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## Impact of biodiesel on engine performance and emission

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## ABSTRACT

The automobile sector mainly depends upon fossil fuels, and the combustion of these fuels contributes approximately 24% of global carbon dioxide (CO<sub>2</sub>) emissions. Biodiesel has properties similar to diesel and is considered a vital alternative to diesel. The advantages of biodiesel are its higher cetane number, better lubrication property and the presence of approximately 10% oxygen molecule which results in a reduced amount of carbon monoxide, hydrocarbons and smoke emissions compared to diesel operations. However, biodiesel exhibits a lower calorific value and higher viscosity, and resulting in lower brake thermal efficiency and higher brake specific energy consumption compared to diesel. This paper gives an outline of the significance of biodiesel as an alternative to diesel fuel. The article provides an overview of selection of various feedstock for biodiesel production, and their characterization with focus on their vital properties. The impact of biodiesel on engine performance and emissions, including challenges and future prospects, is also covered in this work.

## 1. Introduction

Energy is one of the most important elements for the development of any nation. The majority of energy requirements are fulfilled through petroleum fuels, coal, and natural gas. The consumption of petroleum fuels, the primary driving force behind operating engines, is increasing due to the increase in automotive vehicles. India's power consumption alone grew by 127.39 billion units (BU) in September 2022. According to the Ministry of Power, Government of India survey, it is expected that by the end of 2023, India will rank third in energy consumption. Even though the use of non-renewable energy resources meets the need for energy demand, it cannot be ignored that they pollute the environment as well. The heavy usage of hydrocarbon products releases harmful gases during combustion, which results in environmental pollution. The combustion of these fuels contributes approximately 24% of global carbon dioxide (CO<sub>2</sub>) emissions [1]. It is noticed that CO<sub>2</sub> is the most emitted gas and accounts for around 75% of worldwide greenhouse gas (GHG) emissions [2]. In recent years, climate change due to GHG has been considered a serious threat to the economy, environment, and

human life. In addition, these sources will someday deplete, and the shortage in availability is highly anticipated.

The energy needs are only going to increase with each passing year. The world has experienced an energy crisis in the past when members of OAPC (Organization of Arab Petroleum Exporting Countries) forced an oil embargo, especially when human necessities and industrial developments were at their peak. During the 1970<sup>s</sup> energy crisis, vegetable oils and alcohols were widely used as an alternative fuel to petroleum [3]. It led to a dire need and realization to develop alternative fuels to meet supply and demand due to skyrocketing fossil fuel trading prices or import and export costs, the ecological impact, and the required economic investment in sustainable development for the future. As a direct consequence, the research and development of alternative fuels for commercial use is slowly gaining popularity in the scientific and engineering committees. Alternative fuel based on renewable energy solves the problems of fuel depletion, unavailability of fuel, and environment pollution. The use of biofuels is accepted as one of the alternatives to petroleum fuel. Biofuel is produced from biomass, like plants, agricultural, domestic, or industrial waste. There are now

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