

INFLUENCE OF NANO ADDITIVE ON PERFORMANCE AND EMISSION CHARACTERISTICS OF A DIESEL ENGINE RUNNING ON NEAT GARCINIA INDICA OIL BIODIESEL

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Keywords:

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Introduction:

In the growing world the importance or the basic requirement of the energy has created a demand towards the overall development of society. The term energy not only considered as a resource; it plays a major role in day-to-day activities of growing world. In recent surveys it is identified that the major energy resources are derived from fossil fuels where liquid fuels are the byproduct of the fossil fuels which are non-renewable. Biodiesel the term itself speaks about biological improvement, which is one of the alternative resources for the production of power and energy. The level of toxic contents in biodiesel is less as compared to the petrol, diesel oil. Therefore, in current situation the use of biodiesel has received number one position towards petrochemical oils. Therefore, oil seeds, animal fat are utilized for the production of biodiesel. The prepared biodiesel is blended with the diesel which can improve the fuel properties, and can increase performance, lower the emission which can improves the environmental condition by reducing hazardous effects.

Objectives:

1. Extraction of oil using solvent extraction process
2. Characterization of seed oil as per ASTM standards
3. Extraction of Biodiesel from Esterification Process
4. To study the various fuel properties of the extracted biodiesel
5. Preparation of different blends with suitable nano additive (Silver Oxide)
6. To study the performance, combustion, and exhaust characteristics of direct injection diesel engine fueled with blend of Garcinia Indica seed oil with conventional diesel and solid nanoadditives

Methodology:

1. **Collection of garcinia indica fruits:** The Garcinia Indica fruits are collected when they are in season. It contains 5-8 seeds. Generally, these fruits are found in riversides and forestlands, but it can also be grown in places with low rainfall.
2. **Decorticating and drying of Seeds:** Decorticating is the process of removing the outer layer or coating of the fruit to obtain the seeds. The seeds obtained are dried under the sun or dried in an oven at 40°C.
3. **Extraction of oil:** The solvent extraction method will be used to extract oil from the seeds. In this method, the packed seed powder is placed inside the solvent extractor in the presence of catalyst (Hexane) at 55°C. After completion of 3-4 cycles the oil and hexane mixture is obtained. Through condensation process hexane is separated and pure oil is obtained.
4. **Calculating kg of oil per kg of Seed**
5. **Characteristics of Oil:** Finding of free fatty acid level, fatty acid distribution and moisture content. Finding the fuel properties of oil such as flash point, fire point, viscosity, density, calorific value.
6. **Production of Bio Diesel:** Biodiesel can be obtained by transesterification or esterification process. Transesterification is a single stage process where as esterification is a two-stage process. The selection of process depends on free fatty acid (FFA) level. If FFA level is less than 4% then proceed with transesterification else esterification is carried out.
7. **Preparation of Biodiesel and its Conventional Diesel oil Blends:** Two batches of biodiesel blends with and without nano additives are prepared. Magnetic stirring, Ultrasonicator is used to prepare different blends such as B10, B20, B30, B40 and similar blends using nano additive Silver Oxide (Ag_2O).
8. **Investigation of fuel Properties of Biodiesel**
9. **Performance Evaluation:** Performance characteristics like BSFC, BP, BTE, combustion, and emission characteristic study of biodiesel and its conventional diesel oil blend.



Garcinia Indica tree



Garcinia Indica fruit



G I seed



Seed powder



Solvent Extraction



G I oil



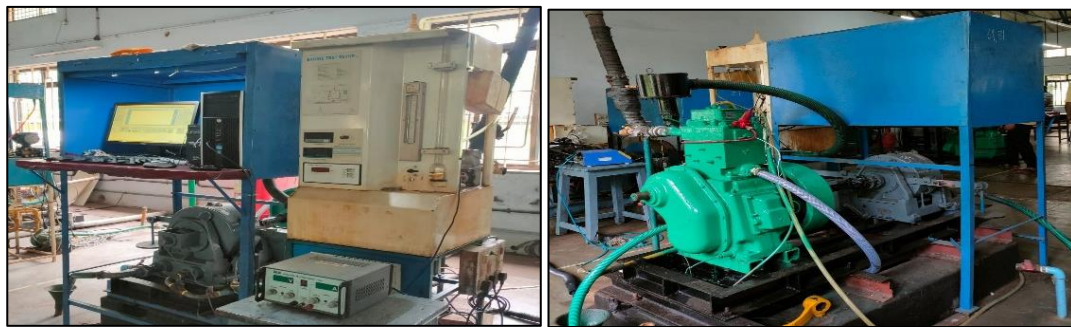
Esterification process



Acid layer separation



Soap water separation



Performance and Emission testing



Biodiesel blends

Conclusion:

1. Garcinia indica seed oil was extracted by solvent extraction method which gives 400-420 ml of oil per kg of seed.
2. The biodiesel is prepared based on esterification (Two stage) process since free fatty acid level of the oil is 12.5%.
3. Esterification reaction was performed with Conc. H_2SO_4 and with Methanol allowed for reaction up to 90 minutes in hot plate with magnetic stirrer and then carried with the transesterification.
4. The biodiesel blended with diesel at different proportions (B10, B20, B30, B40) and blends with nano-additive Silver Oxide (B10Ag₂O, B20Ag₂O, B30Ag₂O, B40Ag₂O) and their performance and emission characteristics were studied.
5. The density, viscosity, flash and fire points of biodiesel blended fuels are slightly higher than diesel fuel.
6. All biodiesel blends resulted with higher BSFC and lower BTE than diesel fuel.
7. The specific fuel consumption of the biodiesel increases with the increase in blended proportion for all the test in different loading conditions.
8. At all engine loading conditions biodiesel blends resulted with lower emission of CO and HC and increase in percent of NO_x.
9. Based on above results garcinia indica seed oil was found to be powerful biodiesel for diesel engine.

Scope for future work:

1. Pyrolysis method can be implemented for production of the biodiesel.
2. Micro oven assisted transesterification can be utilized to reduce the biodiesel production time.
3. Different nano additives can be added for the different proportions of the biodiesel blends