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Experimental Investigations on Production and Usage of Hybrid Biodiesel in CI Engines

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Abstract: Most of the energy consumed worldwide is from coal, petroleum and natural gas. It is well known that these sources are limited and will exhaust in long term. Vegetable oils are renewable and potentially inexhaustible source of energy. India imports about 70% of its petroleum from the gulf countries that are most of the time under political turmoil. By the end of 2020 this percentage is likely to increase to 82%. Most of the energy consumed worldwide, except from nuclear and hydroelectric sources is from coal, petroleum and natural gas. It is well known that these sources are limited and will exhaust in long term. Vegetable oils are renewable and potentially inexhaustible source of energy. India imports about 70% of its petroleum from the gulf countries that are most of the time under political turmoil. By the end of 2010 this percentage is likely to increase to 82%. In India nearly 80% of the country's population being dependent on agriculture, and unemployment is rampant. Thus for India, like many other nations in the world, national security for energy supply, rural employment and concern for the environment are the main driving forces for the search of renewable and clean source of energy for the transportation. Bio-fuels are one of the answers of this search. The ever growing environmental and health hazards associated with diesel fuel necessitates to look for alternative fuel to address all the problems. It is quiet welcome change that today biofuels are being seriously viewed from the multidimensional perspective of depleting fossil fuel resources, environmental health, energy security, agrarian economy and new avenues of gainful employment. The major concern in biofuel usage is the higher production cost. This problem can be addressed by mixing cheaper raw materials with non-edible oils for biodiesel production. In the present work it is proposed to produce hybrid biofuel from Pongamia oil and Cotton seed Oil. Cotton seed oil and Pongamia oil can be mixed in 1:1 proportion and can be used in production of biodiesel which reduces the cost of production.

Keywords: Pongamia, Cotton Seed, Hybrid, multidimensional.

I INTRODUCTION

In the research topics that have main importance on concerning petroleum fuels in vehicle engines are power and energy. However, the last 37 years air pollution due to engine emissions has become a social problem and the achievement of low pollution combustion have become a research subject. Diesel engines were used in a wide range of industry such as automobiles, agriculture, transportation, building, and industry, energy production due to their high efficiency. Besides, with the development in electronics technology more and more used in diesel engines are being in automobiles.

Because many diesel engines are being used, we were in need of petroleum more than ever. On the other hand, it is also commonly recognized today that the world petroleum energy resources are finite, thus many researchers has been carried out to find suitable alternative fuels to petroleum products. Researches, the engine are used on alternative fuels to the petroleum based fuels; they are increased since petroleum fuels are finite, and as well as pollution resulted from their combustion have sincere affects on environments. However the major disadvantages of vegetable oil are its viscosity, which is considerably higher than that of mineral diesel. Because the high viscosity and low volatility of vegetable oils, the brake thermal efficiency of vegetable oil are inferior to those of diesel. This leads to problems of high smoke, HC, CO2 and CO emissions.

II HISTORY OF VEGETABLE OILS

An India is importing crude petroleum oils & petroleum products from Gulf countries. Indian scientists searched for an alternate's diesel fuel to preserve global environment to withstand economical crisis. So, the vegetable oils from plants both edible oils, crude non-edible oils and Methyl esters (Bio-diesels) are used as alternate source for Diesel fuel. Bio-diesel is the found as the best alternate fuel, technically and environmentally acceptable, economically competitive and easily available for vegetable oils.

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III MATERIALS AND METHODS

A lot of the research works have been carried out to use vegetable oils both in its neat form and modified form (Agarwal et al., 2008). The Studies has shown that the usage of vegetable oils in neat form was possible but not preferable (Altõn, 1998). The high viscosity of vegetable oils, the low volatility affect the atomization and spray pattern of fuels, leading to the incomplete combustion and the severe carbon deposits, injector choking and piston ring sticking.

The methods used to the reduce viscosity are * Blending with diesel * Emulsification * Pyrolysis * Transesterification Among these, the transesterification are the commonly used commercial process to produce the clean and environmental friendly vegetable fuel (Pramanik, 2003). However, this adds extra cost of the processing because of a transesterification reaction involving chemical and process heat inputs.

IV BIODIESEL

Biodiesel is an environmentally friendly alternative fuels that can be used in any diesel engine without modification. There have been renewed interest in the use of vegetable oils for making biodiesel due to its low polluting and renewable energy nature compared with conventional petroleum diesel fuels. If the biodiesel is valorised efficiently at energy purpose, so would be benefits for the environment and the local population, job creation, provision of modern energy carries to the rural communities.

A. PONGAMIA OIL

Pongamia oil is derived from the seeds of the Millettia pinnata tree, which is native to tropical and temperate Asia. Millettia pinnata, also known as Pongamia pinnata or Pongamia glabra, is common throughout Asia and thus has many different names in different languages, many of which have come to be used in English to describe the seed oil derived from M. pinnata; Pongamia is often used as the generic name for the tree and is derived from the genus the tree was originally placed in.

Fig. 1 Pongamia Seeds

Fig. 2 Pongamia Oil

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Fig. 3 Pongamia Oil after Emulsification

B. HYDROGEN

Hydrogen is a non-metal. It can become metallic at very high pressures. It can be used in fuel cells to power electric motors or burned in internal combustion engines (ICEs). Hydrogen gases are colourless, odourless, tasteless, flammable and nontoxic. It is exists as a gas at ambient temperatures and atmospheric pressures. Hydrogen gas are the lightest gas known with a density approximately 0.07 that of air. The concentrations of hydrogen gas in the atmosphere volume are 5.0 x 10-5%. Hydrogen are principally shipped and used in gaseous form for refineries, petrochemical companies for hydro treating, catalytic reforming and hydro cracking. Hydrogen is also used in heat treating, metal production, welding, lasers, plastics, food production, and semiconductors.

V PRIMARY STUDY OF OIL

Vegetable oils are generally composed of triglycerides whose molecular structure are branched and complex. Figure shows the structure of a typical triglyceride molecule. On the other hand, diesel consists of straight chain molecular structure. Vegetable oils have comparably energy density, cetane number, heat of vaporization, and stoichiometric air / fuel ratio with mineral diesel fuel. The large molecular sizes of the component triglycerides result in the oils having higher viscosity compared with that of mineral diesel fuel.

The problem of viscosity has an adverse effect on the combustion of vegetable the fuel, such as spray atomization, consequent vaporization, and air/ fuel mixing. But vegetable oils have oxygen molecules present in them.

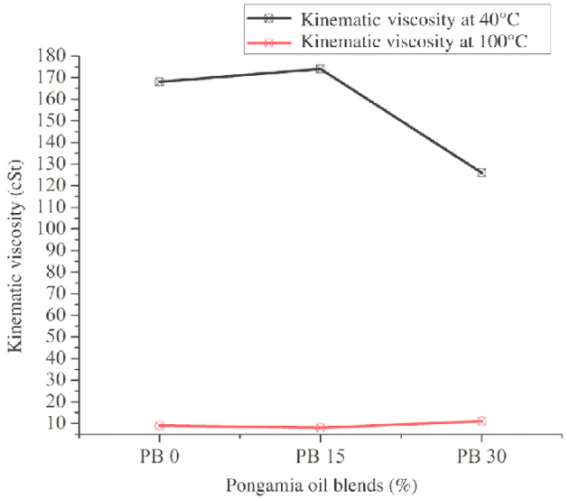

Fig. 4 Pongamia Oil Blends Vs Kinematic Viscosity

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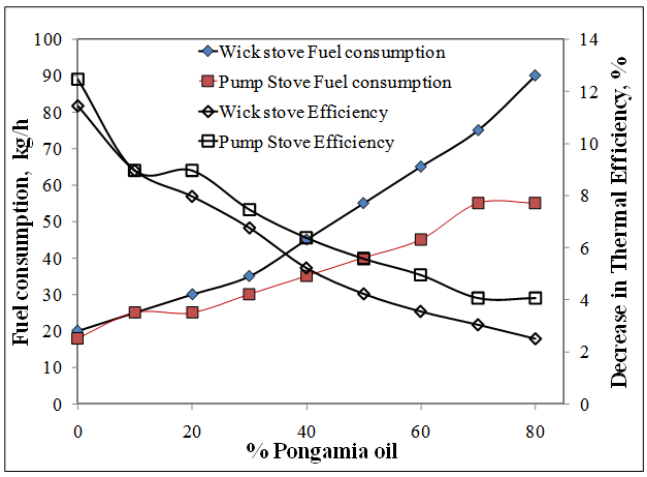

Fig. 5 Fuel Consumption Vs Thermal Efficiency

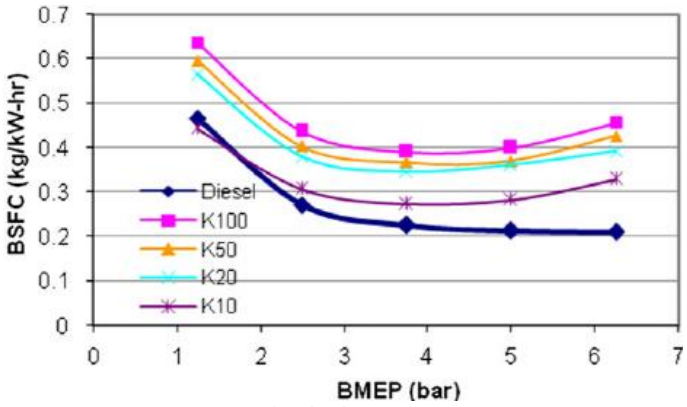

Fig. 6 BSFC Vs BMEP

VI CONCLUSION

The main conclusion of the present investigation was to reduce the viscosity of Pongamia oil close to that of conventional fuel to make it suitable for use in a C.I. engine and to evaluate the performance of the engine with new alternate fuels. In the present study, viscosity is reduced by (i) preheating the oil (Pongamia oil) and (ii) by blending the Pongamia oil with diesel. Diesel and Pongamia oil are characterized for their various physical, chemical and thermal properties. It was found that heating the Pongamia oil between 85°C and 100°C is adequate to bring down the viscosity in close range to diesel. Among the various blends, the blends containing up to 30% (v/v) Pongamia oil have viscosity values close to the diesel fuel. The blend containing of 40% (v/v) vegetable oil has a viscosity slightly higher than that of diesel. The performance and emissions test are conducted with diesel, preheated Pongamia oil, unheated Pongamia oil and blends of Pongamia oil at different loads and constant speed is 1500rpm. BSFC and exhaust gas temperatures for unheated Pongamia oil was found to be higher compared to diesel and heated Pongamia oil. Thermal efficiency is lower for unheated Pongamia oil compared to heated Pongamia oil and diesel. CO2, CO, HC, and smoke opacity were higher for Pongamia oil compared to that of diesel. These emissions are found to be close to diesel for preheated Pongamia oil. For blends, exhaust gas temperature and BSFC are found higher compared to the diesel. Thermal efficiency was also found to be close to diesel for Pongamia oil blends. Emission parameters such as CO, CO2, smoke opacity, and HC were found to have increased with increasing proportion of Pongamia oil in the blends compared to diesel.

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BIOGRAPHY

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