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Production of Bio-diesel from Non-edible (Cotton-seed) Oil

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Abstract: The depletion of fossil fuels and the worst impact on environmental pollution caused of their burning have led to the search for renewable clean energies. Bio-diesel is an alternative to petroleum-based fuels derived from a variety of feed-stocks, including edible and non-edible oils, animal fats, and waste cooking oil. At present, bio-diesel is mainly produced from conventionally grown vegetable oils such as cotton-seed, mahua, sunflower, rapeseed, jatropha, palm and soybean. The cost of bio-diesel is the main obstacle to commercialization of the product. Bio-diesel produced from edible oils is currently not economically feasible. On the other hand, extensive use of edible oils for bio-diesel production may lead to food crisis. Bio-diesel is just one source, but a very important one. The contribution of cotton-seed as a source for bio-diesel production will be of great importance in the coming day. In India cotton-seed plant is a widely grown up termed as a divine tree due to its wide relevance in many areas of study. The present work deals with bio-diesel production from raw cotton-seed oil, which is mono-ester produced using transesterification process. It has high lubricity, clean burning fuel and can be a fuel component for use in existing unmodified diesel engine. Filtered cotton-seed oil (bio-diesel) can be used as a substitute fuel for diesel engines because the properties like calorific value, specific gravity, and viscosity are very much comparable with conventional or normal diesel fuel.

Keywords: Bio-Diesel, Cotton-Seed Oil, Transesterification Process, Non-Edible Oils.

INTRODUCTION

Cotton-seed is a large tree growing about 3 m in height with semi-straight to straight trunk, 0.5 m in girth and spreading branches forming a broad crown, starts fruiting after 3-5 years. From the tenth year onwards, it can produce up to 50 kg of seed annually. The tree has adaptability to a wide range of climatic, topographic factors. It thrives well in dry, stony shallow soils and even on soils having hard calcareous or clay pan, at a shallow depth. The bio-diesel was produced from raw oil using trans-esterification process and the same has been used as a substantial fuel for conventional diesel engine without any changes on engine parts [1]. The bio-diesel was produced and has gained international recognition as an engine fuel additive. It is favored for its low toxicity, high degradability, general reduction of engine emissions and its role in sustainable development [2]. The operation was done for the CI engine fuelled with B-100 with SCR Among the alcohols that can be used in the transesterification process are methanol, ethanol, propanol, butanol and amyl alcohol. Alkali-catalysed transesterification much faster than acid-catalysed transesterification and is most often used commercially

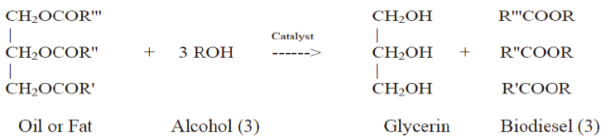

Figure 1: Chemical Equation of Bio-diesel Production

LITERATURE SURVEY

The determination was done on the evaporation constant by using the droplet regression rate data. The neat fuels and fuel blends have been utilized in a test engine with different load conditions to evaluate the performance, combustion and emission characteristics of the fuels. The specific fuel consumption values of these two blends have also been almost the same for the blends, B-25 and B-75. At the highest load, B-0 records the lowest CO volume followed by B-100. From the observed evaporation, performance, and emissions characteristics, it can be suggested that a blend of B-75 canbe optimally used in standard diesel engine settings [4].

The determination was done on the properties of various blends of bio-diesel and conventional fuel. The bio-diesel was produced using the following steps, the first step of acid catalysed esterification reduced the free fatty acid content of cotton-seed oil to below 1%. The optimum combinations of parameters for pre-treatment were found tobe 0.60 volume by volume (v/v) methanol-to-oil ratio, 1% v/v H_2SO_4 acid catalyst and 1-hour reaction time. The next base catalysed transesterification process converted the pre-treated oil to cotton-seed bio-diesel. The optimum combination of parameters for transesterification was found to be 0.24 v/v methanolto-oil ratio, 1.08% weight by volume (w/v) catalyst concentration and 34 min reaction time. This two-step process gave an average yield of 90%. The fuel properties of cotton-seed biodiesel were found to be

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comparable to those of diesel, and conform to the latest American Standards for Testing of Materials Standards [5 & 6].

The production of the bio-diesel from raw cotton-seed oil was done using transesterification process. The yield of the bio-diesel was good. The bio-diesel was produced by using esterification process. The feed-stock, lipid/oil extraction methods were used to generate the bio-diesel [7]. The conversion of bio-diesel was low during reaction at 30°C but increased as the temperature was increased before the decrease beyond 60°C. The maximum yield of 94% was observed at 55°C and the regression equation for yield of cotton-seed bio-diesel against reaction temperature gave R 2-value of 0.931. The result shows that reaction temperature can influence the reaction rate and the ethyl esters (cotton-seed bio-diesel) yield because the intrinsic rate constants are strongly dependent on temperature [8]. the numerous options of non-edible oils as the substantial feedstock's, bio-diesel processing, and effect of different parameters on production of bio-diesel.

The present experimental investigation, the bio-diesel setup has been done. This would combine not only the academic mechanical teachings, but also integrate with therequired industrial skills. This combination is necessary for many real-world applications, and working on this area will hopefully prove helpful in the future.

Objective of the Project

The objectives of this project are to use the example of bio-diesels to demonstrate the way that multiple objectives are developed in energy and environmental policy. Biofuels are promoted as replacements for transport fuels, but biofuel policy is also geared towards socio-economic goals such as agricultural subsidy and strategic goals such as security of energy supply.

Design

Solid works software has been used to create a 3d Model for the bio-diesel setup. The first step was identifying the required dimensions to create the model insolid works, by referring to engineering diagram we constructed the model using diagram in 3D (Fig. 2).

Once the 2-dimensional (2D) diagram is constructed using sketch tools (line, rectangular, construction tools) it was then converted into 3-dimensional model using design tools (extrude, revolve, intrude, shell tools).

After construction of individual parts is done, then assembly section is used to assembly the individual parts using mates' tools (concentric, perpendicular, parallel, tangent tools) once the mates are done then the complete assembly of the bio-Diesel was completed.

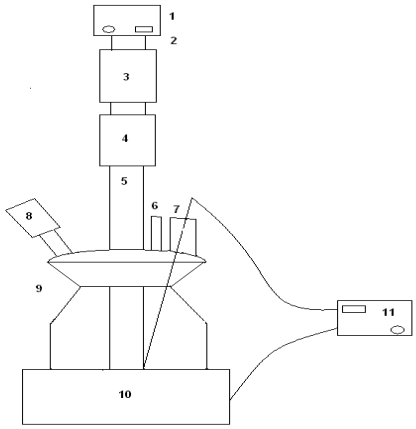

Figure 2: Line-Diagram of Bio-Diesel setup

Figure 3: Experiment Conduction

METHODOLOGY

Bio-diesel production is the process of producing the bio-fuel, bio-diesel, through the chemical reactions of transesterification and esterification. This involves vegetable or animal fats and oils being reacted with short-chain alcohols (typically methanol or ethanol).

The alcohols used should be of low molecular weight.

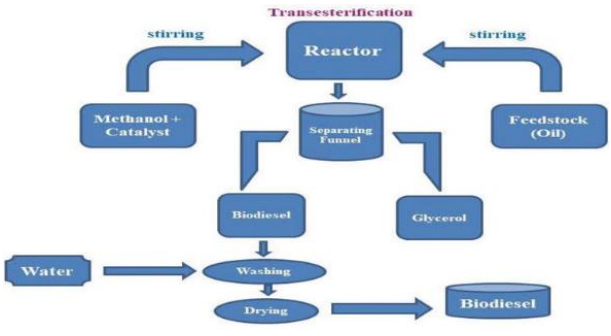

Figure 4: Production of Bio-diesel

CONCLUSIONS

Bio-diesel is a domestic fuel alternative and can contribute to a more stable supply of energy. The bio-diesel fuel production process has evolved considerably to minimize the original problems with viscosity. Today,

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bio-diesel is an increasingly attractive, non-toxic, bio-degradable fossil fuel alternative that can be produced from a variety of renewable sources. cotton-seed oil has potential as an alternative energy source.

But it is not possible for oil alone to solve dependency on foreign oil within any particular time frame. Significant commitment of resources would require increasing production of cotton-seed oil. These needs are being met with recent advances in instrumentation technology. The emphasis should be made to invest in agriculture sector for exploitation of existing potential by establishing model seed procurement centre's, installing pre-processing and processing facilities, oil extraction unit, transesterification units etc. The organized plantation and systematic collection of cotton-seed oil, being potential bio-diesel substitutes will reduce the import burden of crude petroleum.

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