Experimentally Optimization of a Variable Compression Ratio Engine Performance Using Different Blends of Cotton Seed with Diesel Fuel at Different Compression Ratio

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Abstract— **The scarcity of world's petroleum reserves and the sources are at the extreme of getting abolished. Due to the increase in the price of petroleum, environmental concern and availability of fuels are greatly affecting the trends of fuels for transportation vehicles. To fulfill the rising energy demand renewable fuel like biodiesel is in forefront of other technologies. Biodiesel oil one of the option as alternative transport fuel. In the present study, experimental investigations were carried out on a small size, variable compression ratio diesel engine with cotton seed - diesel blends (10–25% by volume) as fuel to determine the optimum blending ratio for the engine performance. Cotton seed oil is non edible vegetable oil, high viscosity, low volatility and widely available in India. It has been observed that B-20 blend (20% cotton seed +80% diesel fuel) gives highest brake thermal efficiency & lowest brake specific fuel consumption as compared to all other blending combinations at different compression ratios. Optimized B20 blend gives very close thermal efficiency, 2.46% lesser to diesel fuel at compression ratio 17 at 75% of maximum load i.e. 12 kg. Among all diesel blend maximum break power was found 3.295 kW by B20 blend at compression ratio 17.**

Index Terms— **brake thermal efficiency, brake specific fuel consumption, biodiesel, compression ratio**

I. Introduction

The present generation is heavily biased towards the conventional energy sources such as petroleum products, coal, atomic energy etc., which are finite in nature besides causing environmental pollution. The fast depleting petroleum reserves have already waved a warning signal all around the globe to look for alternate means to cater to the ever increasing needs of energy. [1] Our society relies heavily on internal combustion (IC) engines for different purposes, viz. transportation, agriculture and power generation. Therefore, research in both gasoline and diesel engines is required for improvement in fuel efficiency and emission reduction. Even a small improvement in fuel efficiency can have a major impact on economy and pollution [2].

Biodiesel oil one of the option as alternative transport fuel. Diesel fuel can be replaced by biodiesel made from vegetable oils. There are different types of vegetable oil available such as peanut, sunflower, rape, soybean, coconut, cottonseed, linseed, castor and mustard, has been tested worldwide [3]. In developed countries, there is growing trend toward using modern and efficient bioenergy using a range of biofuels, which are becoming cost wise competitive with fossil fuels. It has almost no Sulphur, no aromatics and more oxygen content which helps it to burn fully. It has higher cetane number which improves combustion. Since straight vegetable oils cannot be used directly without bringing its properties closer to petroleum fuel as diesel. Mainly viscosity reduction is sufficient to improve its flow and atomization properties. Four important techniques are available to reduce viscosity of these oils such as heating, transesterification, emulsification and blending [3,4]. Transesterification (conversion of vegetable oil into biodiesel) is the best technique to bring the properties of vegetable oil closer to mineral diesel [4,5,6].

The main objective of the present research was to explore the possibility of running an IC engine on cotton seed oil in direct injection variable compression ratio engine without any substantial modifications in the engine design. Performance characteristics like brake

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