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Production of Alternative fuel from Arecanut Husk

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Abstract
The world is confronted with twin crisis of fossil fuel depletion and environment degradation. The indiscriminate extraction and consumption of fossil fuels has led to reduction in petroleum reserves. Petroleum based fuels are obtained from limited resources. These finite reserves are highly concentrated in certain region of the word. Therefore, those countries that do not have are facing a foreign exchange crisis, mainly due to the import of crude petroleum oil. Hence it is necessary to look for alternative fuels. Which can be produced from materials available within the country? In the present scenario, agricultural and food waste is increasingly being considered a valuable resource. The fuel properties namely flash and fire point, kinematic viscosity etc, were studied. It was found that the properties were quite comparable to the properties of the petroleum fuel. By using agricultural waste to produce bio-ethanol, it reduces the cost of production and environmental impact related to the disposal of wastes.

Keywords: Areca Husk, Bio-fuel, Esterification, Distillation.

Introduction
Arecanut is the species of palm which grown in much of tropical regions. Asia and part of East Africa. The palm is believed to have originated in Philippines and it is also grown in India. This species having many names as areca palm, betel palm, Indian nut, etc. areca catechu is a medium sized and palm tree growing straight to 20cm tall, with a trunks 10-15cm India meter. areca is used for in chewing purpose and it is cultivated in all over world .In India areca cultivation is mainly based on the formers, and also areca can be traditionally used crop. In Arecanut then there are two part there are inner and outer part, the inner part is consist of areca seed, and outer is covered fibrous layers. And only inner seeds can be used for all purposes, but outer layer can be wasted. Arecanut seed can be prepared by boiling and drying process after it can be send to market for sale Cellulosic ethanol produced from various lignocelluloses materials has the potential to be a valuable substitute for present day’s fuel crisis. Lignocelluloses biomass, which is most abundant and low-cost biomass world over, can be used as raw materials for production of fuel ethanol.

Bioethanol can be produced from any plant material that contains glucose such as sugarcane, corn, sugar beet and other cereals such as maize and burley (Behera et al., 2010). Over the course of development, ethanol has been produced from a variety of feed stocks such as bagasse, miscanthus, sorghum, grain sorghum, switch grass, reed canary 10 grass, cord grasses, hemp, kenaf, potatoes, sweet potatoes, cassava, sunflower, fruits, molasses, Stover, wheat and Jerusalem artichoke (Behera et al. 2010; Hossain et al., 2009; Staniszewski et al., 2007; Sun and Cheng, 2002; Wen et al., 2004; Zayed and Meyer, 1996).

Ethanol Blended Petrol Program

Currently, ethanol for EBP program is coming from molasses route as a by-product of sugar Industry. At the present levels of cane and sugar production (about 350 MMT & 26-28 MMT per annum respectively), the maximum quantity of molasses available is about 13 MMT, which is sufficient to produce about 300 crore litres of alcohol/ethanol. Currently, C- Heavy Molasses is being used to produce alcohol/ethanol. Adoption of B- heavy Molasses route for ethanol production will be encouraged as per availability of sugar

Materials and Methods

Collection and milling of Arecanut husk

Arecanut husk samples were collected from the local farmer in Hosanagar region, Karnataka, India and cleaned. Moisture content was recorded and stored in an appropriate condition. The Arecanut husk samples were sun dried and powdered sequentially using flour mill to obtain fine sized particles.

Areca husk sample

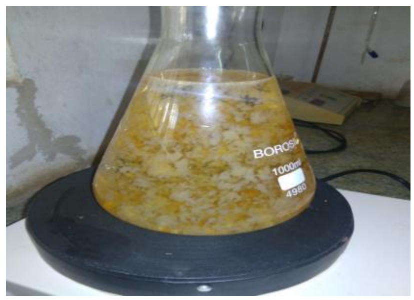
Pre-treatment on the Arecanut husk raw material Acid hydrolysis

50 gram of the raw material was weighed into 1liter conical flasks and 150 ml of 1N sulphuric acid was added to the conical flask. The flasks were covered with Aluminum foil and heated for 30 min on boiling water bath. The flask was allowed to cool and filtered. And 150 ml of dilute sulphuric acid is mixed and again heated up to 90 minutes after cool the pH was adjusted to 5. The total, reducing and non reducing sugar content of pretreated raw materials was estimated.

Acid Hydrolysis process

Alkaline hydrolysis
50 gram of dried sample was weighed into 2 liter conical flask and 550 ml of 0.25 M Sodium hydroxide solution was added to the conical flask. The flask was left for two hour, after which the mixture was neutralized with 0.1 M Hydrochloric acid to a pH of 5. The flask was allowed to cool at room temperature and filtered. The total reducing and non- reducing sugar content of pre-treated raw materials was estimated.

Fermentation Process
Fermentation is chemical process by which molecules such as glucose are broken down anaerobically. More broadly, fermentation is the foaming that occurs during the manufacture of wine and beer, a process at least 10,000 years old. French chemist and microbiologist Louis Pasteur in the 19th century used the term fermentation in a narrow sense to describe the changes brought about by yeasts and other microorganisms growing in the absence of air (anaerobically); he also recognized that ethyl alcohol and carbon dioxide are not the only products of fermentation. Fermentation of sample was done at a room temperature. The fermentation can be done by adding baker yeast in the sample. The yeast can be added in a proper concentration 1.2 gm respectively. The sample was placed at a 30 C for 92 hours.



Fermentation process

Distillation Process
After fermentation the sample were ready for the distillation. The distillation was done in the distillation assembly for about 8 hours. The distillation can be held twice in order to optimize the production of bio ethanol in the final product.

Distillation process

Investigation of Fuel Properties

In this work, the characteristic fuel properties of methyl ester of Areca husk (E100) and blend with petrol in the proportion of 10:90(E10), 25:75(E25), 50:50(E50), and 75:25 (E75) respectively have studied. The characteristic fuel properties of methyl ester blend have found be very near to petrol.

Show the characteristics fuel properties of Areca Bioethanol blend and Petrol

S.NO	PARAMETER	PETROL	ARECA FUEL
1	**Calorific Value in KJ/Kg**	48000	29706
2	**Flash Point in °C**	44	16.73
3	**Fire Point in °C**	49	21
4	**Kinematic Viscosity in CSt**	2.99	1.3
5	**Specific Gravity**	0.7269	0.771
6	**Density in Kg/m^3**	729.8	777.1

Results and Discussions

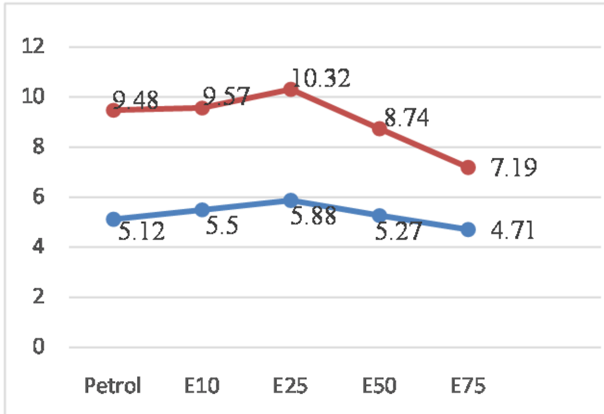
Engine Test and Performance

The Device which convert heat energy into mechanical energy are called heat engine the conversion of chemical energy of fuel into available energy is success; The degree of success is based on brake mean effective presser specific fuel consumption and specific output Etc. The engine performance can be obtained by running an engine with constant speed and fix the throttle to an accurate position.

Engine setup

Brake Thermal Efficiency

Thermal efficiency of the engine is defined as the ratio of output to the energy supplied by the combustion of fuel. If the output is based on the indicated power is known as indicated thermal efficiency and if the Output is based on brake power it is known as brake thermal efficiency.



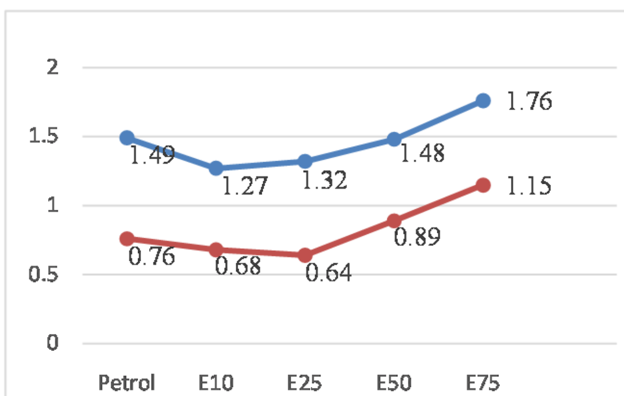
Brake Thermal Efficiency of different sample

The brake thermal efficiencies of different blends of the Bioethanol prepared using cocoa pod for different load conditions can be seen in the above figure and table. The brake Thermal efficiency of the blend E10 is seen to be higher when compared to the other blends and it is also seen to be higher than that of petrol, whereas the brake thermal efficiency of the blend E25 can be seen to be very close to that of petrol.

Specific Fuel Consumption

Specific fuel consumption is defined as the amount of fuel consumed per hour per unit power developed. It is denoted by SFC. It is a comparative parameter that shows how efficiency of an engine is converting fuel in to work.

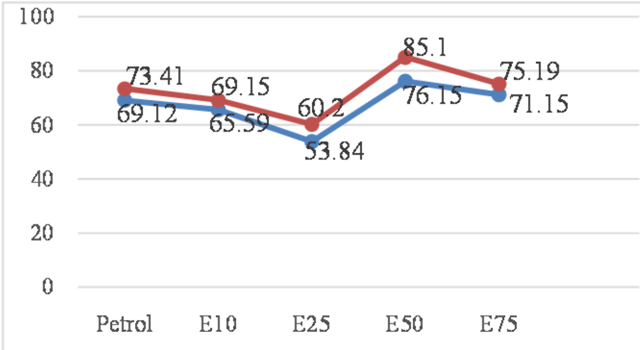
Specific Fuel Consumption, **SFC= mf/BP**



Specific fuel consumption of different fuel sample

Volumetric Efficiency

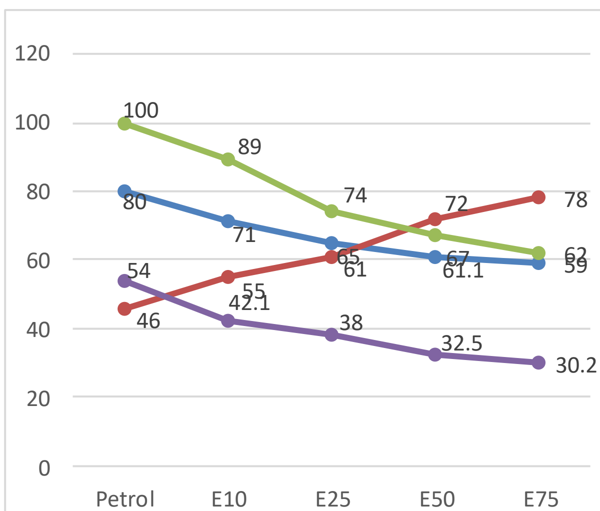
Volumetric efficiency (VE) in internal combustion engine engineering is defined as the ratio of the mass density of the air-fuel mixture drawn into the cylinder at atmospheric pressure (during the intake stroke) to the mass density of the same volume of air in the intake manifold. The term is also used in other engineering contexts, such as hydraulic pumps and electronic components.



Volumetric Efficiency of different fuel samples

Emission Testing

An emission test cycle is a protocol contained in an emission testing to allow repeatable and comparable measurement of exhaust emissions or different engines or vehicles. Test cycles specify the specific conditions under which the engine or vehicle is operated during the emission test. There are many different test cycles issued by various national and international governments and working groups. Specified parameters in a test cycle include a range of operating temperature, speed, and load. Ideally these are specified so as to accurately and realistically represent the range of conditions under which the vehicle or engine will be operated in actual use. Because it is impractical to test an engine or vehicle under every possible combination of speed, load, and temperature, this may not actually be the case.



Emission percentage of different samples

Conclusion

Alternative fuels for SI engine have become increasingly important due to diminishing petroleum reserves and awareness of the increased environmental problems. The use of "renewable fuels" may be the key to overcome these problems. The objective of the present work was to analyse the suitability of blend of Bioethanol-petrol as an alternative SI engine fuel. The most important advantage of this Bioethanol is that it is a renewable. The engine performance test was carried out on SI engine using blend of 10% ethanol-90%

petrol and 25% ethanol-75% petrol while pure petrol was used as a reference fuel. The experimental results show that engine performance with blend was found to be slightly poorer in comparison with reference fuel. From the present experimental study of alternative engine fuel, it can be concluded that a SI engine can be successfully operated with blends of Bioethanol-petrol without any major engine modification and operational difficulty .Conclusion can be drawn based on the SI engine performance and emission characteristics of Bioethanol-petrol blends and petrol in a multi cylinder spark ignition engine without any modification in the engine at various engine speeds. The result may conclude as:

- The use of ethanol as a fuel additive to gasoline causes in the improvement in engine performance and exhaust emissions.
- Since ethanol has lower calorific value so the brake specific fuel consumption of the ethanol-gasoline blends are found to be higher than gasoline.
- Brake thermal efficiency of the ethanol-gasoline blends is found to be higher in comparison to gasoline.
- Due to oxygen contain by ethanol-gasoline blends, the exhaust gas temperature of the blends are found to be lower in comparison to gasoline.

From the results, it can be concluded that ethanol blends are quite successful in replacing pure Petrol in Spark Ignition Engine. Results clearly show that there is an increase in Specific Fuel Consumption because of low calorific Value of ethanol than petrol and also increase in the mechanical efficiency and Brake thermal efficiency. So from the curves it is seen that 10% and 25% ethanol blended petrol is the best choice for use in the existing Spark Ignition Engines without any modification to increase Efficiency. A little consideration has to be taken on material used as maximum pressure inside cylinder is increased by blending.

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