

EXPERIMENTAL INVESTIGATIONS ON FOUR STROKE SINGLE CYLINDER DIESEL ENGINE USING MAHUA MILK SCUM METHYL ESTER AS ALTERNATIVE FUEL

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ABSTRACT

This journal deals with Bio-diesel is a fatty acid alkyl ester which is renewable, bio degradable and non-toxic fuel which can be derived from any vegetable oil and animal fats. Vegetable oils and animal fats in their raw form have high viscosity which makes them unsuitable as fuels for diesel engines. Transesterification is one of the well known processes by which fats and oils are converted into bio-diesel. The reaction often makes use of acid/base catalyst. The present study consists of the production of bio-diesel from mahua oil and dairy waste milk scum oil with the use of potassium hydroxide as a base catalyst. The transesterification result shows that the lower viscosity, lower specific gravity with higher yield. The prepared bio-diesel was tested as per the ASTM bio-diesel standard and was found to be within the standard limits of bio-diesel.

Another common issue is the lack of standard specifications for bio-diesel blend fuels. Even if the engine is designed for an average B100 fuel, problems may arise due to the variability of a non-standard fuel without a widely accepted and enforced quality specification. Compared to the normal diesel to the bio-diesel, bio-diesel is more efficient and less polluting. Pollution percentage is about 25% less when compared to diesel (56.2%).

Keywords: Mahua oil, Milk Scum, Methyl Ester.

1. INTRODUCTION

Bio-diesel is a non-petroleum based fuel defined as fatty acid methyl or ethyl esters derived from vegetable oils or animal fats and it is used in diesel engines and heating systems. Commercial bio-diesel does not have standards which must be met, just like common standard it is very high quality fuel which is superior to petrol or diesel in every way except cold weather performance. Bio-diesel from Mahua seed is important as it is found abundantly in tribal areas. Mahua seed

contains 30-40% fatty oil called mahua oil. Milk scum oil is a less dense floating solid mass usually formed by a mixture of fat, lipids, proteins, packing materials etc. Free fatty acid was found to be high due to biological action. From 3kg of scum we will get 1 kg of scum oil which is used for transesterification. Transesterification reaction is the reaction of a fat or oil with an alcohol to form esters and glycerol. This reaction is also called alcoholysis. To complete the reaction stoichiometrically, a

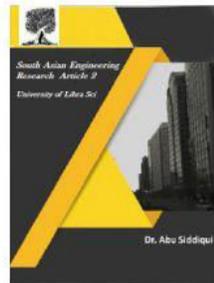


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3:1 molar ratio of alcohol to triglycerides is needed. In practice, the ratio needs to be higher to drive the equilibrium to a maximum ester yield. The literature has revealed that the rate of reaction is strongly influenced by the reaction temperature. However, the reaction is conducted close to the boiling point of methanol (Above 60 C) at atmospheric pressure for a given time.

The mixture of mahua oil, milk scum oil with methyl ester at required ratios to get the required bio-diesel. The experiments are conducted with diesel, Mahua Milk Scum Methyl Ester (MMME) and blends of diesel. With the test conditions, the parameters such as total fuel consumption, brake specific fuel consumption, brake thermal efficiency is presented with respect.

2. EXPERIMENTAL SET UP & PROCEDURE

The experiment aims at determining the appropriate proportions of bio-diesel & diesel for which higher efficiency is obtainable. Hence the experiments are carried out at constant speed, comparing the performance of a compression ignition engine operated at different blends.



Acid catalyst esterification (Mahua oil)

Acid catalyst esterification (Milk scum oil)

Steps involved

1. Switch on the mains of the control panel and set the supply voltage from servo stabilizer to 220 volts.
2. The main gate valve is opened and the pump is switched ON and the water flow rate to the engine cylinder jacket (3000 liters/hour).
3. Engine is started by hand cracking and allowed to run for 20 minutes to reach steady state conditions. The engine has compression ratio of 17.5 and a normal speed of 1500 rpm controlled by the governor. An injection pressure of 200 bars is used for the best performance as a specified.

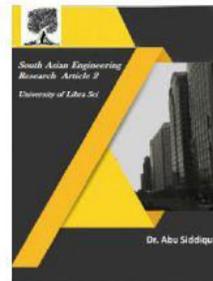


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RESULTS AND DISCUSSION *Mahua Methyl Ester, Milk Scum Methyl Ester & Mahua Milk Scum Methyl Ester*



The experiments were conducted on a direct injection compression ignition engine for various loads with an intention of studying the behavior of the engine in the regard to performance characteristics when it was run on several combinations of diesel, bio-diesel and blends. The fuel properties of each bio-diesel compared with the mixture of bio-diesel and diesel.

CONCLUSIONS

The present work evaluates production of Mahua Milk Scum Methyl Ester (MMSME) using Potassium hydroxide (KOH) as a catalyst and performance evaluation of single cylinder four stroke diesel engine using diesel and its blends are carried out.

. Bio-diesel has become more alternative because of its environmental benefits and the fact that it is made from renewable resources.

. The thermal efficiency of diesel is higher about 12% when compared to that of net bio-diesel at full load.

. It was observed that the specific fuel consumption of bio-diesel and its blends at all loads higher than diesel.

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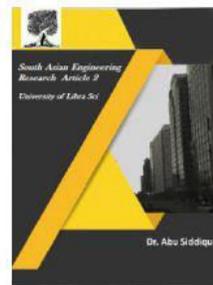


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