2011-08

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Elsevier Ltd.

https://doi.org/10.1016/j.fuel.2011.03.048

Engine performance, exhaust emissions and combustion characteristics of a CI engine fuelled with croton megalocarpus methyl ester with antioxidant

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DOI: https://doi.org/10.1016/j.fuel.2011.03.048

Abstract

The use of biodiesel as a substitute for petroleum-based diesel has become of great interest for the reasons of combating the destruction of the environment, the price of petroleum-based diesel and dependency on foreign energy sources. But for practical feasibility of biodiesel, antioxidants are added to increase the oxidation stability during long term storage. It is quite possible that these additives may affect the clean burning characteristics of biodiesel. This study investigated the experimental effects of antioxidants on the oxidation stability, engine performance, exhaust emissions and combustion characteristics of a four cylinder turbocharged direct injection (TDI) diesel engine fuelled with biodiesel from croton megalocarpus oil. The three synthetic antioxidants evaluated its effectiveness on oxidation stability of croton oil methyl ester (COME) were 1, 2, 3 tri-hydroxy benzene (Pyrogallol, PY), 3, 4, 5-tri hydroxy benzoic acid (Propyl Gallate, PG) and 2-tert butyl-4-methoxy phenol (Butylated Hydroxyanisole, BHA). The fuel sample tested in TDI diesel engine include pure croton biodiesel (B100), croton biodiesel dosed with 1000 ppm of an effective antioxidant (B100 + PY1000), B20 (20% croton biodiesel and 80% mineral diesel) and diesel fuel which was used as base fuel. The result showed that the effectiveness of the antioxidants was in the order of PY > PG > BHA. The brake specific fuel consumption (BSFC) of biodiesel fuel with antioxidants decreased more than that of biodiesel fuel without antioxidants, but both were higher than that of diesel. Antioxidants had few effects on the exhaust emissions of a diesel engine running on biodiesel. Combustion characteristics in diesel engine were not influenced by the addition of antioxidants in biodiesel fuel. This study recommends PY and PG to be used for safeguarding biodiesel fuel from the effects of autoxidation during storage. Overall, the biodiesel derived from croton megalocarpus oil can be utilized as partial substitute for mineral diesel.

Keywords

Croton methyl ester; Engine performance; Emissions; Combustion; Antioxidants