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Performance Of Diesel Engine Using Yellow Oleander, Koroch And Degraded Koroch Biodiesels

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Abstract:

The performance and emissions of an internal combustion engine (ICE) engine fuelled with three bio-diesels are experimentally measured and analysed and compared with that of the petroleum diesel. This study found that the performance of pure bio-diesel fuels (yellow oleander and koroch) is lower due to the lower energy content of biodiesel when compared with petroleum diesel. For both the bio-diesels (yellow oleander and koroch) some emissions were found to be higher than petroleum diesel, while some were lower. One of the major drawbacks of biodiesel over petroleum diesel is that it can be more susceptible to oxidation at room temperature. It is due to the chemical structure of fatty acid methyl esters. The fatty acid methyl esters undergo a chemical process autoxidation when biodiesel is stored for long time and exposed to air. Oxidized koroch biodiesel or degraded biodiesel shows highest fuel consumption reflecting the lower energy content of biodiesel.

Keywords: *yellow oleander, koroch, degraded koroch*

Introduction

In the present era of industrial development, mankind has encountered degradation of environment and depletion of mineral resources. This has led to emergence of technologies that deal with resources other than fossil fuels. Among the prominent ones is transesterification reaction that has now become popular for synthesis of biodiesel. Chemically, biodiesel is a mixture of fatty acid alkyl esters (FAAE) derived from long chain fatty acids. Biodiesel is considered as a safe, clean, biodegradable and renewable fuel [1, 2, 3, 4, 5]. These positive attributes have attracted the attention of the scientific community, industries and governmental agencies worldwide for a step ahead in making biodiesel fuel for usage in the transportation sector. It however, also presents few constraints which have to be taken cared of during its production, storage and utilization as a fuel. The problem encountered during its synthesis is to avoid saponification by reducing its acid value to minimal. On completion of transesterification reaction, the product obtained has to be purified of impurities in the form of soap, water, methanol, catalyst, free glycerol, free fatty acids, mono-, di-, and triglyerides. Unless these impurities are removed, the product synthesized cannot be used as biodiesel fuel [6]. During storage, air contact has to be avoided so as to prevent biodiesel from oxidation. Oxidation arises from the reaction of atmospheric oxygen with bis-allylic sites in FAAE and degrades biodiesel by converting it to acids, esters, aldehydes, ketones, and lactones [7].The objective of this study was to investigate whether the fuel chemistry changes caused by oxidation produce signi5cant changes in the engine performance and emissions.

Methodology

About 300 kg of seeds of yellow oleander and koroch were collected from Guwahati and Tinsukia altogether from villages and roadsides in month of September. The oil was extracted from the grinded seeds with petroleum ether (40-60^{0}C) using the Soxhlet extraction method. Biodiesel used was prepared in laboratory scale from yellow oleander and koroch by alkali catalyzed transesterification. The koroch biodiesel samples, 1 liter each were stored at open air storage condition for 180 days. Koroch biodiesel was oxidized and quality of the fuel was detoriated. This fuel was taken as one of the test fuels for engine application.

Result And Discussions

The variation of brake-specific fuel consumption with load for all test fuels is shown in Fig. 1. For all these fuels brake specific fuel consumption (BSFC) decreases with increase in load.

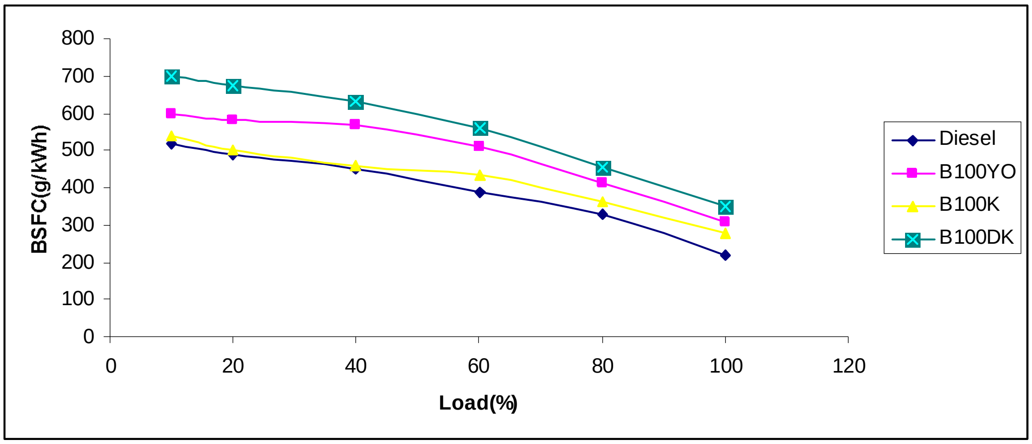

Figure 1: Variations of BSFC

The variation of brake thermal efficiency (BTE) with respect to load for all of the fuels is shown in Fig. 2. In all cases, BTE increases with an increase in load.

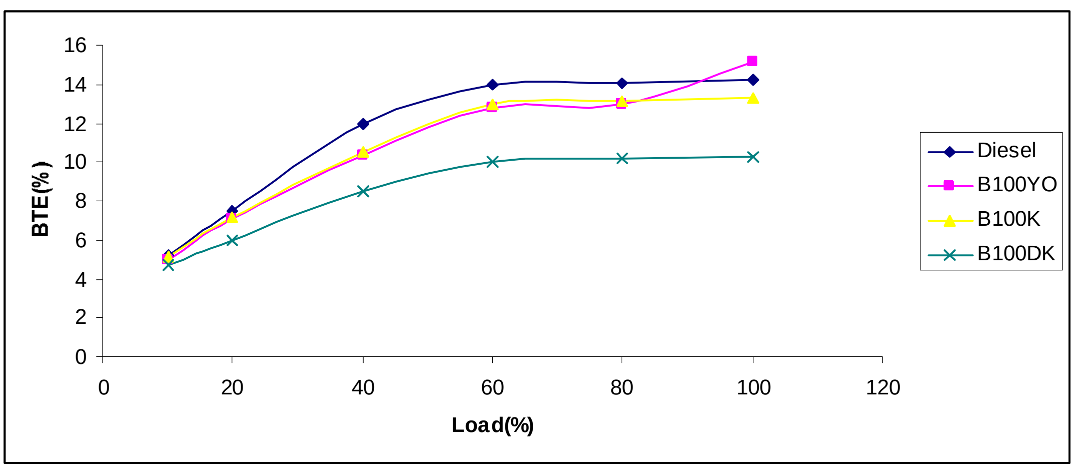

Figure 2: Variations of BTE

Fig. 3 shows the CO traces for different fuels. The highest CO emission was measured for diesel fuel.

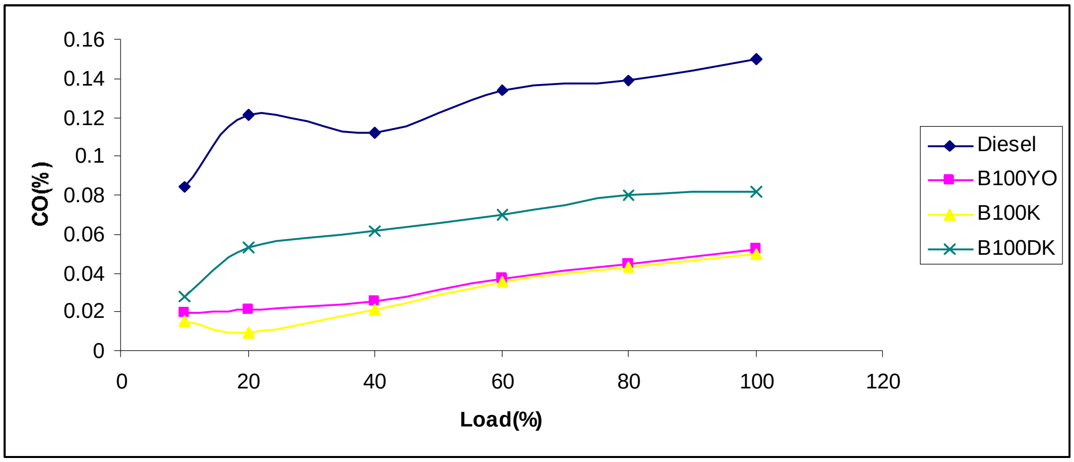

Figure 3: Variations of CO emissions

Conclusion

The engine performance of the oxidized and pure biodiesels (yellow oleander and koroch) was similar to that of diesel fuel with nearly the same thermal efficiency, but with higher fuel consumption reflecting their lower energy content. The pure biodiesels produced lower CO emissions. The oxidized biodiesel reduced the CO emissions over 28% compared with diesel fuel and increased 15% compared to the pure biodiesel at the full-load engine condition.

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