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PREPARATION OF METHYL ESTERS OF KARANJ OIL: IMPORTANT PROPERTIES OF TEST FUELS

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ABSTRACT

Transesterification of karanj oil was done in the laboratory of Dept. of Mechanical Engineering and Dept. of Chemistry. In the transesterification process karanj oil was reacted with methanol in the presence of sodium hydroxide to produce glycerol and fatty acid esters (karanj methyl esters) through batch process. Glycerol was drained off while karanj methyl esters were further treated to remove impurities and to have fuel grade biodiesel. Each batch thus produced was tested for purity.

Keywords: *Transesterification, Karanj Oil, Methanol, Sodium Hydroxide, Biodiesel.*

Introduction

Specific gravities of karanj oil and karanj methyl ester (KME) including their blends with HSD are shown in Fig. 1 and 2 respectively. The specific gravities of the blends were calculated according to the ratio of blended fuels.

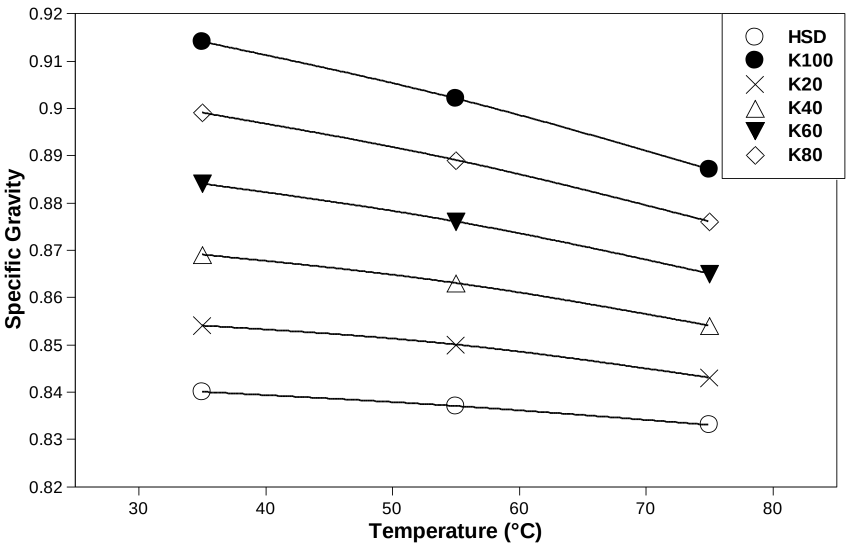

Fig. 1: Effect of temperature on specific gravity of diesel, karanj oil and their blends

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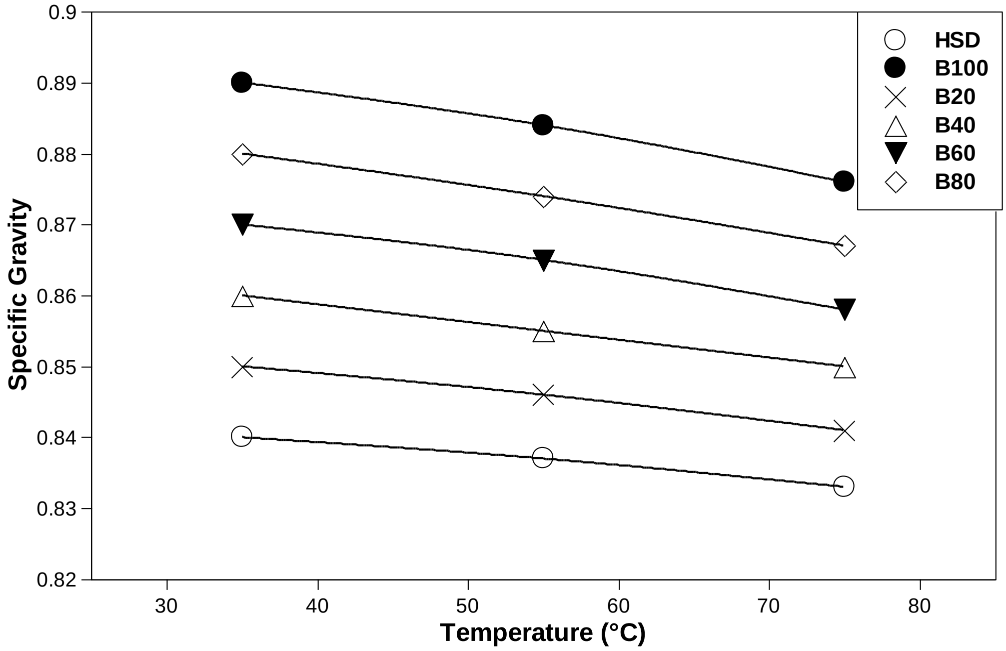

Fig. 2: Effect of Temperature on Specific Gravity of Diesel, KME and their Blends

The higher values of specific gravity of karanj oil and KME as compared to diesel may be attributed to the higher molecular weight.

- **Effect of Temperature on Specific Gravity**

The effect of temperature on the specific gravity of fuel is shown in Fig. 1 and 2. From the figure it is evident that there is a linear relationship between the fuel specific gravity and temperature. As the temperature of the test fuels increased, their corresponding specific gravity decreased. The specific gravity of diesel, KO and KME decreased by 0.83%, 2.95% and 1.57% respectively when the temperature was increased from 35 to 75° C.

- **Effect of Blending on Specific Gravity**

Fig 1 and 2 also represent the effect of blending KO and KME each with diesel on specific gravity. It can be observed from the figures that on increasing the concentration of diesel in KO and KME the specific gravity decreased.

Viscosity

Viscosity of KO and KME (including their blends with diesel) are shown in Fig. 3 and 4 respectively. The higher kinematic viscosity of KO and KME in comparison to diesel may be attributed to greater intermolecular attraction of the long chains of their glyceride molecules and fatty esters respectively.

- **Effect of Temperature on Viscosity**

The effect of change in temperature on test fuel viscosity is depicted in Fig. 3 and 4. It was seen that the kinematic viscosity of fuels decreased with the increase in temperature. The viscosity of K20, B20, B40, B60 and B80 blends met the BIS limit prescribed for Grade A diesel, while that of K40, K60 and B100 blends was within the BIS limit prescribed for Grade B diesel.

- **Effect of Blending on Viscosity**

The effect of blending KO and KME each with diesel at different temperatures is shown in Fig. 3 and 4 respectively. It was observed that with the increase in the concentration of diesel in the blend, the viscosity decreased.

BIS limits of viscosity:

For Grade A diesel - 2.0 to 7.5 cSt at 38 °C

For Grade B diesel - 2.5 to 15.7 cSt at 38 °C

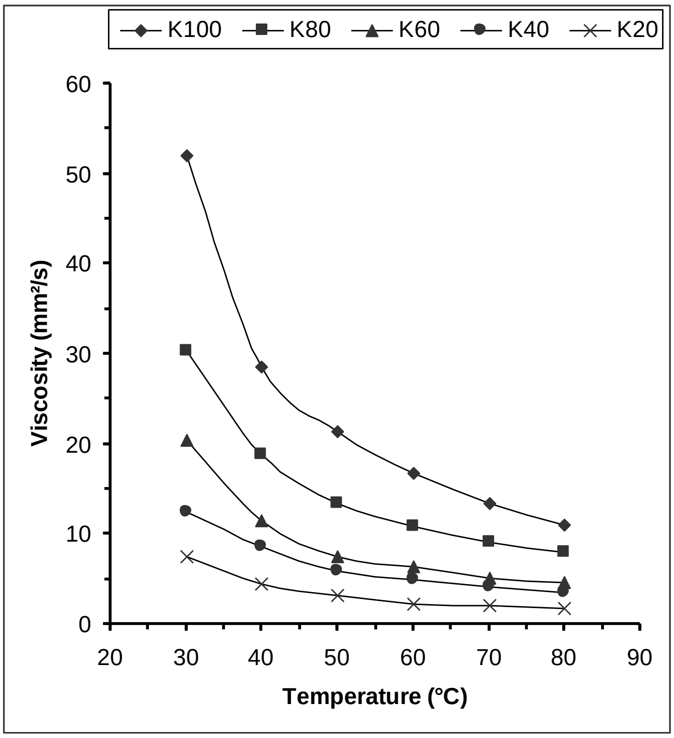

Fig. 3: Effect of Temperature on Viscosity of KO and its Blends with Diesel

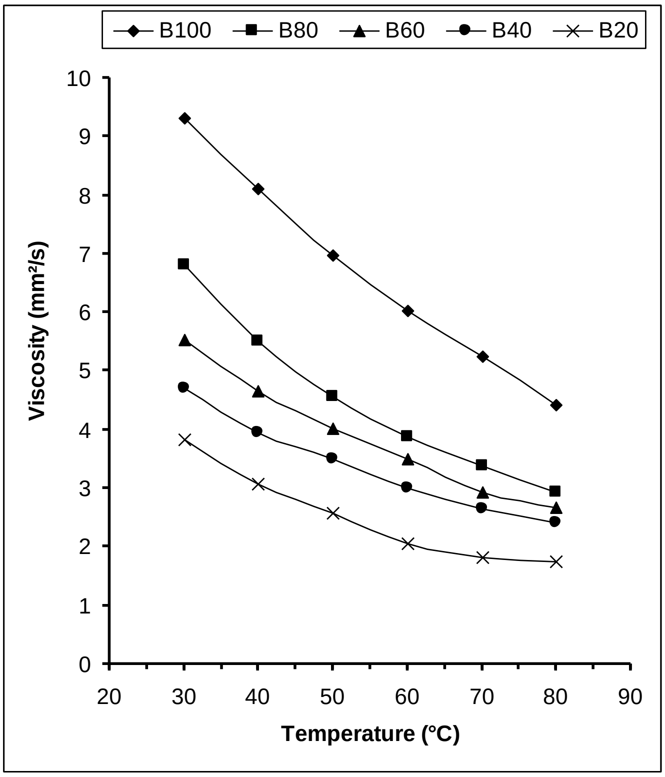

Fig. 4: Effect of Temperature on Viscosity of KME and its Blends

Conclusion

On the basis of the experimental investigations carried out, following salient conclusions can be drawn:

- The methyl esters (biodiesel) thus obtained should be finally heated to remove excess moisture.
- The properties of karanj oil-diesel and KME-diesel blends were comparable to that of neat diesel. Also the viscosity of K20 and B20 blends met the BIS limit prescribed for Grade A diesel.
- Amongst the karanj oil-diesel and KME-diesel blends, K20 and B20 gave the best performance. The performance of the K20 and B20 fuels are more or less similar. Hence, K20 and B20 blends can be successfully used in existing diesel engines in both single fuel and dual fuel mode.
- Operating engine in dual fuel mode resulted in increased CO emissions as compared to single fuel mode operation with the same fuel. Significant lower CO emissions were obtained from B20 and K20 fuels as compared to HSD in single fuel mode. This may be because of lesser amount of available oxygen as, LPG displaces air when inducted with intake air.

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