



Abstract of the Thesis



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Title of the Thesis: Role of Nanoparticles for Production of Biodiesel

Abstract

It is an undeniable fact that the continuous decline of fossil fuels is depraved for the majority of us. It becomes critical to have other resources available. Biodiesel is a green fuel made using a 'transesterification' process that involves the use of oil (triglycerides) and methanol, as well as homogeneous or heterogeneous catalysts. In this study, Cobalt doped Zinc Oxide (CZO) nanoparticles are used for dual step esterification – transesterification processes, which have never been studied before for Karanja Oil, as well as a detailed analytical study using XRD, FESEM, BET, and EDAX on the catalyst, which has never been done before in the literature. The CZO particles are manufactured utilizing the co-precipitation process, which provides particles with a size of 75nm and includes the catalyst's reusability. The best process parameters were found by experimentation, and FTIR was used to analyze the composition of oil and biodiesel. The technical aspects of CZO synthesis, such as the benefits of easy glycerol separation and reduced impurities in the final product, make this process more commercially suitable for Karanja Oil Biodiesel synthesis, and the findings will encourage the use of CZO nanoparticles for other oil biodiesel production as well. Result shows that under optimized condition of transesterification, 1:25 M ratio of oil: methanol, 0.3 wt.% catalytic concentration, 70°C reaction temperature, 180 min time of reaction and 500 rpm of stirring speed FAME conversion was $98.5 \pm 0.5\%$. Thus, This PhD Thesis will help in production of biodiesel using alternate nonedible Karanja oil and Co doped ZnO nano catalysts.

Key Words: Biodiesel, Co doped ZnO, Transesterification, Nano catalyst

List of publications:

1. HN Pandya, SP Parikh, M Shah, [Comprehensive review on application of various nanoparticles for the production of biodiesel](https://doi.org/10.1080/15567036.2019.1648599), Energy Sources, Part A: Recovery, Utilization, and Environmental Effects, 1-14, <https://doi.org/10.1080/15567036.2019.1648599>
2. Hiral Pandya, Samidha Banka, Sachin Parikh, "Pongamia Pinnata Biodiesel Production Using Cobalt Doped ZnO Nanoparticles – An Analytical Study", Environmental Progress and Sustainable Energy, <https://doi.org/10.1002/ep.13814>
3. Hiral N. Pandya, Sachin P. Parikh, "Biodiesel Production using heterogeneous nanoparticles (Co doped ZnO) and Sunflower oil" International Conference on "Green Chemistry and Engineering towards Sustainable Development-An Industrial Perspective" June 16 - June 18, 2021 in virtual mode at Sardar Vallabhbhai National Institute of Technology, Surat, Gujarat, India. https://conferenceproceedings.international/?page_id=1251
4. Vachan Suthar, Hiral Pandya, Samidha Banka, L. D. College of Engineering, Sachin Parikh, that a patent has been granted to the patentee for an invention entitled BIODIESEL PREPARATION DEVICE AND METHOD USING CO DOPED ZNO CATALYST for the term of 20 years from the 12th day of October 2021 in accordance with the provisions of the Patents Act,1970.