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COMBUSTION AND EMISSION CHARACTERISTICS OF A DIESEL ENGINE WORKING WITH DIESEL/JOJOBA BIODIESEL/HIGHER ALCOHOL BLENDS

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ABSTRACT

The main concerns of utilizing jojoba biodiesel in CI engines is that it has a high viscosity and high NO_x formation. Therefore, this article purposes in endeavoring to improve the combustion and emission parameters of a CI engine working with diesel/jojoba biodiesel blend and higher alcohols under various engine loads. The higher alcohols typically are n-butanol, n-heptanol, and n-octanol, which are combined with 50% diesel, 40 % of jojoba biodiesel at a volume portion of 10%, and they are designated as DJB, DJH, and DJO respectively. The jojoba biodiesel is manufactured via a transesterification process with facilitating mechanical dispersion. The findings display that there is a drop in $p_{max.}$ and HRR for DJB, DJH, and DJO blends compared to pure diesel fuel, whereas the combustion duration and ignition delay are extended. The brake specific fuel consumption is enlarged. Concerning engine emissions, the NO_x formation is reduced while the CO, UHC, and soot emissions are increased for DJB, DJH, and DJO mixtures. It can be deduced that combining high fractions of jojoba biodiesel with C_4, C_7, and C_8 alcohols have the feasible to accomplish low NO_x formation in the interim having high thermal efficiency level.

Keywords: Jojoba biodiesel; n-butanol, n-heptanol, & n-octanol; Combustion characteristics; Emission Formations.

INTRODUCTION

Biodiesels are broadly utilized as a renewable source to solve or alleviate the conventional fuel scarcity and environmental issue [1,2]. The non-edible and waste oils are being used, owing to their availability, and they do not make any battle with human consumption. Jojoba oil is considered as an encouraging non-edible source for biodiesel production [3].

Jojoba oil has a unique structure compared to other traditional oils, where it primarily consists of straight-chain wax esters in the variety of C_{26}–C_{48} with two double bonds, one at each side of the ester bond [4]. Thus, it has a significant possibility for utilization in cosmetics, pharmaceuticals, lubricants, and many other purposes [5]. The seed of jojoba comprises raw oil with the weight fraction more than 50%, and hence, pure Jojoba oil is an appropriate feedstock for biodiesel creation. Moreover, the choosing of the Jojoba oil as a biodiesel fuel is attributed to its accessibility in numerous countries, its reasonable price, and its low chemical reactivity [6,7].

There are some studies that have examined the physical properties of Jojoba/diesel blends. Al-Hamamre and Al-Salaymeh [8] examined the impacts of temperature and volume segment on the dynamic viscosity, density, flash point and heating value of jojoba oil/diesel blends. They cited that the temperature and Jojoba percentage in the mixture had a substantial influence on the physicochemical of Jojoba-diesel blends. The impacts of adding jojoba to diesel fuel on the combustion and emission characteristics of a CI engine were examined by Sharma et al. [9] and Azad et al. [10]. The jojoba was added up to 28% by volume with diesel fuel. They cited that the mixture of 10% Jojoba biodiesel could be used in CI engines; however, this mixture was produced a high percentage of NO_x compared to diesel fuel.