

Accepted Manuscript

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PII: S0167-7322(17)33983-1
DOI: doi:[10.1016/j.molliq.2017.11.053](https://doi.org/10.1016/j.molliq.2017.11.053)
Reference: MOLLIQ 8169
To appear in: *Journal of Molecular Liquids*
Received date: 29 August 2017
Revised date: 3 November 2017
Accepted date: 7 November 2017

Please cite this article as: Anjuman Shaheen, Shazia Sultana, Houfang Lu, Mushtaq Ahmad, Maliha Asma, Tariq Mahmood , Assessing the potential of different nano-composite (MgO, Al₂O₃-CaO and TiO₂) for efficient conversion of Silybum eburneum seed oil to liquid biodiesel. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Molliq(2017), doi:[10.1016/j.molliq.2017.11.053](https://doi.org/10.1016/j.molliq.2017.11.053)

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Assessing the Potential of Different Nano- composite (MgO, Al₂O₃-CaO and TiO₂) for Efficient Conversion of *Silybum eburneum* Seed Oil to Liquid Biodiesel

Anjuman Shaheen¹, Shazia Sultana^{2,3}, Houfang Lu², Mushtaq Ahmad^{3,4,*}, Maliha Asma¹, and Tariq Mahmood⁵

¹ Department of Environmental Science, Female Campus, International Islamic University 44000, Islamabad, Pakistan

² Institute of New Energy and Low Carbon Technology, Sichuan University, Chengdu, China

³ Biodiesel Lab, Department of Plant Sciences, Quaid-i-Azam University, 45320, Islamabad, Pakistan

⁴ Centre of Natural Products Lab, Chengdu Institute of Biology, Sichuan, China

⁵ National Centre for Physics (NCP), Quaid-i-Azam University, Islamabad

* **Corresponding Author:** M.Ahmad (mushtaqflora@hotmail.com); Phone No: +28-13881710340

Abstract

This study investigated the potential of nano-composite MgO, Al₂O₃-CaO and TiO₂ for efficient conversion of novel non edible seed oil of *Silybum eburneum* into liquid biodiesel. *Silybum eburneum* contains oil contents (37.7%) and low free fatty acid (FAA) value (0.16 mg KOH/g). The synthesized heterogeneous nano- catalysts were characterized using X-Ray Diffraction (XRD), Fourier Transform Infrared Spectroscopy (FT-IR), Energy Dispersive X-Ray Spectroscopy (EDX) and Scanning Electron Microscopy (SEM) techniques. The highest conversion efficiency was achieved (91 % biodiesel yield) using MgO catalyst followed by Al₂O₃-CaO and TiO₂ at 0.1% catalysts loading. The optimized experimental variables comprised of molar ratio (1:3), temperature (70 °C), reaction time (3hrs.) and stirring rate (600 rpm) using reflux transesterification route. The XRD analysis showed the sizes of the crystal lattices with a sequence of 13nm for MgO, 29 nm for Al₂O₃-CaO and 37nm for TiO₂ which reveals that smaller the size of the crystal structure, higher will be the conversion efficiency. The SEM of MgO showed exclusively porous lamellar like smooth surface highly agglomerated with nano entities with a particle size of 50±10 nm length or width and about 20 nm thickness. SEM images of Al₂O₃-CaO nano-particles showed the size range from 27 nm to 75nm having irregular morphology including spherical as well as rod shape with smooth surface and different size. The

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