Production, performance and emission of biodiesel from a mixture of castor oil and neem oil

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Abstract

The elimination of reserves of petroleum and their consequential environmental impact prompts the development of alternative fuels. This study aimed to blend castor and neem oils (at an 80 : 20 ratio) to address the drawbacks present in castor oil biodiesel, such as elevated kinematic viscosity and density. We propose that this new blending with a highly effective heterogeneous calcium oxide catalyst is the novelty of this work. This study employed a response surface approach to optimize biodiesel production. Biodiesel blends (B10, B20, and B30) were examined via standards EN 14214 and ASTM D6751. The performance of the biodiesel blends was scrutinized under experimental conditions, operating at a steady 2000 rpm with engine loads in the 25-100% range. Biodiesel production was optimized at an 8.75 : 1 methanol-to-oil ratio, 3.01 wt% calcium oxide, 56.6 °C, and 800 rpm, achieving a 95% methyl ester yield. The engine performance results indicated that brake thermal efficiency was lower than that of petroleum diesel. Conversely, brake-specific fuel

consumption exhibited higher values than those observed with petroleum diesel. In terms of emissions, carbon monoxide and smoke opacity were less common than when using petroleum diesel, as the average smoke opacity for diesel was 10.46%, 18.43%, and 26.93% greater than that of the B10, B20, and B30 blends, respectively. However, the carbon dioxide and nitrogen oxide emissions were greater than those of petroleum diesel. Thus, a biodiesel blend from castor and neem oils can be a viable substitute fuel for internal combustion engines.

Indexed keywords

Engineering controlled terms

Alternative fuels; Biodiesel; Brakes; Calcium oxide; Carbon dioxide; Carbon emissions; Carbon monoxide; Diesel engines; Environmental impact; Gasoline; Methyl ester; Nitrogen oxides; Opacity; Smoke

Engineering uncontrolled terms

Bio-diesel blends; Biodiesel production; Castor oil; Castor oil biodiesel; Kinematics viscosity; Neem oil; Performance and emissions; Petroleum diesel; Production performance; Smoke opacity

Engineering main heading

Blending

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