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"Gheorghe Asachi" Technical University of Iasi, Romania

INVESTIGATION OF ENGINE PERFORMANCE OF WALNUT OIL METHYL ESTERS (RME) AS AN ALTERNATIVE FUEL

Dragos Tutunea

Faculty of Mechanics, University of Craiova, Craiova, Romania
E-mail: dragostutunea@yahoo.com; Phone: +0040745523262

Abstract

The increasing need for renewable energy sources has intensified research into biodiesel production from non-traditional feedstocks. This study investigates walnut oil (Juglans regia) as a novel biodiesel feedstock, exploring its potential as an alternative fuel in compression ignition (CI) engines. Despite its high oil content and favorable fatty acid composition, walnut oil remains underutilized in biodiesel applications. Walnut biodiesel was produced through alkaline transesterification and blended with diesel in varying proportions (B10, B20, B30, B70). Performance and emission characteristics were evaluated using a four-cylinder, vertical, air-cooled diesel engine. The study assessed parameters including brake thermal efficiency (BTE), brake specific fuel consumption (BSFC), exhaust gas temperature (EGT), and emissions (CO, CO2, HC, NOx,). BTE decreased with increasing biodiesel content, showing reductions of 1.09% (B10) to 11.81% (B70) compared to diesel. BSFC increased, with a rise of 2.92% (B10) up to 13.5% (B70), due to the lower calorific value of walnut biodiesel. CO emissions decreased by 8.68%, and HC emissions dropped by 16.63% for B70, attributed to the higher oxygen content of biodiesel enhancing combustion. Conversely, NOx emissions increased by up to 16.09% (B70), driven by higher combustion temperatures. The results demonstrate that low-percentage walnut biodiesel blends (e.g., B10, B20) can be used in existing diesel engines without major modifications.

Key words: biodiesel, performance, production method, transesterification, walnut oil properties

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