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STUDY OF THE PERFORMANCE AND EMISSION CHARACTERISTICS OF D I DIESEL ENGINE USING COME AND ITS BLENDS

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Abstract:

The present work is to study the performance and emission characteristics of single cylinder, direct injection diesel engine using coconut oil methyl ester (COME) and their blends with diesel in varying proportions. Experiments were conducted when the engine fueled with pure diesel, pure COME and the blends of diesel and COME by volume for full load range. The exhaust conditions were measured using exhaust gas analyzer similarly AVL smoke meter for measuring smoke density. Results were compared graphically in performance of the engine for specific fuel consumption, brake thermal efficiency, exhaust temperatures and in exhaust gases for concentrations of NO_x and smoke density.

Introduction:

The ever increasing in vehicular population, pollution and fast depletion of fossil fuel require the search for the alternate fuels has become necessary. The vegetable oils can be used as future alternate fuels for the operation of diesel engine [1]. The properties of are very close to diesel after processing, and they can be grown in rural areas with no cost and effort. From previous studies [2] it has been shown that various problems associated with vegetable oils being used as fuels in C I engines due to high viscosity.

This is due large molecular mass and chemical structure of oils. This in turn leads improper atomization of fuel during injection resulting incomplete combustion and higher smoke level in the exhaust [3]. The problem of high viscosity of vegetable oils has been studied in several ways such as preheating the oils, blending with other fuels, thermal cracking and transesterificaton to make biodiesel [4-6]. Kalam et-al [7] showed that 30% of Malaysian coconut oil with diesel blend produced higher brake power, net heat release rate and with reduction in HC, NO_x, CO, smoke but at increased percentage of coconut oil power and heat release rates are decreasing due to its lower calorific values. Raffiq et-al [8] concluded that by introducing coconut oil with diesel blends at 20% found good in fuel efficiency and emissions.

Preparation of fuel:

The COME is prepared by transesterification process in which fat of oil is converted into esters and glycerin. All fats are removed as glycerin in acid and base treatments with the help of acid, catalyst and alcohol. A mixture of coconut oil and sodium hydroxide are heated and maintained at 60^0C for one hour while the solution is continuously stirred. After settlement the two layers formed, lower is glycerin separated to retain upper one which is ester of the coconut oil used for experimentation.

Experimentation:

A vertical water cooled four stroke single cylinder direct injection diesel engine is used for experimental work with COME-diesel blends. Experiments were conducted with pure diesel, pure COME and the blends of COME & diesel in volume at different proportions as in table (1). Smoke density and NO emissions were measured using AVL smoke meter and exhaust gas analyzer respectively.

S no.	Fuel	Fuel Blends
1	D100	100%Diesel
2	B20	20%COME,80%Diesel
3	B40	40%COME,60%Diesel
4	B60	60%COME,40%Diesel
5	B80	80%COME,20%Diesel
6	B100	100%COME

Table 1. Percentage of Fuel Blends

Engine:	Vertical, 4stroke, Water cooled
Rated power:	3.68 kw @ 1500rpm
Cylinder diameter:	80mm
Stroke length:	110mm
Compression Ratio:	16:1

Table 2. Engine details

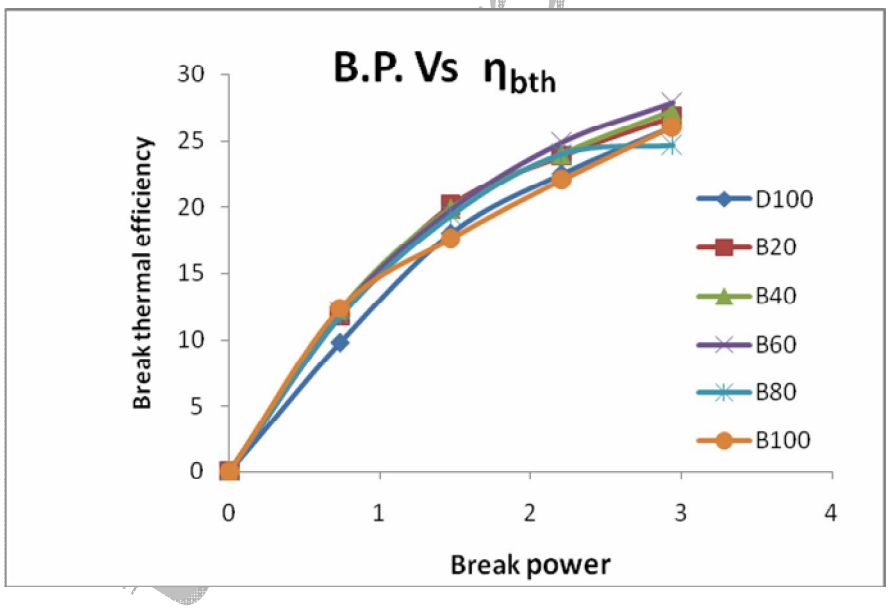

Fig. 1. Thermal efficiency variation with Break power

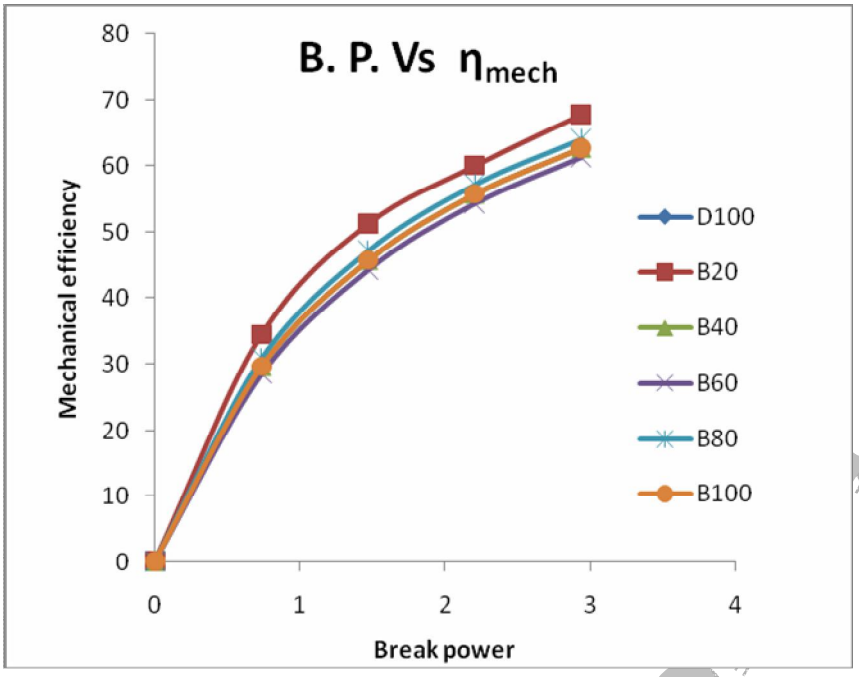

Fig. 2. Mechanical efficiency variation with Break power

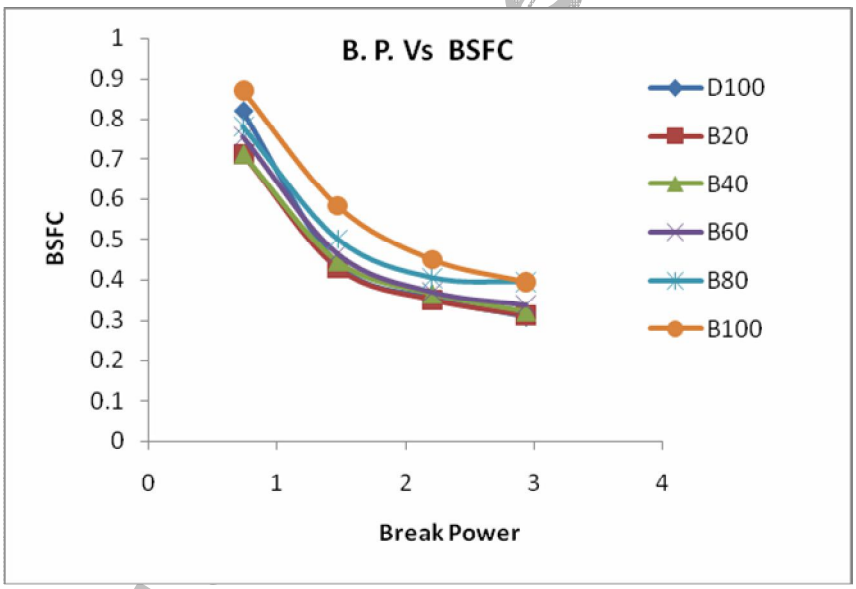

Fig. 3. Variation of fuel consumption with Break power

Results and conclusions:

At rated speed of the engine the variation of break thermal & mechanical efficiency and BSFC are drawn with respect to break power for diesel, diesel & COME blends and pure COME. It is observed that break thermal efficiency is gradually increasing and higher for B60, where as there after decreasing and minimum for B100 at full load.

It has been observed that BSFC for B40 is minimum and it is increasing as the COME percentage increases in diesel. This is due to less calorific value of biodiesel than diesel, the rate of energy release decreasing at higher ratios of COME. With this it can be concluded that biodiesel with 50% diesel gives maximum efficiency and minimum specific fuel consumption.

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