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INFLUENCE OF VEGETABLE OIL FUELING ON EFFICIENCY AND EXHAUST EMISSIONS OF A COMPRESSION IGNITION ENGINE — A REVIEW

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Abstract

The use of vegetable oils and their derivatives as alternative fuels in Compression Ignition (CI) engines has emerged as a viable strategy to reduce dependence on conventional diesel and mitigate environmental impacts. This comprehensive review examines the influence of direct vegetable oil fueling and its processed forms (e.g., methyl esters) on engine performance metrics such as brake thermal efficiency (BTE), brake specific fuel consumption (BSFC), and key exhaust emissions including NOx, CO, HC, and particulate matter (PM). A meta-analysis of recent experimental studies shows that vegetable oil fuels often yield a 3–12% reduction in BTE, a 4–15% increase in BSFC, 10–30% decrease in CO and HC emissions, and 5–25% increase in NOx, depending on fuel properties and engine operating conditions. The review contextualizes these findings with respect to combustion characteristics, fuel physicochemical properties, and engine modifications. The influence of sustainable feedstock choices and advanced fuel processing techniques on performance and emissions is evaluated.

Keywords: Vegetable oil fuels; Compression ignition engine; Performance; Emissions; Sustainability.

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