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Comparative Analysis of Physical, Thermal Characteristics and Quality Testing of Various Biofuels

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Abstract Rise in energy demand, unpredictable diesel fuel prices and fossil fuels-a finite source, will not remain forever draws the attention of researchers looking other alternative sources of energy such as biodiesels, an alternative fuel, is derived from fats of animals and plants. Biodiesel derived from vegetable oils also known as edible oils is one of the alternatives can be used for running internal combustion engines or for other energy requirements. Moreover, these fuels can be added to diesel fuels which will further lower the demand of diesel. The purpose of this study is to analyze experimentally the characteristics of biodiesel made from vegetable oils which includes WVO oil, soybean oil, sunflower oil, palm oil, refined oil and mustard oil while comparing them with each other and with diesel. The properties of various biodiesels are calculated by using standard procedure. Characteristics include density, viscosity, flash point, fire point, calorific value, and base to eliminate acidic content in the oil before processing.

Keywords: Biodiesel, Vegetable oil.

1. Introduction

The Biofuels are produced by using the standard process of transesterification. Vegetable oils can be easily grown in fields hence can be used to produced biofuels. In the recent years Government has indulge more into the renewable or other alternative energy resources as the Government identifies the need of the hour since depletion of natural storage of fossil based fuels.

2. Research Methodology

The research is carried out to evaluate the thermo-physical-chemical properties of the vegetable based oils so that their characteristics can further be used to analyse whether the oils can be used in an automobiles. The Six samples of different vegetable based oils has been prepared in the lab and then testing of various parameters as mentioned in table 1 is performed by using standard procedures in the lab. The Samples results are then comparatively analysed.

Table 1: Oil used and Evaluated Characteristics

Oils Used	Characteristics
• WVO oil • Soya bean oil • Sunflower oil • Palm oil • Refined oil • Mustard oil	• Calorific Value • Soap Content • Flash Point • Fire point • Density • Viscosity

ISSN: 0971-1260
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3. Result and Discussion:

3.1: Amount of base required to eliminating acid content in oil: Using the standard procedure, the observation are depicted in figure 1.It can be seen that Waste vegetable oil (WVO) is required maximum base to neutralize as compared to other biofuels.

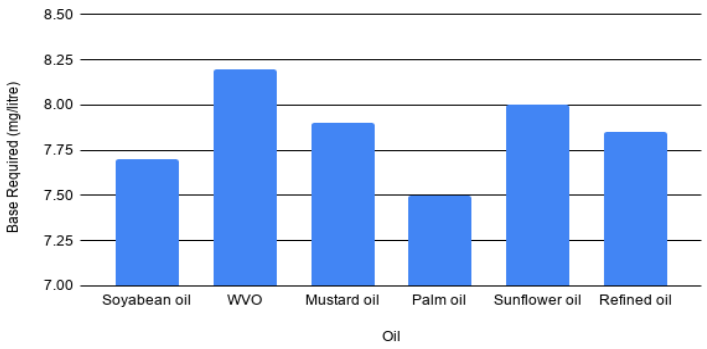

Figure 1 : Base Requirement to neutralize Biofuels

3.2: Density of Biofuels: Using the standard procedure, the observation are depicted in figure 2. It can be seen that Sunflower oil biofuel is having maximum density as compared to other biofuels.

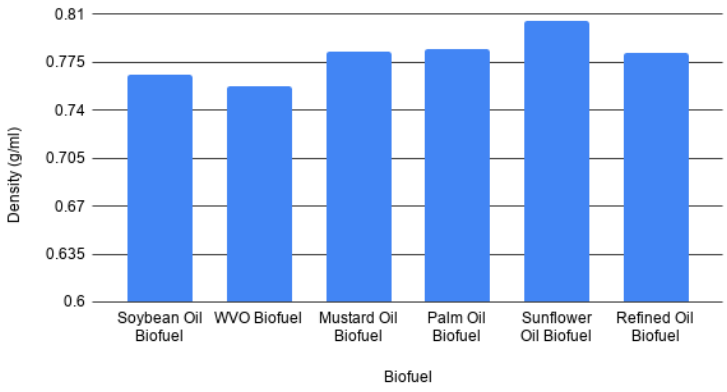

Figure 2: Density of Biofuels

3.3 Soap content: Using the standard procedure, the observation are depicted in figure 3. It can be seen that Waste vegetable oil is having maximum soap content as compared to other biofuels.

ISSN: 0971-1260
Vol-22-Issue-17-September-2019

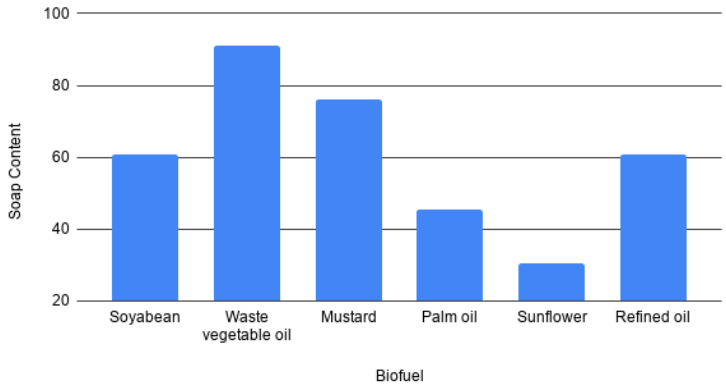

Figure 3: Soap Content of Biofuel

3.4 Viscosity: Using the standard procedure, the observation are depicted in figure 4. It can be seen that sunflower oil is having maximum viscosity as compared to other biofuels.

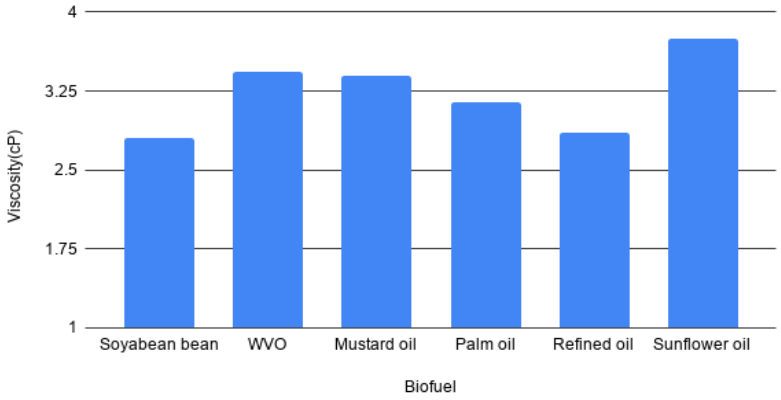

Figure 4: Viscosity of biofuels

3.5 Calorific Value: Using the standard procedure, the observation are depicted in figure 5. It can be seen that WVO is having maximum Calorific value as compared to other biofuels.

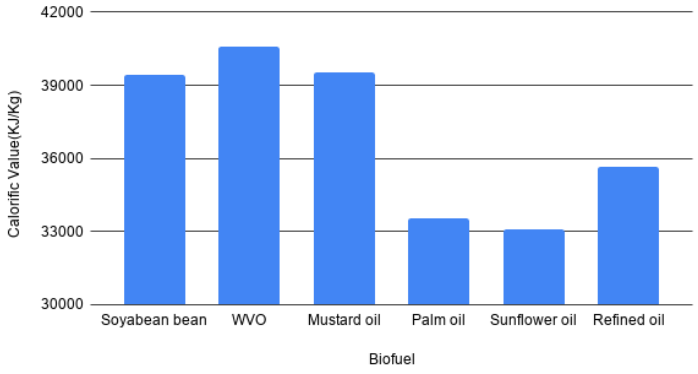

Figure 5: Calorific Value of Biofuels

3.6 Flash Point: Using the standard procedure, the observation are depicted in figure 6. It can be seen that Soyabean oil biodiesel is having maximum flash point as compared to other biofuels.

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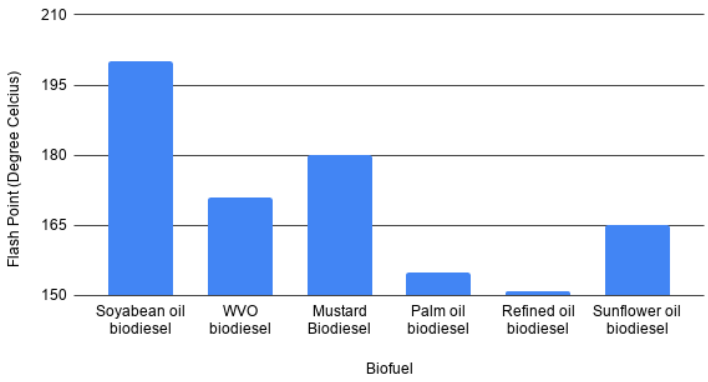

Figure 6: Flash Point of Biofuels

3.7 Fire point: Using the standard procedure, the observation are depicted in figure 7. It can be seen that Soyabean oil biodiesel is having maximum fire point as compared to other biofuels.

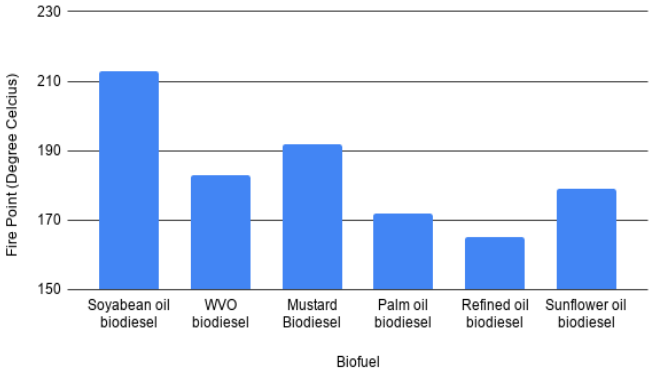

Figure 7:Fire point of Biofuels

4. **Conclusion**: Comparison with the diesel: In figure 9 and figure 10 shows the analytical comparison of diesel with other biofuels prepared from vegetable based oils. It can be seen that

- All biofuels have less calorific value than diesel.
- Soap content is high in biofuels as compared to diesel.
- Flash and Fire point is relatively low for diesel as compared to other biofuels.
- Density of diesel is less as compared to other biofuels.
- Density of diesel for all biofuels and diesel are in range from 0.7 Kg/litre to 0.85Kg/litre.

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Vol-22-Issue-17-September-2019

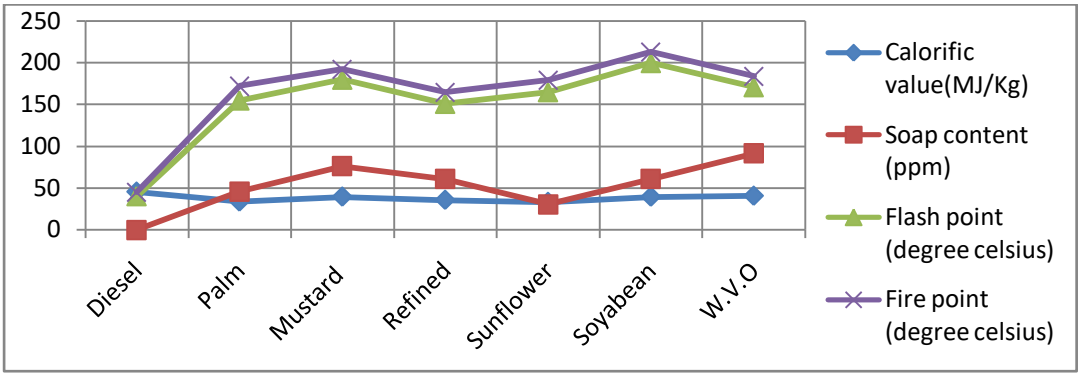

Figure 8: Comparison of Properties of various biofuels (i)

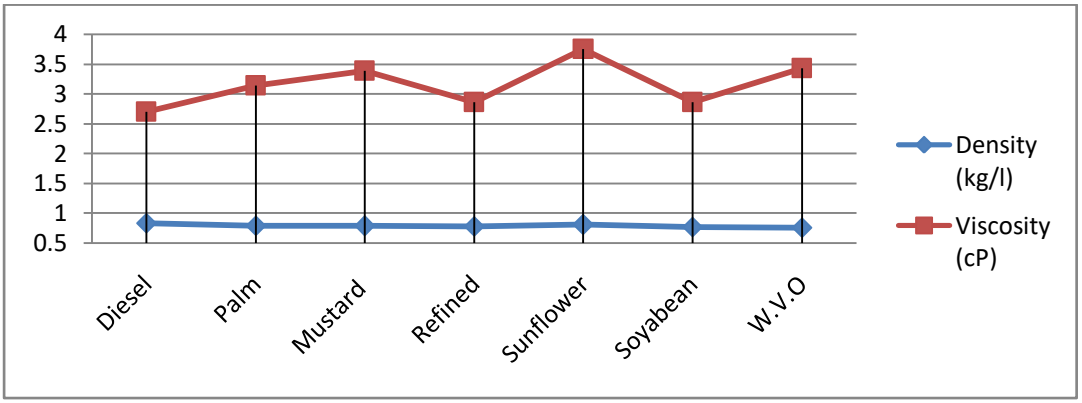

Figure 9: Comparison of Properties of various biofuels(ii)

Reference:

1. Xue, Jinlin, Tony E. Grift, and Alan C. Hansen. "Effect of biodiesel on engine performances and emissions." *Renewable and Sustainable energy reviews* 15.2 (2011): 1098-1116.
2. Van Gerpen, Jon. "Biodiesel processing and production." *Fuel processing technology* 86.10 (2005): 1097-1107.
3. Antolın, G., et al. "Optimisation of biodiesel production by sunflower oil transesterification." *Bioresource technology* 83.2 (2002): 111-114.
4. Ramos, María Jesús, et al. "Influence of fatty acid composition of raw materials on biodiesel properties." *Bioresource technology* 100.1 (2009): 261-268.
5. Hoekman, S. Kent, et al. "Review of biodiesel composition, properties, and specifications." *Renewable and sustainable energy reviews* 16.1 (2012): 143-169.
6. Moser, Bryan R. "Biodiesel production, properties, and feedstocks." *In Vitro Cellular & Developmental Biology-Plant* 45.3 (2009): 229-266.
7. Knothe, Gerhard. "Dependence of biodiesel fuel properties on the structure of fatty acid alkyl esters." *Fuel processing technology* 86.10 (2005): 1059-1070.
8. Benjumea, Pedro, John Agudelo, and Andres Agudelo. "Basic properties of palm oil biodiesel–diesel blends." *Fuel* 87.10-11 (2008): 2069-2075.

ISSN: 0971-1260
Vol-22-Issue-17-September-2019

9. Sorate, Kamalesh A., and Purnanand V. Bhale. "Biodiesel properties and automotive system compatibility issues." *Renewable and Sustainable Energy Reviews* 41 (2015): 777-798.
10. Saxena, Parag, Sayali Jawale, and Milind H. Joshipura. "A review on prediction of properties of biodiesel and blends of biodiesel." *Procedia Engineering* 51 (2013): 395-402.
11. Chang, David YZ, and Jon H. Van Gerpen. *Fuel properties and engine performance for biodiesel prepared from modified feedstocks*. No. 971684. SAE Technical Paper, 1997.
12. Yoon, Seung Hyun, Su Han Park, and Chang Sik Lee. "Experimental investigation on the fuel properties of biodiesel and its blends at various temperatures." *Energy & Fuels* 22.1 (2007): 652-656.
13. Liu, Yun, Hong-ling Xin, and Yun-jun Yan. "Physicochemical properties of stillingia oil: feasibility for biodiesel production by enzyme transesterification." *Industrial Crops and Products* 30.3 (2009): 431-436.
14. Sarma, Anil Kumar, D. Konwer, and P. K. Bordoloi. "A comprehensive analysis of fuel properties of biodiesel from Koroch seed oil." *Energy & fuels* 19.2 (2005): 656-657.
15. de Almeida, Vanessa F., et al. "Biodiesel production from mixtures of waste fish oil, palm oil and waste frying oil: Optimization of fuel properties." *Fuel Processing Technology* 133 (2015): 152-160.