

Research Article

Study on Emission and Performance of Diesel Engine Using Castor Biodiesel

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This paper presents the result of investigations carried out in studying the emission and performance of diesel engine using the castor biodiesel and its blend with diesel from 0% to 40% by volume. The acid-based catalyzed transesterification system was used to produce castor biodiesel and the highest yield of 82.5% was obtained under the optimized condition. The FTIR spectrum of castor biodiesel indicates the presence of C=O and C–O functional groups, which is due to the ester compound in biodiesel. The smoke emission test revealed that B40 (biodiesel blend with 40% biodiesel and 60% diesel) had the least black smoke compared to the conventional diesel. Diesel engine performance test indicated that the specific fuel consumption of biodiesel blend was increased sufficiently when the blending ratio was optimized. Thus, the reduction in exhaust emissions and reduction in brake-specific fuel consumption made the blends of castor seed oil (B20) a suitable alternative fuel for diesel and could help in controlling air pollution.

1. Introduction

An update on the advances production technique can reinforce the biodiesel as an alternative fuel to combat against global warming. The interest in renewable fuels has increased dramatically in recent years due to high demand of energy and the limitation of fossil fuel [1]. It could offer the opportunities to develop domestic resources in a cost effective manner. Supplementing the petroleum consumption with renewable biomass resources might be one of the components of strategic approach to reduce dependence on petroleum based fuels [2]. Nowadays, the search for alternatives of biofuels is a major environmental and political challenge worldwide. These biofuels can be derived from renewable carbon sources to mitigate greenhouse gas emissions, and the end products can be employed as drop-in replacements for petroleum fuels. Furthermore, usage of biodiesel has almost zero emissions of sulfates, a small net contribution

of carbon dioxide (CO₂) when whole lifecycle is considered, and biodiesel is about 10% oxygen by weight [3, 4]. Biodiesel is one of the sustainable energies that can be produced from the transesterification process of oils or fats which are from plant or animal with short chain alcohols such as methanol and ethanol as shown in Figure 1 [5].

Biodiesel has become an interesting alternative to be used in diesel engine which is due to the similar properties to the conventional fossil diesel fuel in terms of power and torque and none or very minor of engine modification is required [6]. Moreover, the biodiesel has a few special features which are biodegradability and being much more environmentally friendly compared to the conventional fossil diesel and resulting in less environmental impact upon accidental release to the environment [7]. Although biodiesel has many environmental advantages, it has some drawbacks performance also. The biodiesel behavior is worsening during the cold conditions compared to the fossil diesel fuel. This