An Experimental Study on Performance Characteristics of Karanja Oil Blends with Diesel in A Direct Injection Variable Compression Ratio Compression Ignition Engine

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***Abstract*—In this paper the effect of addition of karanja biodiesel to normal diesel on the performance characteristics of a Direct Injection Variable Compression Ignition Engine have been experimentally investigated. The experiments were carried out using pure diesel (D100/B0) and three pongamia oil blends which is blended with the different volumetric basics with pure diesel (D95/P5, D90/P10 & D85/P15 as fuels. The performance characteristics shows that brake specific fuel consumption (BSFC), brake thermal efficiency (BTE), indicate thermal efficiency (ITE) and volumetric efficiency (VE) increases with the use of karanja biodiesel.**

Keywords— VCR Diesel engine; Biodiesel; Karanja oil blends; Engine performance

I. INTRODUCTION

The world faces the crises of energy demand, rising petroleum prices and depletion of fossil fuel resources. Biodiesel has obtained from vegetable oils that have been considered as a promising alternate fuel [1]. Biodiesel is an alternative fuel produced from different kinds of vegetable oils and animal fats. It is an oxygenated, non-toxic, sulfur free, biodegradable and renewable fuel that can be used in diesel engines without any significant modifications [2]. Fossil fuels are commonly used fuel for automobiles. The reserve stock and exhaust gas emission of fossil fuel cause a serious problem. So there is a need of an alternative ecofriendly fuel. Biodiesel is a renewable fuel produced from plant and animal material by esterification [3]. Karanja methyl esters give higher brake thermal efficiency at higher load and higher brake specific fuel consumption as the blend ratio of bio diesel to diesel increases [4-6]. It is noted that BSFC of all the blends of PME 20, PME 40, PME 60, PME 80 and PME 100 is higher than that of petroleum diesel at various loading conditions. The percentage of pongamia biodiesel in blends influences the engine economy with better performance [7].

II. EXPERIMENTAL PLANS

A load test on an engine provides information regarding the performance characteristics of the engine. The performance characteristics of such engines are obtained by varying the load on the engine. The experiments were carried out on a single cylinder 4 stroke variable compression diesel engine of a model manufactured by Kirloskar oil engines Ltd., the largest manufacturer of portable multi-fuel engines. The Kirloskar engine is a single cylinder, vertical and air cooled diesel engine. It is coupled to a 3 phase loading rheostat. A fuel tank with a measuring burette enables the engine fuel consumption to be measured. The loading rheostat is coupled by means of rigid coupling carefully without any misalignment between axes. The proper alignment helps to damp-out any vibration that may occur during transmission.

III. RESULTS AND DISCUSSIONS

A. Brake Specific Fuel Consumption (BSFC)

Effect of specific fuel consumption for P0, P5, P10 and P15 blends in various load conditions is shown in figure.1. It also shows that the brake specific fuel consumption (BSFC) of the engine is decreased with increasing load.

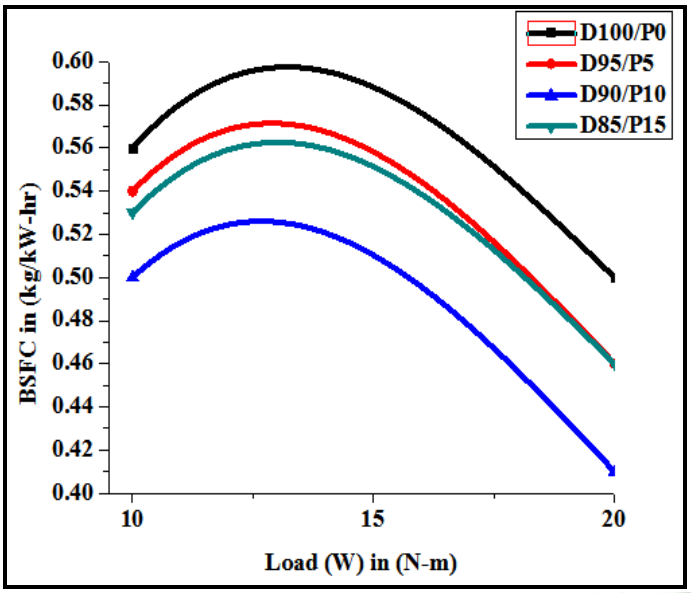

Fig. 1. Variation of brake specific fuel consumption.

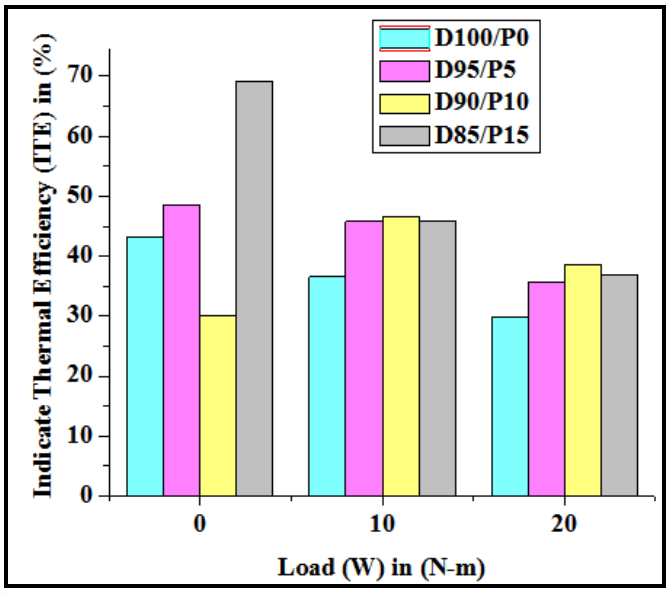

Fig. 3. Variation of indicate thermal efficiency.

B. Brake Thermal Efficiency (BTE)

Effect of brake thermal efficiency for P0, P5, P10 and P15 blends in various load conditions is shown in figure.2. It also shows that the brake thermal efficiency (BTE) of the engine is increase with increasing load.

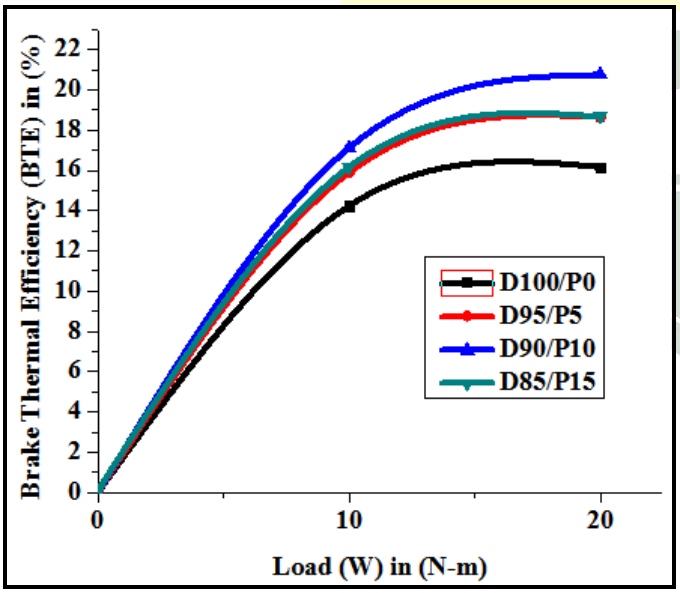

Fig. 2. Variation of brake thermal efficiency.

C. Indicate Thermal Efficiency (ITE)

Effect of indicate thermal efficiency for P0, P5, P10 and P15 blends in various load conditions is shown in figure.3. It also shows that the indicate thermal efficiency (ITE) of the engine is increase when load is zero. Then half load condition ITE gradually increase compare to full loading conditions.

D. Volumetric Efficiency (VE)

Effect of volumetric efficiency for P0, P5, P10 and P15 blends in various load conditions is shown in figure.4. It also shows that the volumetric efficiency (VE) of the engine is maximum in no load condition compare to other blends.

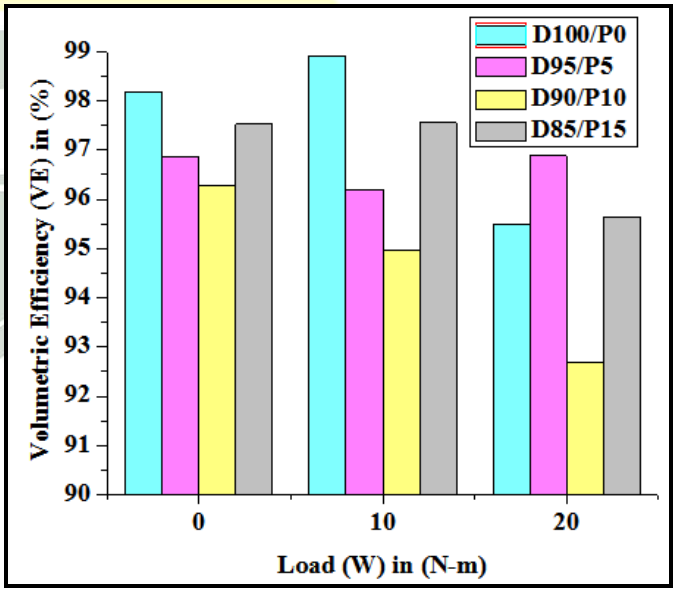

Fig. 4. Volumetric Efficiency.

SUMMARY

In this study, the performance characteristics of direct injection diesel engine fuelled with karanja oil as neat biodiesel and its blend with diesel are investigated and compared with neat diesel fuel. Based on the experimental study, the following conclusions are summarized as follows: The BSFC decreased with an increase in engine load. For biodiesel and its blends the BSFC are lower than that of diesel fuel. For biodiesel and its blends there is an enormous increase in brake thermal efficiency. The indicate thermal efficiency decreased with an

increase in engine load. For biodiesel and its blends the indicate thermal efficiency are lower than that of diesel fuel. For biodiesel and its blends volumetric efficiency is higher than that of pure diesel fuel.

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