycol and ethylene glycol from glycerol using Raney Ni as a versatile catalyst. *Green Chemistry* 2009;11:1514–6. <https://doi.org/10.1039/b913395j>.
- [41] Kim YC, Moon DJ. Sustainable Process for the Synthesis of Value-Added Products Using Glycerol as a Useful Raw Material. *Catalysis Surveys from Asia* 2019;23:10–22. <https://doi.org/10.1007/s10563-018-09263-z>.

- [42] Freitas IC, Manfro RL, Souza MMVM. Hydrogenolysis of glycerol to propylene glycol in continuous system without hydrogen addition over Cu-Ni catalysts. *Appl Catal B* 2018;220:31–41. <https://doi.org/10.1016/j.apcatb.2017.08.030>.
- [43] Chaminand J, Djakovitch LA, Gallezot P, Marion P, Pinel C, Rosier C. Glycerol hydrogenolysis on heterogeneous catalysts. *Green Chemistry* 2004;6:359–61. <https://doi.org/10.1039/b407378a>.
- [44] Santacesaria E, Vitiello R, Tesser R, Russo V, Turco R, Di Serio M. Chemical and technical aspects of the synthesis of chlorohydrins from glycerol. *Ind Eng Chem Res* 2014;53:8939–62. <https://doi.org/10.1021/ie403268b>.
- [45] Santacesaria E, Tesser R, Serio M Di, Casale L, Verde D. New process for producing epichlorohydrin via glycerol chlorination. *Ind Eng Chem Res*, vol. 49, 2010, p. 964–70. <https://doi.org/10.1021/ie900650x>.
- [46] Miao Z, Li Z, Liang M, Meng J, Zhao Y, Xu L, et al. Ordered mesoporous titanium phosphate material: A highly efficient, robust and reusable solid acid catalyst for acetalization of glycerol. *Chemical Engineering Journal* 2020;381. <https://doi.org/10.1016/j.cej.2019.122594>.
- [47] Zahid I, Ayoub M, Abdullah BB, Nazir MH, Ameen M, Zulqarnain, et al. Production of Fuel Additive Solketal via Catalytic Conversion of Biodiesel-Derived Glycerol. *Ind Eng Chem Res* 2020;59:20961–78. <https://doi.org/10.1021/acs.iecr.0c04123>.
- [48] Vannucci JA, Nichio NN, Pompeo F. Solketal synthesis from ketalization of glycerol with acetone: A kinetic study over a sulfated zirconia catalyst. *Catal Today* 2021;372:238–45. <https://doi.org/10.1016/j.cattod.2020.10.005>.
- [49] Roy T, Sahani S, Chandra Sharma Y. Study on kinetics-thermodynamics and environmental parameter of biodiesel production from waste cooking oil and castor oil using potassium modified ceria oxide catalyst. *J Clean Prod* 2020;247.

- <https://doi.org/10.1016/j.jclepro.2019.119166>.
- [50] Kulkarni RM, Arvind N. Acetalization of glycerol and benzaldehyde to synthesize biofuel additives using $\text{SO}_4^{2-}/\text{CeO}_2\text{-ZrO}_2$ catalyst. *Heliyon* 2021;7. <https://doi.org/10.1016/j.heliyon.2021.e06018>.
- [51] Sudarsanam P, Mallesham B, Prasad AN, Reddy PS, Reddy BM. Synthesis of bio-additive fuels from acetalization of glycerol with benzaldehyde over molybdenum promoted green solid acid catalysts. *Fuel Processing Technology* 2013;106:539–45. <https://doi.org/10.1016/j.fuproc.2012.09.025>.
- [52] Pinheiro ALG, do Carmo JVC, Carvalho DC, Oliveira AC, Rodríguez-Castellón E, Tehuacanero-Cuapa S, et al. Bio-additive fuels from glycerol acetalization over metals-containing vanadium oxide nanotubes ($\text{MeVO}_x\text{-NT}$ in which, $\text{Me} = \text{Ni, Co, or Pt}$). *Fuel Processing Technology* 2019;184:45–56. <https://doi.org/10.1016/j.fuproc.2018.11.008>.
- [53] Zahid I, Ayoub M, Abdullah B Bin, Nazir MH, Zulqarnain, Kaimkhani MA, et al. Activation of nano kaolin clay for bio-glycerol conversion to a valuable fuel additive. *Sustainability (Switzerland)* 2021;13:1–17. <https://doi.org/10.3390/su13052631>.
- [54] Hussein H, Aprile C, Devillers M. Wet-impregnated niobosilicate catalysts for glycerol conversion into solketal. *Appl Catal A Gen* 2023;667. <https://doi.org/10.1016/j.apcata.2023.119444>.
- [55] da Silva MJ, Rodrigues AA, Pinheiro PF. Solketal synthesis from glycerol and acetone in the presence of metal salts: A Lewis or Brønsted acid catalyzed reaction? *Fuel* 2020;276. <https://doi.org/10.1016/j.fuel.2020.118164>.
- [56] Umbarkar SB, Kotbagi T V., Biradar A V., Pasricha R, Chanale J, Dongare MK, et al. Acetalization of glycerol using mesoporous $\text{MoO}_3/\text{SiO}_2$ solid acid catalyst. *J Mol Catal A Chem* 2009;310:150–8. <https://doi.org/10.1016/j.molcata.2009.06.010>.
- [57] Laskar IB, Rajkumari K, Gupta R, Rokhum L. Acid-Functionalized Mesoporous

- Polymer-Catalyzed Acetalization of Glycerol to Solketal, a Potential Fuel Additive under Solvent-Free Conditions. *Energy and Fuels* 2018;32:12567–76. <https://doi.org/10.1021/acs.energyfuels.8b02948>.
- [58] Mallesham B, Sudarsanam P, Reddy BM. Eco-friendly synthesis of bio-additive fuels from renewable glycerol using nanocrystalline SnO₂-based solid acids. *Catal Sci Technol* 2014;4:803–13. <https://doi.org/10.1039/c3cy00825h>.
- [59] Fatimah I, Sahroni I, Fadillah G, Musawwa MM, Mahlia TMI, Muraza O. Glycerol to solketal for fuel additive: Recent progress in heterogeneous catalysts. *Energies (Basel)* 2019;12. <https://doi.org/10.3390/en12152872>.
- [60] Khayoon MS, Hameed BH. Solventless acetalization of glycerol with acetone to fuel oxygenates over Ni-Zr supported on mesoporous activated carbon catalyst. *Appl Catal A Gen* 2013;464–465:191–9. <https://doi.org/10.1016/j.apcata.2013.05.035>.
- [61] Mallesham B, Sudarsanam P, Raju G, Reddy BM. Design of highly efficient Mo and W-promoted SnO₂ solid acids for heterogeneous catalysis: Acetalization of bio-glycerol. *Green Chemistry* 2013;15:478–89. <https://doi.org/10.1039/c2gc36152c>.
- [62] Rossa V, Pessanha YDSP, Díaz GC, Câmara LDT, Pergher SBC, Aranda DAG. Reaction kinetic study of solketal production from glycerol ketalization with acetone. *Ind Eng Chem Res* 2017;56:479–88. <https://doi.org/10.1021/acs.iecr.6b03581>.
- [63] Ciriminna R, Pina C Della, Rossi M, Pagliaro M. Understanding the glycerol market. *European Journal of Lipid Science and Technology* 2014;116:1432–9. <https://doi.org/10.1002/ejlt.201400229>.
- [64] Tyson KS, Bozell J, Wallace R, Petersen E, Moens L. *Biomass Oil Analysis: Research Needs and Recommendations*. 2010.
- [65] Frondel M, Peters J. Biodiesel: A new Oildorado? *Energy Policy* 2007;35:1675–84. <https://doi.org/10.1016/j.enpol.2006.04.022>.

- [66] da Silva César A, Otávio Batalha M. Biodiesel production from castor oil in Brazil: A difficult reality. *Energy Policy* 2010;38:4031–9. <https://doi.org/10.1016/j.enpol.2010.03.027>.
- [67] Peters J, Thielmann S. Promoting biofuels: Implications for developing countries. *Energy Policy* 2008;36:1538–44. <https://doi.org/10.1016/j.enpol.2008.01.013>.
- [68] Aprialdi F, Mujahidin D, Kadja GTM. Glycerol Transformation over Zeolite-Based Catalysts into Diverse Valuable Chemicals: A review. *Waste Biomass Valorization* 2024. <https://doi.org/10.1007/s12649-024-02487-3>.
- [69] Sandid A, Spallina V, Esteban J. Glycerol to value-added chemicals: State of the art and advances in reaction engineering and kinetic modelling. *Fuel Processing Technology* 2024;253. <https://doi.org/10.1016/j.fuproc.2023.108008>.
- [70] Ghosh A, Singha A, Auroux A, Das A, Sen D, Chowdhury B. A green approach for the preparation of a surfactant embedded sulfonated carbon catalyst towards glycerol acetalization reactions. *Catal Sci Technol* 2020;10:4827–44. <https://doi.org/10.1039/d0cy00336k>.
- [71] da Silva MJ, Rodrigues AA, Pinheiro PF. Solketal synthesis from glycerol and acetone in the presence of metal salts: A Lewis or Brønsted acid catalyzed reaction? *Fuel* 2020;276. <https://doi.org/10.1016/j.fuel.2020.118164>.
- [72] Hidalgo-Carrillo J, Estévez-Toledano RC, López-Tenllado FJ, Bautista FM, Urbano FJ, Marinas A. Fourth generation synthesis of solketal by glycerol acetalization with acetone: A solar-light photocatalytic approach. *J Taiwan Inst Chem Eng* 2021;125:297–303. <https://doi.org/10.1016/j.jtice.2021.06.035>.
- [73] Timofeeva MN, Panchenko VN, Krupskaya V V., Gil A, Vicente MA. Effect of nitric acid modification of montmorillonite clay on synthesis of solketal from glycerol and acetone. *Catal Commun* 2017;90:65–9. <https://doi.org/10.1016/j.catcom.2016.11.020>.

- [74] Cornejo A, Campoy M, Barrio I, Navarrete B, Lázaro J. Solketal production in a solvent-free continuous flow process: Scaling from laboratory to bench size. *React Chem Eng* 2019;4:1803–13. <https://doi.org/10.1039/c9re00083f>.
- [75] Vivian A, Soumoy L, Fusaro L, Fiorilli S, Debecker DP, Aprile C. Surface-functionalized mesoporous gallosilicate catalysts for the efficient and sustainable upgrading of glycerol to solketal. *Green Chemistry* 2021;23:354–66. <https://doi.org/10.1039/d0gc02562c>.
- [76] Li X, Jiang Y, Zhou R, Hou Z. Layered α -zirconium phosphate: An efficient catalyst for the synthesis of solketal from glycerol. *Appl Clay Sci* 2019;174:120–6. <https://doi.org/10.1016/j.clay.2019.03.034>.
- [77] Menezes FDL, Guimaraes MDO, Da Silva MJ. Highly selective SnCl_2 -catalyzed solketal synthesis at room temperature. *Ind Eng Chem Res* 2013;52:16709–13. <https://doi.org/10.1021/ie402240j>.
- [78] Gui Z, Zahrtmann N, Saravanamurugan S, Reyero I, Qi Z, Bañares MA, et al. Brønsted Acid Ionic Liquids (BAILs) as Efficient and Recyclable Catalysts in the Conversion of Glycerol to Solketal at Room Temperature. *ChemistrySelect* 2016;1:5869–73. <https://doi.org/10.1002/slct.201601600>.
- [79] Da Silva MJ, Julio AA, Dorigetto FCS. Solvent-free heteropolyacid-catalyzed glycerol ketalization at room temperature. *RSC Adv* 2015;5:44499–506. <https://doi.org/10.1039/c4ra17090c>.
- [80] Li X, Zheng L, Hou Z. Acetalization of glycerol with acetone over $\text{Co[II](Co[III]}_x\text{Al}_{2-x}\text{O}_4$ derived from layered double hydroxide. *Fuel* 2018;233:565–71. <https://doi.org/10.1016/j.fuel.2018.06.096>.
- [81] Gonçalves M, Rodrigues R, Galhardo TS, Carvalho WA. Highly selective acetalization of glycerol with acetone to solketal over acidic carbon-based catalysts from biodiesel waste. *Fuel* 2016;181:46–54. <https://doi.org/10.1016/j.fuel.2016.04.083>.

- [82] Saikia K, Rajkumari K, Moyon NS, Basumatary S, Halder G, Rashid U, et al. Sulphonated biomass-based catalyst for solketal synthesis by acetalization of glycerol – A byproduct of biodiesel production. *Fuel Processing Technology* 2022;238. <https://doi.org/10.1016/j.fuproc.2022.107482>.
- [83] Ao S, Alghamdi LA, Kress T, Selvaraj M, Halder G, Wheatley AEH, et al. Microwave-assisted valorization of glycerol to solketal using biomass-derived heterogeneous catalyst. *Fuel* 2023;345. <https://doi.org/10.1016/j.fuel.2023.128190>.
- [84] Wang L, Du X, Zhang D, Hu T, Ren D, Huo Z. Recent Progress in Solketal Synthesis from Glycerol and Acetone. *ChemistrySelect* 2024;9. <https://doi.org/10.1002/slct.202400111>.
- [85] Ammaji S, Rao GS, Chary KVR. Acetalization of glycerol with acetone over various metal-modified SBA-15 catalysts. *Appl Petrochem Res* 2018;8:107–18. <https://doi.org/10.1007/s13203-018-0197-6>.
- [86] Reddy BM, Sreekanth PM, Lakshmanan P, Khan A. Synthesis, characterization and activity study of SO₄²⁻/CexZr1-xO₂ solid superacid catalyst. *J Mol Catal A Chem* 2006;244:1–7. <https://doi.org/10.1016/j.molcata.2005.08.054>.
- [87] Kulkarni RM, Arvind N. Acetalization of glycerol and benzaldehyde to synthesize biofuel additives using SO₄²⁻/CeO₂-ZrO₂ catalyst. *Heliyon* 2021;7. <https://doi.org/10.1016/j.heliyon.2021.e06018>.
- [88] Reddy BM, Sreekanth PM, Yamada Y, Kobayashi T. Surface characterization and catalytic activity of sulfate-, molybdate- and tungstate-promoted Al₂O₃-ZrO₂ solid acid catalysts. *J Mol Catal A Chem* 2005;227:81–9. <https://doi.org/10.1016/j.molcata.2004.10.011>.
- [89] Taavoni-Gilan A, Taheri-Nassaj E, Akhondi H. The effect of zirconia content on properties of Al₂O₃-ZrO₂ (Y₂O₃) composite nanopowders synthesized by aqueous sol-

- gel method. *J Non Cryst Solids* 2009;355:311–6.
<https://doi.org/10.1016/j.jnoncrysol.2008.11.012>.
- [90] Nayebzadeh H, Saghatoleslami N, Tabasizadeh M. Application of microwave irradiation for fabrication of sulfated ZrO₂–Al₂O₃ nanocomposite via combustion method for esterification reaction: process condition evaluation. *J Nanostructure Chem* 2019;9:141–52. <https://doi.org/10.1007/s40097-019-0304-y>.
- [91] Kurnia Amin A, Wijaya K, Trisunaryanti W. The Catalytic Performance of ZrO₂-SO₄ and Ni/ZrO₂-SO₄ Prepared from Commercial ZrO₂ in Hydrocracking of LDPE Plastic Waste into Liquid Fuels. *Oriental Journal of Chemistry* 2018;34:3070–8. <https://doi.org/10.13005/ojc/340650>.
- [92] Sudarsanam P, Baithy M, Mallesham B, Reddy PS, Reddy BM. Highly Promising Sulfate Ion Promoted M-ZrO₂ (M=Al₂O₃ and CeO₂) Heterogeneous Solid Acids for Biodiesel-Derived Glycerol Esterification CO₂ reforming View project Equilibrium and kinetic studies of synthesized ceria and nanostructured titania supported View project Highly Promising Sulfate Ion Promoted M-ZrO₂ (M=Al₂O₃ and CeO₂) Heterogeneous Solid Acids for Biodiesel-Derived Glycerol Esterification. vol. 2. 2013.
- [93] Shao Y, Li Y, Sun K, Zhang Z, Tian H, Gao G, et al. Sulfated Zirconia with Different Crystal Phases for the Production of Ethyl Levulinate and 5-Hydroxymethylfurfural. *Energy Technology* 2020;8. <https://doi.org/10.1002/ente.201900951>.
- [94] Marakatti VS, Marappa S, Gaigneaux EM. Sulfated zirconia: An efficient catalyst for the Friedel-Crafts monoalkylation of resorcinol with methyl tertiary butyl ether to 4-tertiary butylresorcinol. *New Journal of Chemistry* 2019;43:7733–42. <https://doi.org/10.1039/c9nj01311c>.
- [95] Liu E, Locke AJ, Frost RL, Martens WN. Sulfated fibrous ZrO₂/Al₂O₃ core and shell nanocomposites: A novel strong acid catalyst with hierarchically macro-mesoporous

- nanostructure. *J Mol Catal A Chem* 2012;353–354:95–105.
<https://doi.org/10.1016/j.molcata.2011.11.010>.
- [96] Miranda M CD, Ramírez S AE, Jurado SG, Vera CR. Superficial effects and catalytic activity of ZrO₂-SO₄²⁻ as a function of the crystal structure. *J Mol Catal A Chem* 2015;398:325–35. <https://doi.org/10.1016/j.molcata.2014.12.015>.
- [97] Chavez-Esquivel G, Garcia-Martinez JC, De Los Reyes JA, Suárez-Toriello VA, Vera-Ramirez MA, Huerta L. The influence of Al₂O₃ content on Al₂O₃-ZrO₂ composite-textural structural and morphological studies. *Mater Res Express* 2019;6. <https://doi.org/10.1088/2053-1591/ab352d>.
- [98] Ergu OB, Gürü M, Cabbar C. Preparation and characterization of alumina-zirconia composite material with different acid ratios by the sol-gel method. *Central European Journal of Chemistry* 2008;6:482–7. <https://doi.org/10.2478/s11532-008-0047-y>.
- [99] Crotti C, Farnetti E, Guidolin N. Alternative intermediates for glycerol valorization: Iridium-catalyzed formation of acetals and ketals. *Green Chemistry* 2010;12:2225–31. <https://doi.org/10.1039/c0gc00096e>.
- [100] Danish M, Umer Rashid T, Mai Sci CJ, Waseem Mumtaz M, Fakhar M, Rashid U. Response Surface Methodology: An Imperative Tool for the Optimized Purification of the Residual Glycerol from Biodiesel Production Process Performance Evaluation and Modification of Existing Indigenous Biomass Briquette Forming Machine View project DNA binding potential of sulfonamides and their metal complexes View project Response Surface Methodology based Optimized Purification of the Residual Glycerol from Biodiesel Production Process. vol. 43. 2016.
- [101] Rossa V, Chenard Díaz G, Juvenal Muchave G, Alexandre Gomes Aranda D, Berenice Castellã Pergher S. Production of Solketal Using Acid Zeolites as Catalysts. *Glycerine Production and Transformation - An Innovative Platform for Sustainable Biorefinery and*

- Energy, IntechOpen; 2019. <https://doi.org/10.5772/intechopen.85817>.
- [102] Ghosh A, Singha A, Auroux A, Das A, Sen D, Chowdhury B. A green approach for the preparation of a surfactant embedded sulfonated carbon catalyst towards glycerol acetalization reactions. *Catal Sci Technol* 2020;10:4827–44. <https://doi.org/10.1039/d0cy00336k>.
- [103] Saini B, Tathod AP, Saxena SK, Arumugam S, Viswanadham N. Sustainable Upgrade of Bioderived Glycerol to Solketal through Acetalization over Metal-Free Mordenite Catalysts. *ACS Sustain Chem Eng* 2022;10:1172–81. <https://doi.org/10.1021/acssuschemeng.1c06330>.
- [104] Zhang S, Zhao Z, Ao Y. Design of highly efficient Zn-, Cu-, Ni- and Co-promoted M-AlPO₄ solid acids: The acetalization of glycerol with acetone. *Appl Catal A Gen* 2015;496:32–9. <https://doi.org/10.1016/j.apcata.2015.02.006>.
- [105] Li X, Zheng L, Hou Z. Acetalization of glycerol with acetone over Co[II](Co[III]_xAl_{2-x})O₄ derived from layered double hydroxide. *Fuel* 2018;233:565–71. <https://doi.org/10.1016/j.fuel.2018.06.096>.
- [106] Laskar IB, Rajkumari K, Gupta R, Rokhum L. Acid-Functionalized Mesoporous Polymer-Catalyzed Acetalization of Glycerol to Solketal, a Potential Fuel Additive under Solvent-Free Conditions. *Energy and Fuels* 2018;32:12567–76. <https://doi.org/10.1021/acs.energyfuels.8b02948>.
- [107] Roy T, Sahani S, Madhu D, Chandra Sharma Y. A clean approach of biodiesel production from waste cooking oil by using single phase BaSnO₃ as solid base catalyst: Mechanism, kinetics & E-study. *J Clean Prod* 2020;265. <https://doi.org/10.1016/j.jclepro.2020.121440>.
- [108] Vannucci JA, Nichio NN, Pompeo F. Solketal synthesis from ketalization of glycerol with acetone: A kinetic study over a sulfated zirconia catalyst. *Catal Today* 2021;372:238–45.

- <https://doi.org/10.1016/j.cattod.2020.10.005>.
- [109] Li X, Jiang Y, Zhou R, Hou Z. Layered α -zirconium phosphate: An efficient catalyst for the synthesis of solketal from glycerol. *Appl Clay Sci* 2019;174:120–6. <https://doi.org/10.1016/j.clay.2019.03.034>.
- [110] Li L, Korányi TI, Sels BF, Pescarmona PP. Highly-efficient conversion of glycerol to solketal over heterogeneous Lewis acid catalysts. *Green Chemistry* 2012;14:1611–9. <https://doi.org/10.1039/c2gc16619d>.
- [111] Manjunathan P, Maradur SP, Halgeri AB, Shanbhag G V. Room temperature synthesis of solketal from acetalization of glycerol with acetone: Effect of crystallite size and the role of acidity of beta zeolite. *J Mol Catal A Chem* 2015;396:47–54. <https://doi.org/10.1016/j.molcata.2014.09.028>.
- [112] Timofeeva MN, Panchenko VN, Krupskaya V V., Gil A, Vicente MA. Effect of nitric acid modification of montmorillonite clay on synthesis of solketal from glycerol and acetone. *Catal Commun* 2017;90:65–9. <https://doi.org/10.1016/j.catcom.2016.11.020>.
- [113] Kowalska-Kuś J, Held A, Nowińska K. A continuous-flow process for the acetalization of crude glycerol with acetone on zeolite catalysts. *Chemical Engineering Journal* 2020;401. <https://doi.org/10.1016/j.cej.2020.126143>.
- [114] Umbarkar SB, Kotbagi T V., Biradar A V., Pasricha R, Chanale J, Dongare MK, et al. Acetalization of glycerol using mesoporous MoO₃/SiO₂ solid acid catalyst. *J Mol Catal A Chem* 2009;310:150–8. <https://doi.org/10.1016/j.molcata.2009.06.010>.
- [115] Huang Y, Zhang G, Zhang Q. Preparation of the WOX/MCM-41 Solid Acid Catalyst and the Catalytic Performance for Solketal Synthesis. *ACS Omega* 2021;6:3875–83. <https://doi.org/10.1021/acsomega.0c05671>.
- [116] da Silva MJ, Rodrigues AA, Pinheiro PF. Solketal synthesis from glycerol and acetone in the presence of metal salts: A Lewis or Brønsted acid catalyzed reaction? *Fuel* 2020;276.

<https://doi.org/10.1016/j.fuel.2020.118164>.

- [117] Huang Z, Lin Y, Li L, Ye C, Qiu T. Preparation and shaping of solid acid SO₄²⁻/TiO₂ and its application for esterification of propylene glycol monomethyl ether and acetic acid. *Chin J Chem Eng* 2017;25:1207–16. <https://doi.org/10.1016/j.cjche.2016.11.006>.
- [118] Zayat M, Levy D. Blue CoAl₂O₄ particles prepared by the sol-gel and citrate-gel methods. *Chemistry of Materials* 2000;12:2763–9. <https://doi.org/10.1021/cm001061z>.
- [119] Azmoon AH, Ahmadpour A, Nayebzadeh H, Saghatoleslami N, Heydari A. Fabrication of nanosized SO₄²⁻/Co–Al mixed oxide via solution combustion method used in esterification reaction: effect of urea-nitrate ratio on the properties and performance. *J Nanostructure Chem* 2019;9:247–58. <https://doi.org/10.1007/s40097-019-00315-y>.
- [120] Wijaya K, Putri AR, Sudiono S, Mulijani S, Patah A, Wibowo AC, et al. Effectively synthesizing so₄/tio₂ catalyst and its performance for converting ethanol into diethyl ether (Dee). *Catalysts* 2021;11. <https://doi.org/10.3390/catal11121492>.
- [121] Gingasu D, Mindru I, Culita DC, Marinescu G, Somacescu S, Ianculescu A, et al. Mentha piperita-mediated synthesis of cobalt aluminate nanoparticles and their photocatalytic activity. *Journal of Materials Science: Materials in Electronics* 2021;32:11220–31. <https://doi.org/10.1007/s10854-021-05791-z>.
- [122] Chen C, Cai L, Shanguan X, Li L, Hong Y, Wu G. Heterogeneous and efficient transesterification of *Jatropha curcas* L. seed oil to produce biodiesel catalysed by nano-sized SO₄²⁻/TiO₂. *R Soc Open Sci* 2018;5. <https://doi.org/10.1098/rsos.181331>.
- [123] Mohamed RM, Zaki ZI. CoAl₂O₄–TiO₂ nanocomposite photocatalyst for effective destruction of herbicide imazapyr under visible light. *Applied Nanoscience (Switzerland)* 2021;11:1009–19. <https://doi.org/10.1007/s13204-020-01644-z>.
- [124] Basaleh A, Mahmoud MHH. CoAl₂O₄-g-C₃N₄ Nanocomposite Photocatalysts for Powerful Visible-Light-Driven Hydrogen Production. *ACS Omega* 2021;6:10428–36.

- <https://doi.org/10.1021/acsomega.1c00872>.
- [125] Guo S, Zhang L, Chen M, Ahmad F, Fida H, Zhang H. Heterogeneous Activation of Peroxymonosulfate by a Spinel CoAl_2O_4 Catalyst for the Degradation of Organic Pollutants. *Catalysts* 2022;12. <https://doi.org/10.3390/catal12080847>.
- [126] Pang D, Qiu L, Zhu R, Ouyang F. Silica supported $\text{SO}_4^{2-}/\text{TiO}_2$ for photocatalytic decomposition of acrylonitrile under simulant solar light irradiation. *Chemical Engineering Journal* 2015;270:590–6. <https://doi.org/10.1016/j.cej.2015.02.055>.
- [127] Wang AQ, Wang JX, Wang H, Huang YN, Xu ML, Wu XL. Synthesis of $\text{SO}_4^{2-}/\text{TiO}_2\text{-ZnAl}_2\text{O}_4$ composite solid acids as the esterification catalysts. *RSC Adv* 2017;7:14224–32. <https://doi.org/10.1039/c7ra01386h>.
- [128] Ghosh A, Singha A, Auroux A, Das A, Sen D, Chowdhury B. A green approach for the preparation of a surfactant embedded sulfonated carbon catalyst towards glycerol acetalization reactions. *Catal Sci Technol* 2020;10:4827–44. <https://doi.org/10.1039/d0cy00336k>.
- [129] Jiang Y, Zhou R, Ye B, Hou Z. Acetalization of glycerol over sulfated UiO-66 under mild condition. *Journal of Industrial and Engineering Chemistry* 2022;110:357–66. <https://doi.org/10.1016/j.jiec.2022.03.008>.
- [130] Crotti C, Farnetti E, Guidolin N. Alternative intermediates for glycerol valorization: Iridium-catalyzed formation of acetals and ketals. *Green Chemistry* 2010;12:2225–31. <https://doi.org/10.1039/c0gc00096e>.
- [131] Huang Y, Zhang G, Zhang Q. Preparation of the $\text{WOX}/\text{MCM-41}$ Solid Acid Catalyst and the Catalytic Performance for Solketal Synthesis. *ACS Omega* 2021;6:3875–83. <https://doi.org/10.1021/acsomega.0c05671>.
- [132] Zhang S, Zhao Z, Ao Y. Design of highly efficient Zn-, Cu-, Ni- and Co-promoted M-ALPO_4 solid acids: The acetalization of glycerol with acetone. *Appl Catal A Gen*

- 2015;496:32–9. <https://doi.org/10.1016/j.apcata.2015.02.006>.
- [133] Priya SS, Selvakannan PR, Chary KVR, Kantam ML, Bhargava SK. Solvent-free microwave-assisted synthesis of solketal from glycerol using transition metal ions promoted mordenite solid acid catalysts. *Molecular Catalysis* 2017;434:184–93. <https://doi.org/10.1016/j.mcat.2017.03.001>.
- [134] Laskar IB, Rajkumari K, Gupta R, Rokhum L. Acid-Functionalized Mesoporous Polymer-Catalyzed Acetalization of Glycerol to Solketal, a Potential Fuel Additive under Solvent-Free Conditions. *Energy and Fuels* 2018;32:12567–76. <https://doi.org/10.1021/acs.energyfuels.8b02948>.
- [135] Jaiswal S, Sharma YC. Ni modified distillation waste derived heterogeneous catalyst utilized for the production of glycerol carbonate from a biodiesel by-product glycerol: Optimization and green metric studies. *Waste Management* 2023;156:148–58. <https://doi.org/10.1016/j.wasman.2022.11.003>.
- [136] Alali K, Lebsir F, Amri S, Rahmouni A, Srasra E, Besbes N. Algerian Acid Activated Clays as Efficient Catalysts for a Green Synthesis of Solketal by Chemoselective Acetalization of Glycerol with Acetone. *Bulletin of Chemical Reaction Engineering & Catalysis* 2019;14:130–41. <https://doi.org/10.9767/bcrec.14.1.2445.130>.
- [137] Kowalska-Kuś J, Held A, Nowińska K. A continuous-flow process for the acetalization of crude glycerol with acetone on zeolite catalysts. *Chemical Engineering Journal* 2020;401. <https://doi.org/10.1016/j.cej.2020.126143>.
- [138] Li X, Zheng L, Hou Z. Acetalization of glycerol with acetone over $\text{Co[II](Co[III]}_x\text{Al}_{2-x}\text{O}_4$ derived from layered double hydroxide. *Fuel* 2018;233:565–71. <https://doi.org/10.1016/j.fuel.2018.06.096>.
- [139] Gonzalez-Arellano C, Arancon RAD, Luque R. Al-SBA-15 catalysed cross-esterification and acetalisation of biomass-derived platform chemicals. *Green Chemistry*

- 2014;16:4985–93. <https://doi.org/10.1039/c4gc01105h>.
- [140] Ghosh A, Singha A, Auroux A, Das A, Sen D, Chowdhury B. A green approach for the preparation of a surfactant embedded sulfonated carbon catalyst towards glycerol acetalization reactions. *Catal Sci Technol* 2020;10:4827–44. <https://doi.org/10.1039/d0cy00336k>.
- [141] da Silva MJ, Rodrigues AA, Pinheiro PF. Solketal synthesis from glycerol and acetone in the presence of metal salts: A Lewis or Brønsted acid catalyzed reaction? *Fuel* 2020;276. <https://doi.org/10.1016/j.fuel.2020.118164>.
- [142] Da Silva MJ, Julio AA, Dorigetto FCS. Solvent-free heteropolyacid-catalyzed glycerol ketalization at room temperature. *RSC Adv* 2015;5:44499–506. <https://doi.org/10.1039/c4ra17090c>.
- [143] Hua W, Xia Y, Yue Y, Gao Z. Promoting Effect of Al on SO₂-4/MxO_y (M=Zr, Ti, Fe) Catalysts. *J Catal* 2000;196:104–14. <https://doi.org/10.1006/jcat.2000.3032>.
- [144] Dosuna-Rodríguez I, Adriany C, Gaigneaux EM. Glycerol acetylation on sulphated zirconia in mild conditions. *Catal Today*, vol. 167, 2011, p. 56–63. <https://doi.org/10.1016/j.cattod.2010.11.057>.
- [145] Saravanan K, Tyagi B, Shukla RS, Bajaj HC. Esterification of palmitic acid with methanol over template-assisted mesoporous sulfated zirconia solid acid catalyst. *Appl Catal B* 2015;172–173:108–15. <https://doi.org/10.1016/j.apcatb.2015.02.014>.
- [146] Wijaya K, Putri AR, Sudiono S, Mulijani S, Patah A, Wibowo AC, et al. Effectively synthesizing so₄/tio₂ catalyst and its performance for converting ethanol into diethyl ether (Dee). *Catalysts* 2021;11. <https://doi.org/10.3390/catal11121492>.
- [147] Wang J, Wang A, Tian X, Wang H, Xu M, Yang L. Development of palygorskite-SO₄²⁻/ZnAl₂O₄ composites as a novel solid acid catalyst for the esterification of acetic acid with n-butanol. *Appl Clay Sci* 2017;135:596–602.

- <https://doi.org/10.1016/j.clay.2016.11.001>.
- [148] Wang A, Wang J, Lu C, Xu M, Lv J, Wu X. Esterification for biofuel synthesis over an eco-friendly and efficient kaolinite-supported $\text{SO}_4^{2-}/\text{ZnAl}_2\text{O}_4$ macroporous solid acid catalyst. *Fuel* 2018;234:430–40. <https://doi.org/10.1016/j.fuel.2018.07.041>.
- [149] Kumar A, Priyanka, Mangalam J, Yadav V, Goswami T. Synthesis of sulfated zirconia catalyst using sol–gel technique for alkane isomerization. *Reaction Kinetics, Mechanisms and Catalysis* 2022;135:1929–44. <https://doi.org/10.1007/s11144-022-02254-2>.
- [150] Wang AQ, Wang JX, Wang H, Huang YN, Xu ML, Wu XL. Synthesis of $\text{SO}_4^{2-}/\text{TiO}_2\text{-ZnAl}_2\text{O}_4$ composite solid acids as the esterification catalysts. *RSC Adv* 2017;7:14224–32. <https://doi.org/10.1039/c7ra01386h>.
- [151] Pradhan G, Jaiswal S, Sharma YC. Exploring the promotional effect of transition metals (Cr and V) on the catalytic activity of MgO for glycerol carbonate synthesis. *Molecular Catalysis* 2022;526. <https://doi.org/10.1016/j.mcat.2022.112332>.
- [152] Huízar-Padilla E, Guillén-Bonilla H, Guillén-Bonilla A, Rodríguez-Betancourt VM, Sánchez-Martínez A, Guillen-Bonilla JT, et al. Synthesis of ZnAl_2O_4 and evaluation of the response in propane atmospheres of pellets and thick films manufactured with powders of the oxide. *Sensors* 2021;21. <https://doi.org/10.3390/s21072362>.
- [153] Wang J, Wang A, Liao Y, Shi L, Yang L. Development of $\text{SO}_4^{2-}/\text{ZnAl}_2\text{O}_4\text{-ZrO}_2$ composite solid acids for efficient synthesis of green biofuels via the typical esterification reaction of oleic acid with methanol. *Reaction Kinetics, Mechanisms and Catalysis* 2023;136:2123–45. <https://doi.org/10.1007/s11144-023-02439-3>.
- [154] Yan P, Wang H, Liao Y, Wang C. Synthesis of renewable diesel and jet fuels from bio-based furanics via hydroxyalkylation/alkylation (HAA) over $\text{SO}_4^{2-}/\text{TiO}_2$ and hydrodeoxygenation (HDO) reactions. *Fuel* 2023;342. <https://doi.org/10.1016/j.fuel.2023.127685>.

- [155] Hu J, Zhao W, Hu R, Chang G, Li C, Wang L. Catalytic activity of spinel oxides MgCr₂O₄ and CoCr₂O₄ for methane combustion. *Mater Res Bull* 2014;57:268–73. <https://doi.org/10.1016/j.materresbull.2014.06.001>.
- [156] Saikia K, Rajkumari K, Moyon NS, Basumatary S, Halder G, Rashid U, et al. Sulphonated biomass-based catalyst for solketal synthesis by acetalization of glycerol – A byproduct of biodiesel production. *Fuel Processing Technology* 2022;238. <https://doi.org/10.1016/j.fuproc.2022.107482>.
- [157] Ao S, Alghamdi LA, Kress T, Selvaraj M, Halder G, Wheatley AEH, et al. Microwave-assisted valorization of glycerol to solketal using biomass-derived heterogeneous catalyst. *Fuel* 2023;345. <https://doi.org/10.1016/j.fuel.2023.128190>.
- [158] Vannucci JA, Nichio NN, Pompeo F. Solketal synthesis from ketalization of glycerol with acetone: A kinetic study over a sulfated zirconia catalyst. *Catal Today* 2021;372:238–45. <https://doi.org/10.1016/j.cattod.2020.10.005>.
- [159] Roy T, Ágarwal AK, Sharma YC. A cleaner route of biodiesel production from waste frying oil using novel potassium tin oxide catalyst: A smart liquid-waste management. *Waste Management* 2021;135:243–55. <https://doi.org/10.1016/j.wasman.2021.08.046>.
- [160] Hidalgo-Carrillo J, Estévez-Toledano RC, López-Tenllado FJ, Bautista FM, Urbano FJ, Marinas A. Fourth generation synthesis of solketal by glycerol acetalization with acetone: A solar-light photocatalytic approach. *J Taiwan Inst Chem Eng* 2021;125:297–303. <https://doi.org/10.1016/j.jtice.2021.06.035>.
- [161] Kulkarni RM, Arvind N. Acetalization of glycerol and benzaldehyde to synthesize biofuel additives using SO₄²⁻/CeO₂–ZrO₂ catalyst. *Heliyon* 2021;7. <https://doi.org/10.1016/j.heliyon.2021.e06018>.

**LIST OF
PUBLICATIONS AND
CONFERENCES**

1. LIST OF PUBLICATIONS -

- I. **Maurya, Sunita**, and Yogesh Chandra Sharma. "Synthesis of oxygenated additive fuels from bio-renewable glycerol using sulfated Zr-Al based heterogeneous acid catalyst." *Fuel* 355 (2024): 129352.
- II. Jaiswal, Siddhi, **Sunita Maurya**, and Yogesh Chandra Sharma. "Studies on role of support metal in glycerol conversion to glycerol carbonate through Mg/MnO₂ and Mg/CuO heterogeneous catalyst." *Molecular Catalysis* 546 (2023): 113243.
- III. Pradhan, Gitanjali, **Sunita Maurya**, Subhalaxmi Pradhan, and Yogesh Chandra Sharma. "An accelerated route for synthesis of Glycerol carbonate using MgTiO₃ perovskite as greener and cheaper catalyst." *Molecular Catalysis* 545 (2023): 113162.
- IV. Maurya, **Sunita**, and Yogesh Chandra Sharma. "Synthesis and E-metric Studies of an Economically Viable Heterogeneous Acid Catalyst for Production and Upscaling of Solketal." *Energy & Fuels* (2024).
- V. **Maurya, Sunita**, and Yogesh Chandra Sharma. " A facile approach for the synthesis of solketal, a fuel additive from biowaste glycerol using transition metal-based solid acid catalyst. (Communicated).
- VI. **Maurya, Sunita**, and Yogesh Chandra Sharma. "An overview of valorization of biodiesel by-product waste-glycerol to value-added products: environmental and economic aspects. (Under Review).

2. LIST OF CONFERENCES PRESENTATIONS -

1. Indo-UK workshop on “Valorization of agri-waste for energy and Nutrient Recovery”. Organized by IIT BHU, Varanasi, India. 15-17 January 2020.
2. Participated in an international workshop on “supporting chemistry research with modern DFT: software, techniques, and applications” organized by Sankalchand Patel University, 5th -16th February 2021.
3. One-day workshop on Green and Sustainable Technologies Initiatives at IIT (BHU), 26 Nov 2022.
4. Participated in webinar Sublime Precursors: how modeling organometallics at surfaces drives Innovation in materials processing, 28 Oct 2021.
5. Presented poster in Synthesis of solketal fuel additive using bio-diesel waste through $\text{SO}_4^{2-}/\text{ZrO}_2\text{-Al}_2\text{O}_3$ catalyst” organized by Department of Applied Science & Humanities, Jamia Millia Islamia, New Delhi. 28-30 November 2022.
6. Presented poster in Emergent Materials for Energy and Environment (EMEE-2023)- IIT Roorkee poster presentation title- Synthesis of solketal fuel additive using bio-diesel byproduct glycerol through $\text{SO}_4^{2-}/\text{ZrO}_2\text{-Al}_2\text{O}_3$ catalyst. 04-05 March, 2023, Roorkee, India.
7. 2nd award for oral presentation in International Conference on “Waste Recycling & Environmental Technologies (WRET-2024)- Solventless solketal synthesis as an oxygenated fuel additive using sulfonated acid catalyst from biowaste glycerol: Optimization & E-metrics studies. BBAU Lucknow, India 8th -9th February 2024.
8. Presented poster at Global Conference for Women Leaders and Emerging Researchers in Material Science, NTU Singapore. 9-11th July 2024.

