

Investigation on Performance Test of a CI Engine using Fish Oil and Pongamia Oil as a Biodiesel

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ABSTRACT: The methyl esters of vegetable oils, known as biodiesel are becoming increasingly popular because of their low environmental impact and potential as a green alternative and eco-friendly fuel for diesel engine and they would not require significant modification of existing engine hardware. A large volume of fish wastes is produced on a daily basis in the Indian sub-continent. This abundant waste source could serve as an economic feedstock for bioenergy generation. In the present study, oil extracted from discarded fish parts was used for high quality biodiesel production. Fish oil Methyl Ester or Fish oil biodiesel is extracted from crude fish oil by the process called as “Transesterification”. Experiment has been carried out to study various properties of fish oil and pongamia oil, such as Calorific value, Flash point, Fire point, Viscosity etc. For different blends (i.e. B10, B20, B30,B100)

KEYWORDS: Biodiesel, Methyl Ester, Transesterification Blend And C I Engine

I. INTRODUCTION

Non edible oils are considered as good alternatives to diesel as their properties are close to diesel. Thus, they offer the advantage to be used in existing diesel engine without any engine modifications. They have a reasonably high cetane number. The flash point of non edible oils is high and hence it is safe to use them. Non edible oils typically have large molecules, with carbon, hydrogen and oxygen being present. They have a structure similar to diesel fuel, but differ in the type of linkage of the chains and have a higher molecular mass and viscosity.

Around 30-40 % of fish is consumed fresh whereas, 60-70 % is being processed for human consumption and other purpose. However, not all parts of fish are eaten and substantial parts are discarded. The discarded fish parts include caudal fin, anal fin, pelvic fin, dorsal fin, operculum, overlapping scales, and eye. Therefore, the subcontinent regions worldwide have a vast potential for generation of value added products from fish wastes

Pongamia Pinnata found as one of the most suitable non edible oil plant species in India due to its good fixing ability and not grazable eatable by animal. It can be grown in water logged, saline and alkaline soil, waste land, fellow land and can withstand harsh agro climates. It is a medium sized evergreen tree with spreading crown and a short bole. The tree is planted in for shade and grown as ornamental tree. The seed contain 30% - 40% oil.

II. RELATED WORK

“Performance Analysis of CI Engine using Pongamia Pinnata Biodiesel as an Alternative Fuel” Biodiesel is typically blended with diesel fuel in formulations referred to as B-2 (2% biodiesel and 98% diesel), B-5 (5% biodiesel and 95% diesel), B-20 (20% biodiesel and 80% diesel). Blends of 20% biodiesel and lower can be used in diesel equipment without any modification in diesel engine. Biodiesel can also be used in its pure form (B-100),

Experiments were performed on Kirloskar AV1 stationary single cylinder four stroke diesel engine of maximum power 3.7KW and at constant speed 1500 rpm. CO and HC emissions were observed to be less for B-10 and B-20, NO_x emission decreased by 39% for B-10 and 28% for B-20 compared with diesel. Experiments were conducted on 10.3KW single cylinder water cooled direct injection diesel engine. Based on the performance and emission authors reported that the blend B-10 was selected for long term use

“Fast Synthesis of high quality Biodiesel from Waste Fish Oil by Single Step transesterification” numerous attempts have been made to explore potential feedstocks containing substantial which could also lead to economic production of biodiesel. Among those, microalgae, waste cooking oil (WCO) and animal and fish fats/oil waste have attracted a great deal of attention for such resources do not trigger competition with food resources. Fish is widely consumed world-wide because of high nutritional value in particular omega-3 fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). Fish oil has also been found of wide applications such as medicinal uses (Eslick et

al. 2009). Around 30-40 % of fish is consumed fresh whereas, 60-70 % is being processed for human consumption and other purpose.

III. BIODIESEL

3.1 Pongamia Seed

The leaves are soft, shiny burgundy in early summer and mature to a glossy, deep green as the season progresses. Flowering starts in general after 4-5 years. Cropping of pods and single almond sized seeds can occur by 4-6 years and yields 9-90 kg's of seed. The yield potential per hectare is 900 to 9000 kg/hectare.



Figure 1: Pongamia tree and seeds

3.2 Waste Fish Oil

According to the Food and Agriculture Organization (FAO), in 2005 the estimated world fish production was around 142 MT. Approximately 75% of this production is used for direct human consumption. The remaining 25% is destined for non-food products. Fish oil extracted from marine fish is rich in omega-3 poly-unsaturated fatty acids.



Figure 2: Fish wastes

3.3 Transesterification Process

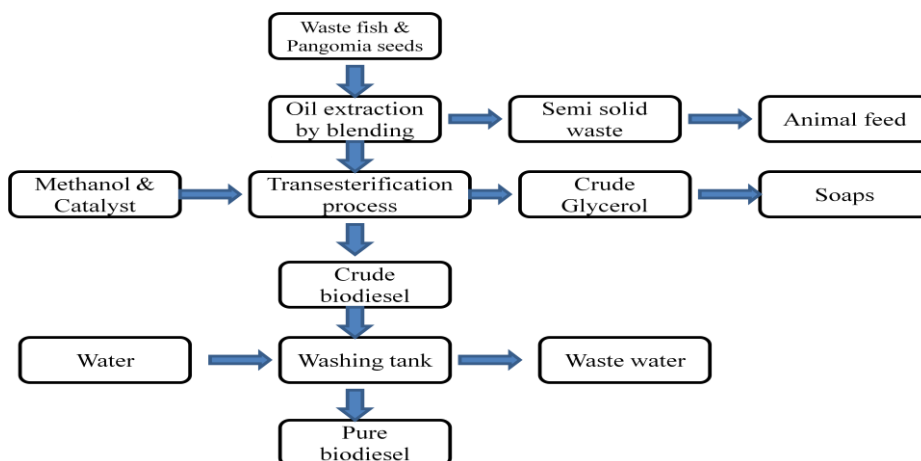
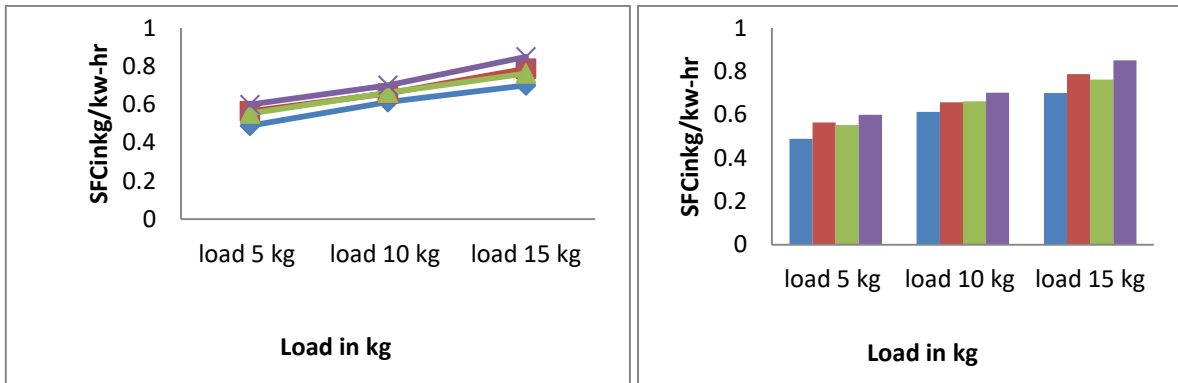


Figure 3: Block diagram Transesterification Process

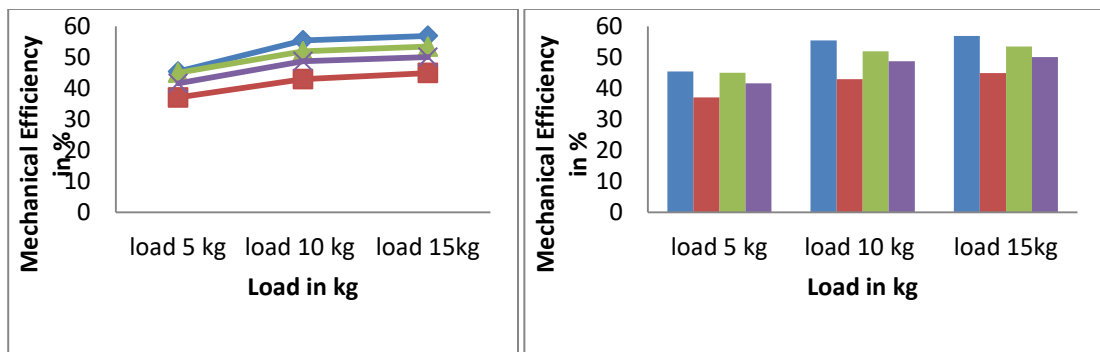
IV. EXPERIMENTAL RESULTS

4.1 SFC v/s Load



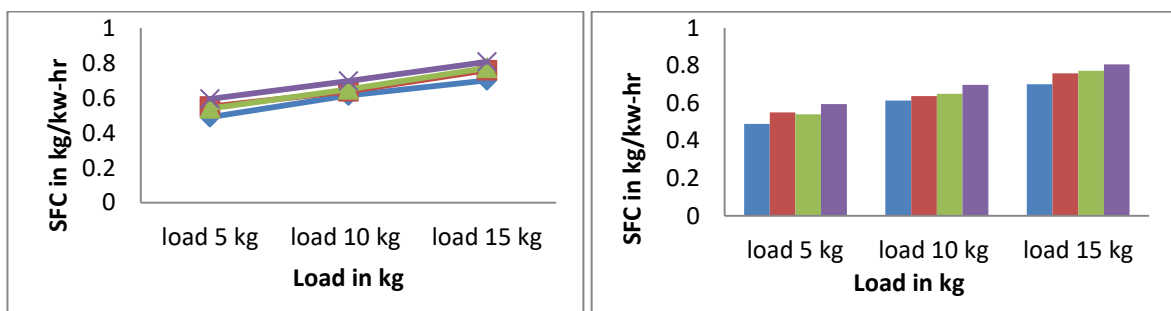
From the graph it can be seen that as the load increases with the integral of 5kg gradually SFC (specific fuel consumption) also increases. SFC of diesel is very less compare to other blended biodiesel. SFC of B20 biodiesel is better than B10 and B30 blends.

4.2 Mechanical efficiency v/s Load



From the graph it can be seen that as the load increases with the integral of 5kg gradually ME (mechanical efficiency) also increases. ME of diesel is very high compare to other blended biodiesel. ME of B20 biodiesel is better than B10 and B30 blends.

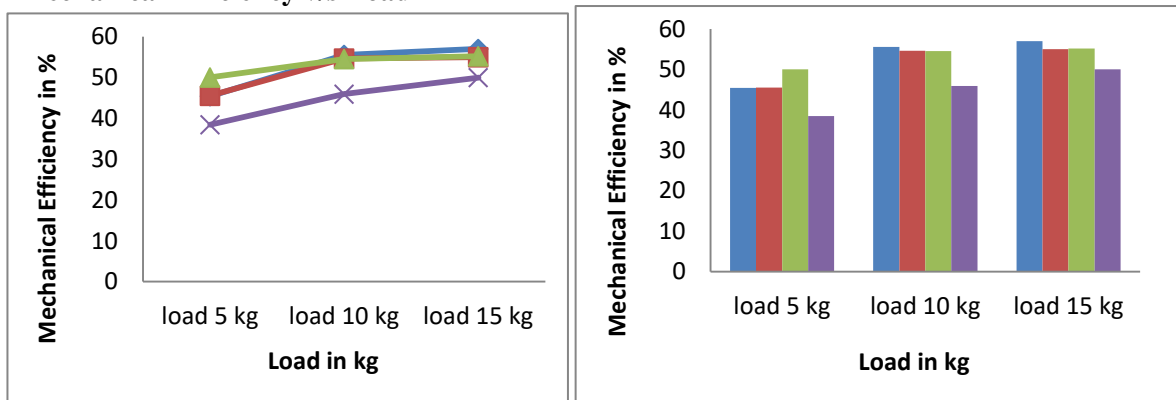
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From the graph it can be seen that as the load increases with the integral of 5kg gradually SFC (specific fuel consumption) also increases. SFC of diesel is very less compare to other blended biodiesel. SFC of B20 biodiesel is better than B10 and B30 blends. B30 biodiesel has very high fuel consumption.



4.4 Mechanical Efficiency v/s Load



From the graph it can be seen that as the load increases with the integral of 5kg gradually ME(mechanical efficiency) also increases. ME of diesel is very high compare to other blended biodiesel. ME of B20 biodiesel is better than B10 and B30 blends. ME of B30 biodiesel is very less.

V. CONCLUSION

The cost of biodiesel is more than petroleum diesel due to non availability of sources in abundance. General awareness of biodiesel and increased plantation of pongamia and other oil yielding in crops will be the solution for non-availability. Fish waste, vegetable wastes, and waste cooking oil etc can also be used for oil production.

Experiments were conducted for different percentage of blends of pongamia biodiesel and fish oil biodiesel with diesel at various blends ratio. Experimental investigation on the performance parameters and exhaust gas temperature of the engine were recorded. B20 pongamia oil and B20 fish oil gives efficiencies very near to the diesel. Properties of these blends are also similar to the diesel value.

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