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RECYCLING EDIBLE VEGETABLE OILS BY USING VARIOUS TYPES OF ALKALI WITH ALCOHOL TO PRODUCE BIODIESEL AND STUDY ITS OPTICAL AND PHYSICAL PROPERTIES

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Abstract
In the present study, recycling edible oils which have been used in frying purposes of taamia, fish, potatoes, etc. are used to produce biodiesel in order to help in solving the fuel shortages and to share in the energy conservation efforts. Four types of biodiesels were prepared by treated the waste edible oil, firstly NaOH with methanol, secondly NaOH with ethanol, thirdly KOH with methanol, and fourthly KOH with ethanol. One liter of the cheapest and available used vegetable oils, 4gm of Alkali and 250ml of Alcohol was used for producing biodiesel. Optical tests for their absorption, density, viscosity and refractive index of the four produced biodiesels were compared with the fossil diesel (control biodiesel). The findings were showed that the properties of the prepared biodiesel samples are similar to the fossil diesel.
Keywords: biodiesel, edible oils, recycling.

Introduction

One of the hottest issues today, which faces the world, are the fuels problems; mainly the diesel and gasoline fuels, so, for that reason: many studies nowadays have been focused on how to get these from the cheapest raw materials. The gain will be great if the wastes were used to produce them. The waste is not a prime product for the initial uses, and has no further use in terms of production, transformation or consumption, but it's a disposal material. Wastes might be generated during the raw materials' extraction, or the processing of raw material into an intermediate of the final products, or also from other human activities.

Frying oil can be an expensive part of food processing because any effort of reducing losses or wastages of oil, could result in greater business profitability. There is no a single method for optimizing oil life but it should be addressed comprehensively as many as areas influence oil integrity. Some of these areas include the selection of the most suitable oil, effective fryer design, established oil specification, the storage and handling oil are an effective frying procedures.

Many studies carried out in this field (Canakci and Van Gerpen, 1999 and Nelson et al.,1996) are encouraging to go ahead, by trying different ways to produce the biodiesel, this occurs by adding NaOH & KOH to the edible oil with methanol and ethanol, in room temperature. In this method the cost is more less than procuring the cost of lost fuel. In addition to that it can be produced from the waste material that does not affect the food stuff, because it is just a waste collecting from hotels and grand restaurants, where there are large quantities of waste oil which are simply trashed as a liquid waste. The oil wastes could use as a feed trashed in producing the biodiesels. The biodiesel is a fuel that composed of mono-alkyl esters of long chain fatty acids derived from variety of vegetable oils or animal fats, designated as B100, and confirming to different quality standards e.g. ASTMD 6751, EN14214 or IS 15607. The most cursory look at the literature relating to biodiesel will reveal soon the following relationship for prediction of biodiesel from fats and oils (Shimada, 1999). Therefore, by taking 100 lbs of oil +10 lbs of methanol as result the 100 lbs of biodiesel +10lbs of glycerol were obtained by Shimada (1999).

Objectives of this study

There are two objectives behind this paper; the first one is to keep the environment clear by recycling the wastes and the second is the using of liquid wastes, particularly, the edible oil waste to produce biodiesel and studies their optical and physical characters such as density, viscosity and refractive indices.

Material and Methods

Collection and Preparation of treated samples

Our wasted edible oils were collected from prince's hotel, Khartoum (Sudan) and then the treated samples were prepared as follows: (a) the used vegetable edible oil was treated with NaOH and methanol, (b) the used vegetable edible oil was treated with NaOH and ethanol, (c) the used vegetable edible oil was treated with KOH and methanol or (d) the used vegetable edible oil was treated with KOH and ethanol. The methanol, ethanol, NaOH and KOH were brought from company. The simplest method for producing alcohol esters is to use a batch system as described by Shimada (1999).

Recycling of the used vegetable edible oil

Formation of biodiesel from the used vegetable edible oil.

4gm of lye (about half a teaspoon) was added to the methanol with the lid screwed tightly. The jar was agitated until the lye was completely dissolved. Then it was heated up to accelerate the reaction and allow at least 10minutes. The meth-oxide compound was formed and then one liter of used vegetable oil was added to it and heated to 140°F (60°C), so the warmed oil was poured into dry of 2-liter plastic bottle by using funnel. The mixture of methanol/lye (meth-oxide) were poured on the top of the used oil by using funnel, and/ with the lid screwed down tightly, the mixture were shaken vigorously for 20 seconds. Lastly, the mixtures were allowed for some hours to separate into two portions. Portion one is the honey colored biodiesel that found at the top, and where portion two is darker glycerin layer which found at the bottom. The biodiesel was cloudy at first and was kept in a cool dark place for few days for clarifications. The lid was removed and the biodiesel was gently poured into cleaning 2 liters plastic bottle by using the funnel and left the darker glycerin.

Removing water from produced Biodiesel

The biodiesel probably contains some soaps, therefore the soap must be washed by pouring 500 ml of body temperature water into it and caped tightly. The bottle was rotated for 30 seconds and then standard it upright again. When water and biodiesel have separated, thumb was used to drain the water out the mixture i.e. it contains soap. This process was repeated several times with hard shaken until fresh biodiesel was very cloudy and unpromising to be obtained. This method required a day or two to be allowed for the obtaining dried biodiesel, as described by Stidham *et al.,* (2000) and Assman *et al*., (1999).

Methods of optical and physical

The optical and physical characters were determined according to method described by AOAC (1984).

Statically Analysis

It was done according to method described by Robert *et al.,* (2004).

Results and discussion

Optical characters of produced biodiesel (Recycling edible oil)

Figure (1) shows the absorption of the spectrum of biodiesel that prepared from the used vegetable oil treated with NaOH and methanol. It indicates that the largest absorption value was approximately four units at 325 nm, and there was another absorption spectrum greater than three units at 238nm. Generally, the shape of the absorption spectrum for the treated sample with NaOH and methanol is similar to absorption spectrum of the control sample. These findings are indicated that the characteristic of biodiesel that prepared from NaOH with methanol and plus the using edible oil is similar to control biodiesel's efficiency with four units–absorption

approximately, (Fig.5). In addition there was a difference in the absorption spectrum band more than 11nm, which indicates that the combustion of produced biodiesel is so closely to the combustion condition of fossil fuel.

Figure (2) shows absorption of the spectrum of biodiesel that prepared from the uses vegetable oil treated with NaOH and ethanol. It is indicated that the largest absorption value was approximately 3.5 units at 310 nm, and there was another absorption spectrum greater than 3.15 units at 239 nm. These results indicate that the produced biodiesel's shape is similar to the shape of control biodiesel(Fig4), but an absorption efficiency was decreased, which creates a little difference in the biodiesel produced from uses vegetable oil treated with NaOH and ethanol compared with control biodiesel, and the difference in the absorption spectrum is about 26nm. This indicates that, the combustion of the biodiesel produced occurs in different conditions from the combustion of the control biodiesel.

Figure (3) shows absorption of the spectrum of biodiesel that prepared from the uses vegetable oil treated with KOH and methanol. It was also indicated that the largest absorption value was ranged from 3.35 units (307 nm) to 3.15 units (238 nm). These results were indicated that the shape of produced biodiesel is similar to the shape of control biodiesel(Fig5), but the absorption efficiency was less than the produced biodiesel, which indicates the difference of this produced biodiesel from the control biodiesel, and the difference in the absorption spectrum are 29nm , which indicates that the produced biodiesel combustion happens in different condition of the two previous produced biodiesels compared with reference biodiesel.

Figure (4) shows the absorption of the spectrum of biodiesel that prepared from the uses vegetable oil treated with KOH and ethanol. It indicated that the largest absorption value was 3.5 units (310 nm), and however, another absorption spectrum was 3.25 units (338nm). These results were indicated that the shape of produced biodiesel formed from KOH with ethanol was found to be similar to the shape of produced biodiesel formed from NaOH and ethanol or KOH and ethanol.

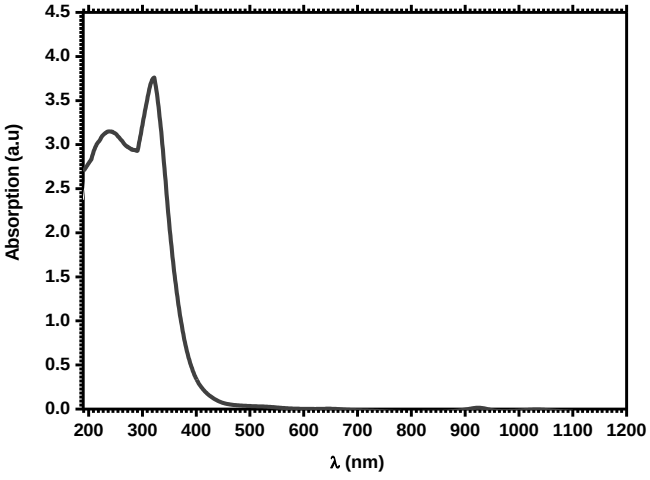

Figure 1. Shows biodiesel prepared from edible oil treated with NaOH and Methanol

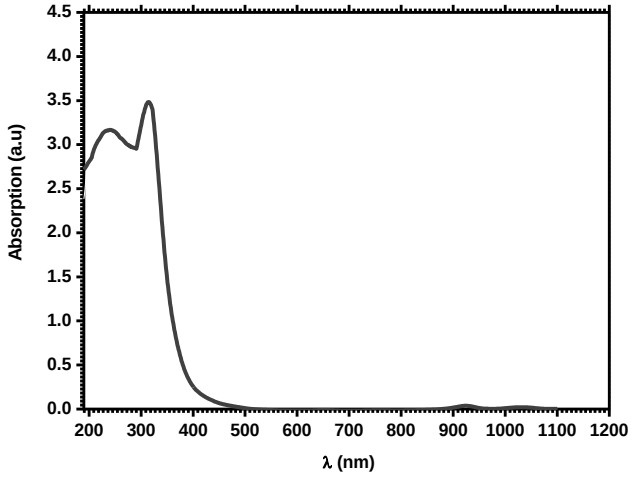

Figure 2. Shows biodiesel prepared from edible oil treated with NaOH and Ethanol

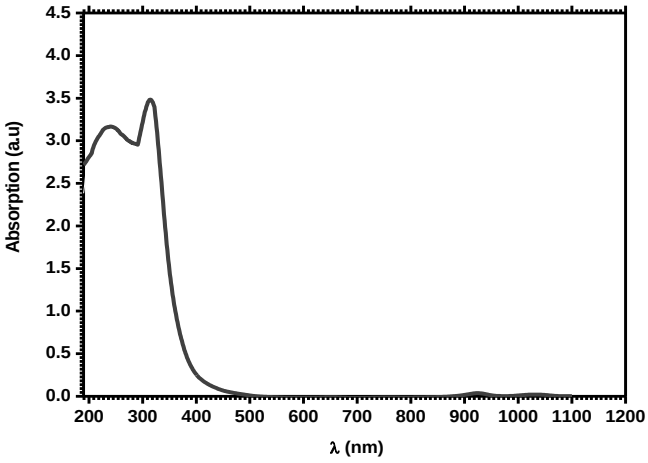

Fig. 3 Shows biodiesel prepared from uses edible oil treated with KOH and methanol.

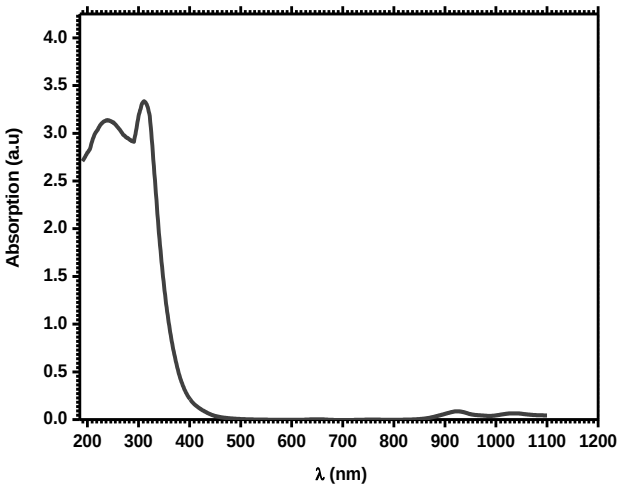

Fig. 4 Shows biodiesel prepared from uses edible oil treated with KOH and ethanol.

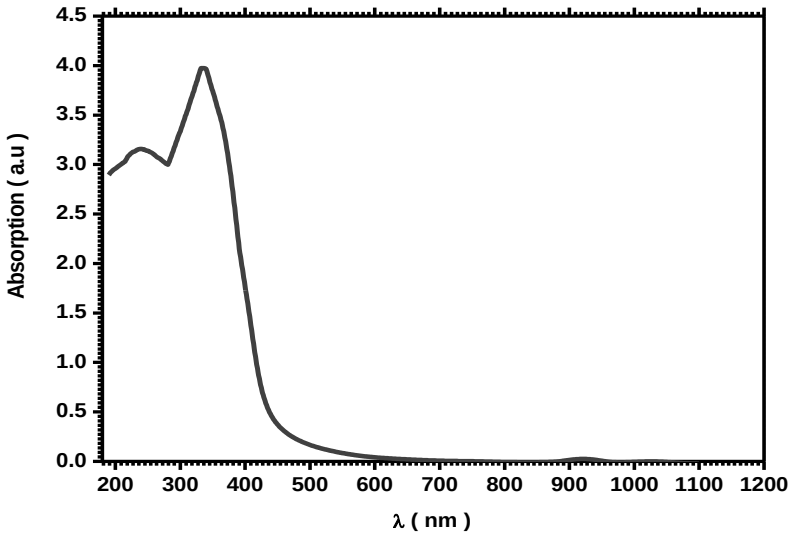

Fig. 5. The fossil fuel diesel as a reference sample, largest absorption spectrum was 4 units (336 nm) and other value was 3.15 units (240nm)

Physical parameters

Refractive index

Table (1) indicates the refractive indices for biodiesel that prepared from uses edible oil treated with NaOH and methanol, treated with NaOH and ethanol, treated with KOH and methanol, and treated with KOH and ethanol were 1.4550, 1.4335, 1.4745 and 1.4336 and refractive index for control sample (not treated) was 1.4650, respectively. These results were clearly indicated that the maximum value of refractive index obtained by edible oil that treated

with KOH and methanol while the minimum value of refractive index obtained by edible oil that treated with NaOH and ethanol as compared with those values obtained by control sample.

Density

Table(1) indicates that maximum value of density was obtained by biodiesel that prepared from edible treated with KOH and ethanol (0.97) while minimum value of density was obtained by biodiesel that prepared from edible treated with NaOH and ethanol, and sample of edible treated with KOH and ethanol(0.94) as compared with control biodiesel(0.95). These findings for fours produced biodiesel are agree with those values reported by Carlos *et al.*(2011)

Viscosity

Table (1) shows the high viscous that produced by biodiesel, is edible oil that treated with KOH and methanol while the low viscous that produced by biodiesel, is edible oil that treated with KOH and methanol or also edible oil that treated with KOH and ethanol**.** These achieved results are lower than those value obtained by Carlos *et al.*(2011) and Refaat (2009).

Table 1. The Refraction Index, Density& Viscosity

Treated samples	Refraction Index	Density (g/cm^3)	Viscosity ($N.s/cm^2$)
NaOH +methanol	1.4550	0.95	$0.79*10^{-5}$
NaOH +ethanol	1.4335	0.94	$0.72*10^{-5}$
KOH +methanol	1.4745	0.97	$0.83*10^{-5}$
KOH + ethanol	1.4336	0.94	$0.72*10^{-5}$
Fossil Gasoline(Control)	1.4650	0.95	$0.79*10^{-5}$

Conclusion

The presented data suggests that the unique variable affect for absorption spectrum, refractive index, density and viscosity of four produced biodiesels from waste oil treated with alcohol and alkali is according to the type of catalyst and alcohol which are used for producing the biodiesel. In addition to that the findings were showed the properties of the prepared biodiesel samples are similar to the fossil diesel's properties**.**

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