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Study of Physical Properties of Cashew Nut Shell Oil Bio Diesel Blends

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*Abstract -**The modern scenario reveals that the world is facing energy crisis due to dwindling source of fossil fuels. Nowadays biodiesel which is an alternate fuel, is produced from easily available resources like virgin or used vegetable oils, both edible and non-edible. Without any further changes it can be used in compression-ignition (diesel) engines. There is a big demand to produce bio diesel in India and supply of this oil is becoming necessary. In India, as edible oils are less in supply, non-edible seeds of karanja, Jatropha, Mahua and Neem are found as the sources of neat vegetable oil and biodiesel. Plant species, which has a certain amount of oil in their seeds or kernel, have been identified. Cashew Nut Shell Oil (CNSO) is produced from waste shell collected from Cashew Nut Industry by additives and processes. Bio fuels produced are blended with diesel with same percentage of 10%, 20%, 30% and 40%. Properties like fire point, viscosity and calorific value are found. Analyses of properties of blends of bio fuels are done. Dynamic viscosity and Kinematic viscosity both are high CNSO and there is small change in the viscosity with increase in the temperature. Calorific value is more in case of CNSO. CNSO blends can retain their viscosity in high temperature so it will provide lubrication.***

Keywords- Cold press method, Viscosity, Calorific value, Kinematic Viscosity

I. INTRODUCTION

The current methods to produce, convert and consume energy derived from fossil fuels throughout the world are not sustainable. Due depletion of fossil fuels and increasing the concerns of global warming, there is ever growing urge to develop fuel substitutes that are renewable and sustainable. Biodiesel is well-accepted alternatives to diesel fuel as they are economically feasible, renewable, environmental-friendly and can be produced easily in rural areas where there is an acute need for modern forms of energy. Cashew nut Shell Liquid (CNSO) is a reddish brown viscous liquid, having the honey comb structure of the shell of cashew nut obtained from cashew tree. Cashew Nut Shell Liquid (CNSO) is a versatile by-product of the cashew in industry. The nut has a shell of about 1/ 8 inch thickness inside which is a soft honey comb structure containing a dark, reddish brown viscous liquid. It is called cashew nut shell liquid, which is the fluid of the cashew nut. It is often considered as the better and cheaper, material for unsaturated phenols. C.N.S.O. has innumerable applications in polymer based industries such as friction linings, paints and varnishes, laminating resins, rubber compounding ,resins, cashew cements, polyurethane ,based polymers, surfactants, epoxy ,resins, foundry chemicals and ,intermediates for chemical industry. It offers much scope and varied opportunities for the development of other tailor - made polymers. Studied on extraction and isolation of cashew nut liquid and he found various methods for extraction of cashew nut shell oil like roasting method, hot oil bath method, screw press method, solvent extraction, extraction using supercritical carbon dioxide. Work can be focused on using different solvents and combination of solvents for extraction of CNSO from Indian cashew nut shell, both for Steam roasted shells as well raw cashew nut shells and their yields at different solute to solvent ratios. This enables optimum solute to solvent ratios for extraction of CNSO. Supercritical extraction of Cold extracted CNSO as well as CNSO obtained from Steam extracted shells can also be carried out for recovery of anacardic acid to compare the extent of anacardic acid obtained with that of chemical methods.

II. METHODOLOGY

A. Production of Cashew Nut Shell Oil

Extraction of Cashew Nut Shell oil from cashew nut shell includes open pan roasting, drum roasting, hot oil roasting, cold extraction, solvent extraction, super critical fluid extraction, pyrolysis process, Soxhlet extraction method. The percentage yield of oil varies with the type of extraction process. The Bio-Diesel is extracted from CNSO. It is done by making the CNSO to react with Methanol in the presence of catalyst like KOH which is Potassium Hydroxide. The procedure is to 100 ml of CNSO, 70 ml of methanol and 4gm of KOH is added in room temperature and is stirred well for one hour at room temperature itself. It will take 24 hours to get the bio-diesel. We get 100ml of bio diesel from 100 ml of CNSO.

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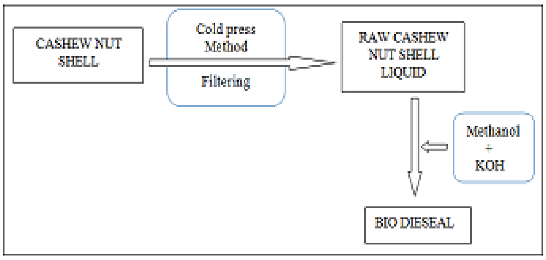

Fig. 1 Extraction of CNSO and Transesterification Process

B. Blending of CNSO with Diesel

The produced biodiesel is blended with the regular diesel in different percentages. The blending process was carried out with the help of measuring jar and beaker. The approximate amount of diesel and biodiesel were added to the beaker and then transferred into the bottle. The bottles were shaking well and were allowed to stay upside down to ensure proper mixing of fuels. The bottle were stored in dry place and kept still for the 24 hours. Blends were checked for every 6 hours time intervals for any layer formation. All the blends were stable and passed the 24 hours. Blending is done for CNSO with diesel with percentage of 10, 20, 30, and 40.

C. Investigation of Properties

The following properties are found for blends of CNSO with diesel.

1) *Calorific value*: A bomb calorimeter is a type of constant-volume calorimeter used in measuring the heat of combustion of a particular reaction. Bomb calorimeters have to withstand the large pressure within the calorimeter as the reaction is being measured. Electrical energy is used to ignite the fuel; as the fuel is burning, it will heat up the surrounding air, which expands and escapes through a tube that leads the air out of the calorimeter. When the air is escaping through the copper tube it will also heat up the water outside the tube. The change in temperature of the water allows for calculating calorie content of the fuel.
2) *Viscosity**:*** The redwood viscometer consists of vertical cylindrical oil cup with an orifice in the centre of its base. The orifice can be closed by a ball. A hook pointing upward serves as a guide mark for filling the oil. The cylindrical cup is surrounded by the water bath. The water bath maintains the temperature of the oil to be tested at constant temperature. The oil is heated by heating the water bath by means of an immersed electric heater in the water bath, The provision is made for stirring the water, to maintain the uniform temperature in the water bath and to place the thermometer record the temperature of oil and water bath. The cylinder is 47.625mm in diameter and 88.90mm deep. The orifice is 1.70mm in diameter and 12mm in length, this viscometer is used to determine the kinematic viscosity of the oil. From the kinematic viscosity the dynamic viscosity is determined.

Fig. 2 Redwood Viscometer

3) *Fire Point*: In the Pensky–Martens closed-cup flash-point test, a brass test cup is filled with a test specimen and fitted with a cover. The sample is heated and stirred at specified rates depending on the material that is being tested. An ignition source is directed into the cup at regular intervals with simultaneous interruption of stirring until a flash that spreads throughout the inside of the cup is seen. The corresponding temperature is its flash point.
4) *Flash Point*: Pensky–Martens closed cup is sealed with a lid through which the ignition source can be introduced periodically periodically. The vapour above the liquid is assumed to be in reasonable equilibrium with the liquid. Closed cup testers give lower values for the flashpoint than open-cup testers (typically 5–10 K) and are a better approximation to the temperature at which the vapour pressure reaches the "lower flammable limit".

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Fig. 3 Pensky Martenz's Apparatus

III. RESULTS AND DISCUSSION

A. Results are taken for the blends of CNSO with diesel.

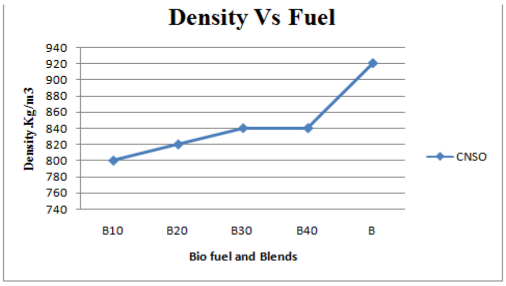

Fig. 4 Density Vs Fuels graph.

Graph shows that density increases with increase in the percentage bio fuels with diesel.

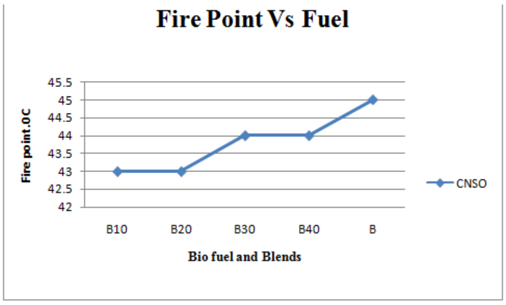

Fig. 5 Fire Point Vs Fuels graph.

Graph shows that fire point increases with increase in the percentage bio fuels with diesel.

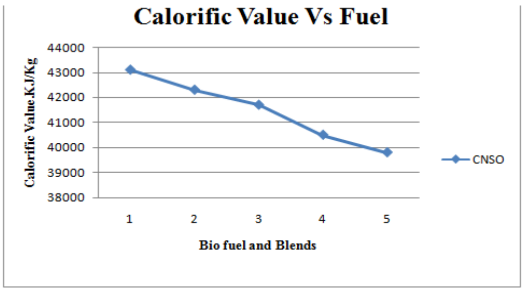

Fig. 6 Calorific Value Vs Fuels graph

Graph shows that Calorific value of blends decreases with increase in the percentage bio fuels with diesel.

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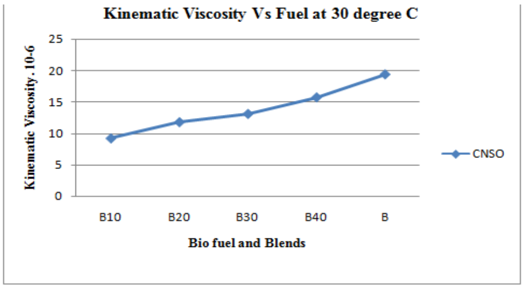

Fig. 7 Kinematic Viscosity Vs Fuels graph at 30^0C

Graph shows that kinematic viscosity increases with increase in the bio fuel with diesel. In graph we can observe that there is a sudden increase in the kinematic viscosity between the blend B30 and B40.

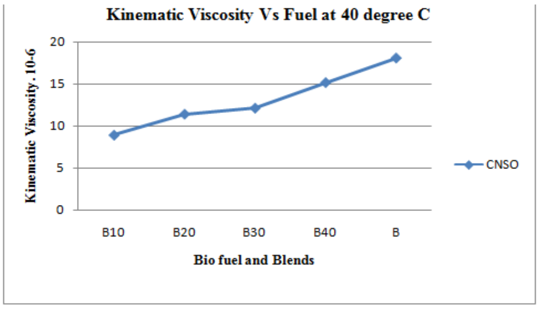

Fig. 8 Kinematic Viscosity Vs Fuels graph at 40^0C

Graph shows that kinematic viscosity increases with increase in the bio fuel with diesel. In graph we can observe that there is a slightly decrease in the kinematic viscosity with increase in temperature.

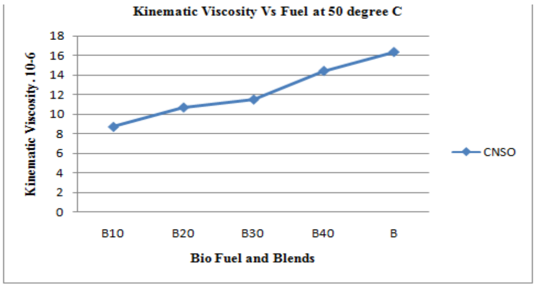

Fig. 9 Kinematic Viscosity Vs Fuels graph at 50^0C

Graph shows that kinematic viscosity increases with increase in the bio fuel with diesel. At 50 degree C the kinematic viscosity deceased rapidly.

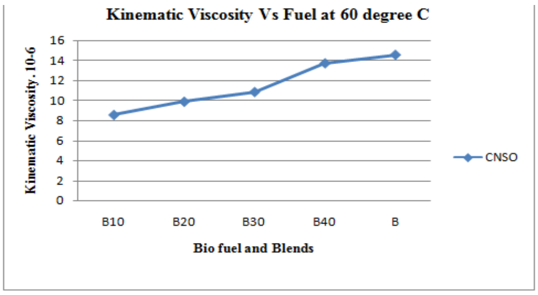

Fig. 10 Kinematic Viscosity Vs Fuels graph at 60^0C

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Graph shows that kinematic viscosity decreased suddenly at 60 degree C compared to the other blends.

Fig 7, Fig 8, Fig 9 and Fig 10 shows increase in the viscosity with increase in blends. It has been observed that CNSO and its blends are having more kinematic viscosity.

IV. CONCLUSION

Bio fuel from Cashew Nut Shell Oil are produced using different processes. CNSO properties satisfies ASTM standards. So Blending is done directly without any additional process. Properties of CNSO is more reactive and also with the increase in the temperature little change in the kinematic viscosity is observed for CNSO. CNSO can be used for high temperature applications as lubricant. B10 blend is having higher calorific value.

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