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**Jatropha Oil as a Non-Edible Feedstock for Biodiesel:
A Comprehensive Review**

Somnath Choubey

Department of Chemistry, Chunaram Gobinda Memorial Government College, Boro, Purulia-723131,

West Bengal, India

Email: somnathchoubey@gmail.com

Abstract: Biodiesel continues to attract attention as a renewable alternative to fossil diesel, helping reduce greenhouse-gas emissions and strengthen energy security. Among non-edible oilseeds, *Jatropha curcas* stands out because of its high seed-oil yield and capability to grow on degraded or marginal lands. This review summarizes recent progress in producing biodiesel from Jatropha oil, including oil extraction methods, transesterification processes (homogeneous, heterogeneous, enzymatic, and supercritical), and optimization strategies aimed at improving yield, cost, and scalability. A range of fuel characterization techniques used to assess biodiesel quality: key physicochemical properties (viscosity, density, cold-flow behavior), chemical purity (free fatty acids, moisture, glycerol), and performance metrics (cetane number, oxidative stability, emissions) have been examined. While Jatropha biodiesel shows considerable promise, several barriers remain notably feedstock supply stability, land-use and sustainability challenges, catalyst efficiency, and techno-economic feasibility. Addressing these issues through improved agronomy, advanced conversion technologies, and valorization of by-products will be essential to strengthen the role of Jatropha-based biodiesel in a sustainable energy portfolio.

Keywords: *Jatropha curcas*, Biodiesel, Transesterification, Fuel quality, Characterization, Renewable energy

*Corresponding author: S. Choubey

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1. Introduction

The growing concerns over climate change, depletion of petroleum reserves, and rising fuel demand have intensified global efforts to transition toward renewable energy sources [1]. Diesel fuel plays a central