ISSN : 0974 - 7486 Volume 12 Issue 6

Materials Science

An Indian Journal

Full Paper

MSAIJ, 12(6), 2015 [196-198]

Rheological properties (refractive index) for olive oil in Palestine

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ABSTRACT

In this study, olive oil samples of different storage ages and locations in Palestine were studied. The refractive indexof the samples was measured. The refractive index of the olive oil samples were studied against storage ages and results showed that the refractive index decreases as a function of storage age.

INTRODUCTION

Olive oil is a fat obtained from the olive fruit by mechanical or chemical means. Olive oil is commonly used in cooking, cosmetics, pharmaceuticals, soaps, and as a fuel for traditional oil lamps. Olive oil is used throughout the world, but especially in the Mediterranean countries and, in particular, in Greece, which has the highest consumption per person[2].

Olives are very important for the Palestinian, not only because they are the biggest crop in what remains a largely agricultural economy, but also for their deep cultural significance as a symbol of traditional society and ties to the land. It is estimated that olive trees account for nearly 45 percent of cultivated land in Palestine and in good years can contribute as much as 15 - 19 percent of agriculture output. Given that agriculture accounts for nearly 25 percent of gross domestic product, olives are an important element of the Palestinian economy and estimates suggest that about 100,000 families depend to some extent upon the olive harvest for their livelihoods[7].

Studies in New Zealand by Sims indicated that vegetable oils, particularly rapeseed oil, could be used as a replacement for diesel fuel[6].

In 1988, a model was used by Patil and his group to describe the liquid - liquid thermal hypothesis of vegetable oils. Extensive data on hydrolysis equilibrium and rate have been obtained[4].

Reid and his group evaluated the chemical and physical properties of 14 vegetable oils. These injection studies pointed out that the oils behave very differently from petroleum - based fuels[5].

Goering and his group studied the characteristic properties of eleven vegetable oils to determine which oil would be the best suited for use as an alternative fuel source[5].

OBJECTIVES OF THE STUDY

The physical properties (Refractive index) of olive oil in Palestine will be measured and compared with standard values. The experimental data will be fitted by using SPSS and Excel programs.

THEORY

Refractive index (n) of a medium is defined as the ratio of the speed of light in a vacuum to the speed

of light traveling through this medium, and mathematically it is written as:

$$n = \frac{c}{v} \quad (1)$$

Where c is the speed of light in vacuum and v is the speed of light in the substance. The refractive index for olive oil extends from 1.4677 to 1.4707 at 20 °C[3].

METHODOLOGY

Olive oil samples were collected from different region in Palestine, they were all produced by Palestinian industrial olive oil mills, from the crop of 1994 until the crop of 2012 at least four samples were collected from each region representing different olive oil ages.

The samples were collected from different regions, these are:L_1, L_2, L_3, L_4, L_5, L_6, L_7, L_8, L_9, L_{10}, L_{11}, L_{12}, and L_{13}. The samples were kept in closed glass bottles in dark place at 25°C. The refractive index was measured using the refractometer.

Refractive index apparatus

The index of refraction of the olive oil samples was measured using theway - 2s ABBE digital refractometer.

The measurement range of the device extends from 1.3000 - 1.7000 with accuracy equals to ± 0.0002.

Figure 1: The way - 2s ABBE digital refractometer

RESULTS AND DATA

The measured refractive index of olive oil for all samples, from all regions aregiven in TABLE 1.

The average value of refractive index of all olive oil samples is 1.4708. The range of refractive index of all samples extends from 1.4690 (16 years storage age L_{10} sample) to 1.4718 (1 year storage age L_8 sample).

The relationship between refractive index and storage age for samples collected from L_1 and L_8 are shown in Figure 2 and 3.

One can notice from Figure 2 and 3 that the refractive index decreases as the storage age of the olive oil sample increases.

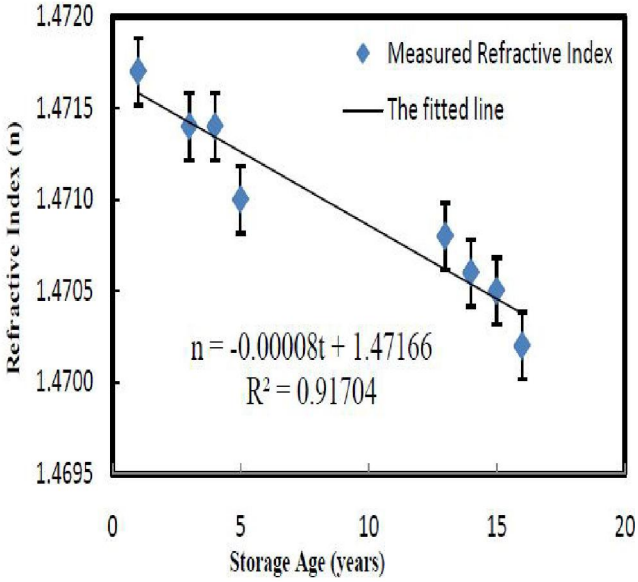

Figure 2 : Measured refractive index versus storage age of olive oil samples of L_1

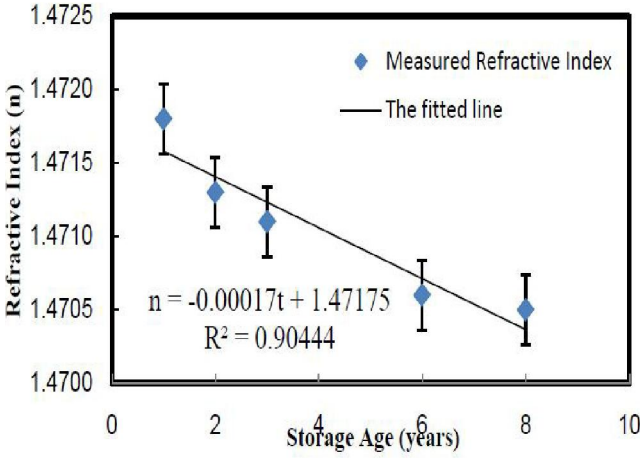

Figure 3 : Measured refractive index versus storage age of olive oil samples of L_8

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TABLE 1 : Measured refractive index of olive oil samples of different regions and different storage ages

Storage ages (years)	L_1	L_2	L_3	L_4	L_5	L_6	L_7	L_8	L_9	L_{10}	L_{11}	L_{12}	L_{13}	Average
1	1.4717	1.4712	1.4710	1.4717	1.4716			1.4718						1.4715
2			1.4710	1.4716				1.4713	1.4713			1.4713		1.4713
3	1.4714	1.4711		1.4711	1.4714	1.4711	1.4715	1.4711	1.4713		1.4713	1.4712	1.4711	1.4712
4	1.4714			1.4707	1.4710		1.4714						1.4705	1.4710
5	1.4710						1.4712		1.4712					1.4711
6					1.4708		1.4712	1.4706				1.4709		1.4709
7					1.4707				1.4709					1.4708
8					1.4707			1.4705			1.4711			1.4708
12						1.4705							1.4703	1.4704
13	1.4708					1.4702								1.4705
14	1.4706	1.4708	1.4709			1.4701				1.4708			1.4701	1.4706
15	1.4705	1.4706	1.4708			1.4704				1.4698	1.4710		1.4702	1.4705
16	1.4702					1.4700				1.4690			1.4700	1.4698
19							1.4711							1.4711
Average	1.4710	1.4709	1.4709	1.4713	1.4710	1.4704	1.4713	1.4711	1.4712	1.4699	1.4711	1.4711	1.4704	1.4708

DISCUSSION AND CONCLUSION

Eight samples from L1 and five samples from L8are selected to be analyzed. The reasons of choosing these two regions are:

Firstly: they are far enough from each others.

Secondly: the altitude are different, it is 350 m for L1, and 890 m for L8.

Thirdly: the quantities of rain are different for both regions, since we have different crops.

The average value of refractive index is measured to be 1.4708 while the standard value is 1.4677 - 1.4705 (IOOC, 2000).

Our values of refractive index are in good agreement with the standard ones. A linear fit showed that the refractive index is decreasing as a function of storage age.

REFERENCES

[1] C.E.Goering, A.W.Schwab, M.J.Daugherty, E.H.Pryde, A.J.Heakin; "Fuel Properties of Eleven Vegetable Oils", ASAE, 81-3579 **(1981)**.

[2] http://www.naooa.org/, NAOOA, North American Olive Oil Association **(2013)**.

[3] IOOC, International Olive oil Council ØTrade standards applying to olive oil and olive pomace oilØ, E. /Conv. /Doc. no.1 /16 November 2000. International Olive Oil Council, Madrid, Spain **(2000)**.

[4] T.Patil, D.Butala, T.Raghunathan, H.Shankar; " Thermal Hydrolysis of Vegetable Oils and Fats. 1. Reaction KineticsØ, Ind.Eng.Chem.Res., **27(5)**, 727–735 **(1988)**.

[5] J.F.Reid, A.C.Hansen, C.E.Goering; "Quantifying Diesel Injector Coking with Computer Vision"., ASAE,**32(5)**, 1503-1506 **(1989)**.

[6] R.E.Sims, R.Raine, R.McLeod; "Rapeseed Oil as a Fuel for Diesel Engines".SAE-Australia.Paper presented at the National Conference on Fuels from Crops of the Society of Automotive Engineers – Australia **(1981)**.

[7] The World Bank 2012, West Bank and Gaza Program, ØBrief Overview of the Olive and the Olive Oil Sector in the Palestinian TerritoriesØ, http://go.worldbank.org/MBK9GU1TD0