EXAMINATION OF CHANGING OF PHYSICAL CHARACTERISTIC OF SOYBEAN METHYL ESTER WHICH DIRECTLY EXPOSED TO SUNLIGHT

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ABSTRACT
Soybean has got broad planting area in the world and is first oil plant at the vegetable oil production. Density, viscosity and oxidation stability are characteristic of methyl ester which using as a alternative fuel in internal combustion engines. In this study, soybean oil has chosen that is one of the most available sources as raw material for biofuel production in this sector. Soybean methyl ester has derived with transesterification from this raw material. Soybean methyl ester has at certain volume to 6 different samples, have examinated changes of physical properties of fuel by means of expose directly to sunlight certain times. One of the samples has chosed as a reference fuel and has storaged different ambient and changes have determined graphically according to others samples has expose to sunlight. Thanks to this study donâ€™t have to expose to sunlight principle have again lay stress on which one of the pay attention subject at storage of biofuels.

Keyword: *Biodiesel, Soybean Methyl Ester, Storage,Property,Sunlight*

1.INTRODUCTION

The challenges and opportunities of the workshop on energy and transportation took place in 2002 are world energy demand will increase continuous, fossil fuels will remain abundant and available as well as continue to provide most of the world's energy and that's why alternative fuel consumption will increase in the future [1]. Biodiesel, defined as the mono-alkyl esters of vegetable oils or animal fats, is an "alternative" diesel fuel that is becoming accepted in a steadily growing number of countries around the world [7]. It is compatible with conventional diesel fuel and already comprises a commercial fuel in Europe [5]. While biodiesel provides numerous environmental benefits such as reduced exhaust emissions, it is more prone to oxidation than petroleum-based diesel fuel and this can alter its fuel properties [2]. Due to biodiesel is affected by surroundings conditions its physical and chemical properties can change easily. This change especially affects the oxidation of biodiesel. The influence of parameters such as presence of air, heat, light, traces of metal, antioxidants, peroxides as well as materials of the storage container was investigated in the recently studies about biodiesel fuels. Time, oxygen, rate, temperature and container materials are important for oxidation of biodiesel.

One of the main criteria for the quality of a biofuel is its storage and oxidation stability. If oxidation stability of biodiesel fuels is low, it can plug fuel conveyance line and can raise up the viscosity [3, 4]. Viscosity affects the atomization of a fuel upon injection into the combustion chamber and thereby ultimately the formation of engine deposits. While oxidation causes the fuel viscosity to increase, fuel filter plugging was not necessarily a natural consequence of biodiesel oxidation even when the fuel was oxidized to a level beyond what would be observed in practice [2].
The viscosity of transesterified oils is about an order of magnitude lower than that of the parent oil for good atomization
[7, 8].

In this work soybean methyl ester was separate in six sample equal volumes. One of these samples is choosed as reference biodiesel fuel. Others are exposed to directly sunlight and air in front of the window in June and July months and the medium temperature almost was 30^{o}C. The five samples were exposed to directly sunlight to leave 5, 12, 18, 25, 32 days respectively. Viscosity, density and oxidative stability features of all samples were experimented after 32 days.

The objective of this work was to determine the oxidative stability and viscosity changes of the soybean methyl ester manufactured by the transesterification of refined soybean oil. When viscosity and density changes are experimented in the fuel laboratory of Selcuk University Faculty of Technical Education, biodiesel fuel oxidative stability experiments are done in Marmara University Faculty of Technical Education.

1.1 Material and Methods

The reaction of transesterification was carried out with refined, soybean oil in a 40 liter cylindrical reactor, provided with temperature control and mechanical stirring. 10 liter of refined soybean oil were added in the reactor and warmed up. When the system reached to goaled temperature (60ºC), a solution of methanol and NaOH (catalyst) was added in reactor, in the ratio of 100:1,75 (g/g), taking this moment as zero time of the reaction. After an hour stirring process, sample was put to rest in the reactor. The transesterification process separates the glycerin from the esters. Keep a watch on what flows through the sight tube. When the light-colored biodiesel appears, divert it to a separate container. Glycerine and methyl esters were taken out from bottom of the reactor respectively. The semi-liquid glycerin has a dark brown color and the biodiesel is honey-colored. When washing soybean methyl ester the firstly added the pure water that has to same volume with methyl esters by means of air bubble method. Washing time was approximately two hours. After the washing process the methyl ester and water was separate in two phases along 8 hours. The water and other impurities sink to bottom because of have high density. Water and alcohol residues get removed from the methyl ester by re-heating to the 100°C slowly. When the temperature reached 100°C, residual water and alcohol in the methyl ester were evaporated. After this process the final product should have a pH of 7, was checked with a digital pH tester.

Viscosities of the samples were determined by Redwood viscometer that determines liquid viscosity by measuring the time it takes for a given amount (50 ml) of liquid to pass through an orifice. Determinations of viscosity were done at the following temperatures: 25 and 40°C. The results in unit Redwood No.1 are converted, using viscosity convert table, to the mm^2/s [10].

Densities (g/ml) of the samples were determined by hydrometer that determines directly the specific gravity of a liquid [11].

The oxidative stability of the biodiesel samples was evaluated by means of the Rancimat equipment, under temperatures of 110°C and air flow of 20 l/h. Samples of 5g were utilized, weighed in the Rancimat flask. The oxidation was then induced by the passage of the air flow through the sample, kept under constant temperature. The volatile products of the reaction, which were blown with the air, were collected in distilled water and measured by the change in electric conductivity of this water. They were expressed through a curve from which the induction period can be calculated by the interception of two lines: a tangent to the inclination and another tangent to the curve level part [9].

Ferrari et al. (2005) notified the oxidative stability values at 100 and 105°C of refined soybean oil is 238 and 132 min.

The figures of materials are used in experiments.

Fig. 1: Redwood viscometer and a hydrometer

Fig. 2: Oxidation stability tester Rancimat

2.CONCLUSION

Reference methyl ester is denoted as '0 day'. Obtained results after the viscosity, density and oxidation stability experiments are below.

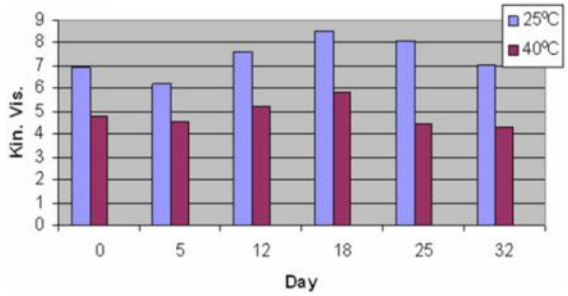

Fig. 3: Kinematic viscosity values of soybean methyl ester samples

Kinematic viscosity values of reference methyl ester at 25 and 40°C is 6.93 and 4.82 mm^2/s respectively. Kinematic viscosity values of the other samples are raised up to 20 days, after these values fell down to 7.04 and 4.34 mm^2/s. The last sample (32 Day) has lower kinematic value at 40°C (valid for fuel standarts) than reference methyl ester. The reason of decrease in viscosity value may be explain as changing in molecular structure of sample due to exposed to directly sunlight.

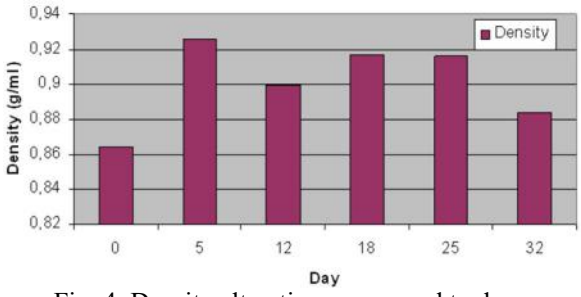

Fig. 4: Density alterations compared to days

Densities of soybean methyl ester samples akin to viscosity alterations such as showed in Fig.3. Because the samples, that was waited under the sunlight different times, has affected badly, induction period of samples not to be measured. Its oxidation stability isn't existing.

Until better than a knowledge biodiesel and diesel mixtures don't storages more than 6 month in the storage tank. If it forced us or storage conditions is poor antioxidant should used. Most of them have market by nutrient additive materials producer. At the short and long period tests, apprehend that sunlight has got a strong effect on the fuel oxidation. So biodiesel storage mustn't be done transparent and light protected.

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