



The Viscosity Testing on the Blending of HSD with PPO for Eligibility Criteria of Gas Turbine Fuel as the Renewable Energy Solution

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Abstract

The viscosity of vegetable oils palm oil in particular olein is 18 times higher than the viscosity of HSD. Whereas, the viscosity is allowable for the gas turbine engines which is around 0 to 10 CSt at the maximum temperature of 50 °C or when converted to the dynamic viscosity of about 0.78 to 780 mPa.s. In order to meet the gas turbine criteria, so that done the blending between the samples of HSD with PPO and then heated. From the blending of 95 % HSD – 5 % PPO at the temperature range of 30° - 35 °C were obtained the viscosity value with an average of 3,43 mPas. That results show that the viscosity value of the blending between HSD with PPO still meets the standards of eligibility as a gas turbine fuel.

Keywords: Gas turbine; HSD; PPO; temperature; viscosity.

1. Introduction

PPO (Pure Plant Oil) is a fuel derived from vegetable oils. Based on the reference, obtained that the value of viscosity of PPO in 40 °C is range between 30 CSt to 50 CSt. HSD (High Speed Diesel) fuel is coming from fossil oil. The value of its viscosity is range from (2 to 5) CSt at 40 °C.

The content of energy on PPO depending from its type. Basically, PPO has the heat value less than 5 % from the heat value of FUEL diesel.

To avoid the influence of impurities in the process of combustion in the gas turbine engines, PPO must be purified before.

Pure plant oil (PPO) can be mixed with HSD/diesel oil to be used as a fuel gas turbine engine on a particular mixture. After filtration, the blend of fuels need to be heated to reduce viscosity of its alloy so that the fog process that occur in the combustion chamber can be perfect.

The burning using PPO is very useful for the environment because the PPO that replaces diesel FUEL/HSD system resulted in becoming neutral carbon.

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2. Methods

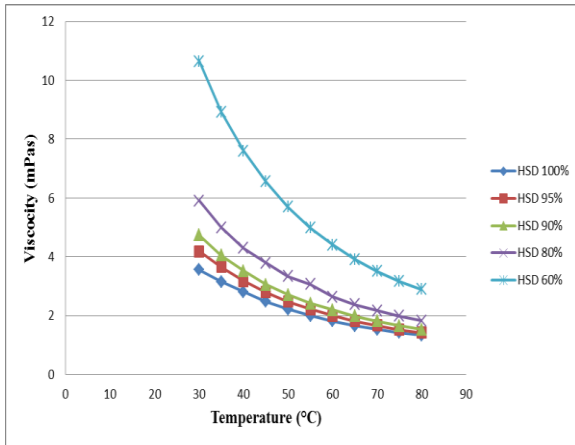
The viscosity test aims to find out the default value from the sample blending results as eligibility on gas turbine fuel specifications. Measurement begins with doing a calibration on the viscometer then conducted sampling HSD 100 %, PPO 100 % and sample blending results in the two hours firstly. Then on each sample measurement, the temperature is set according to the magnitude of the temperature used in the blending system that aims to make the state of the same temperature of sample during the process of blending is done so it can know the value of viscosity of the sample results of the eligibility level for blending on specification for gas turbine fuel. On the testing, the viscosity of sample values recorded at a temperature of 30 °C and 35 °C adjust the temperature that is used on the running blending system of HSD – PPO.



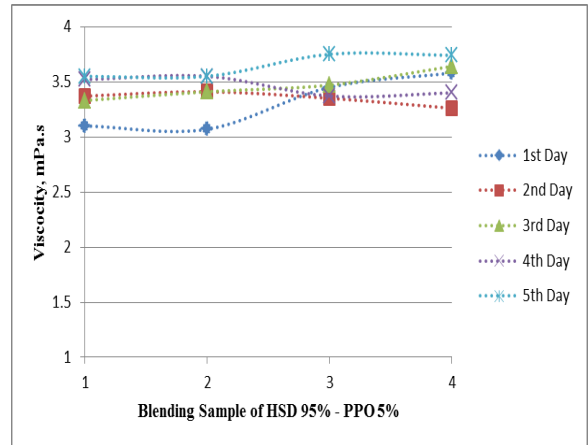
Fig. 1. The blending samples of HSD – PPO.

3. Result and discussion

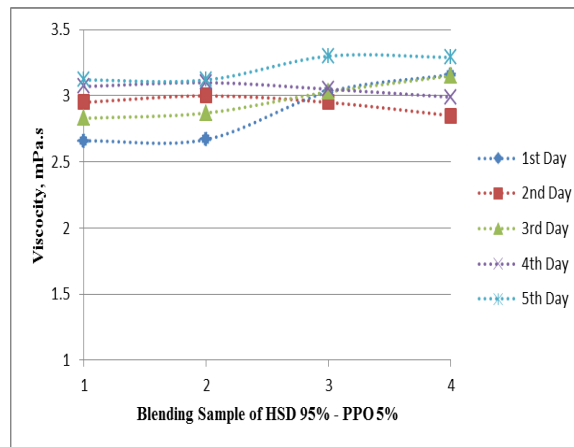
The first testing is a sample of 100 % pure HSD. On this test was obtained the viscosity value of HSD is 3.16 mPas at a temperature of 30 °C. On the next test is the blending sample with the composition of 95 % HSD and 5 % PPO was obtained the viscosity with an average value of 3.44 mPas at a temperature of 30 °C and 3.00 mPas at a temperature of 35 °C. And the third test is the blending sample with a composition of 90 % HSD and 10 % PPO was obtained the viscosity is 3.88 mPas at a temperature of 30 °C and 3.35 mPas at a temperature of 35 °C.



(a)



(b)



(c)

Fig. 2. (a) The influence of temperature to the dynamic viscosity value of the HSD – PPO blending;
 (b) The dynamic viscosity value of the 95 % HSD – 5 % PPO at the 30 °C;
 (c) The dynamic viscosity value of the 95 % HSD – 5 % PPO at the 35 °C.

4. Conclusion

The parameter of viscosity is useful for determining the success of the burning system. The test results performed on the viscosity of HSD – PPO blending is measured on a scale of 30 °C to 35 °C adjust the temperature with the temperature used in the blending system. It is intended that the viscosity is stayed at a temperature that range to maintain the viscosity value is less than the limit set by the entrance of the viscosity of a gas turbine engine.

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