

Rheological properties (acidity) 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 acidity of the samples was measured. The acidity of olive oil samples from different regions and different crops showed that acidity increases as a function of storage age. Most of olive oil samples (storage age ≤ 12 years) acidity did not exceed the international quality standards ($< 3.3\%$). It is worth noting that olive oil can be stored until 12 years without exceeding the international quality standards of acidity in proper conditions.

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 (NAOOA, 2013).

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 (The World Bank, 2012).

Vegetable oils have become increasingly important for nutritional purposes and in a wide range of industrial applications which include fuels, skin care products, high pressure lubricants and alkyl resins for paint. These applications require extensive studies on the physico-chemical properties of oils in order to ascertain their suitability as raw materials. Such properties include viscosity and acidity which are an important parameters in the design of process equipment for oils (Eromosele, and Paschal, 2003). (Nierat *et al.*, 2013).

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 (Reid *et al.*, 1989).

OBJECTIVES OF THE STUDY

The physical properties (Acidity) 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

The acidity of olive oil is effected by different parameters such as degree of ripeness, industrial processes employed for oil extraction, altitude, the cultivator, climate and other factors.

Olive oil is classified qualitatively according to its acidity into many classes as given in TABLE 1 (IOOC, 2000).

TABLE 1: Classification of olive oil according to FFA%

Category	FFA%
Extra virgin olive oil	≤ 0.8
Virgin olive oil	≤ 2.0
Ordinary virgin olive oil	≤ 3.3
Lampante oil	> 3.3

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: L₁, L₂, L₃, L₄, L₅, L₆, L₇, L₈, L₉, L₁₀, L₁₁, L₁₂, and L₁₃. The samples were kept in closed glass bottles in dark place at 25°C. Chemical titration was used to measure the acidity.

RESULTS AND DATA

The results of olive oil samples acidity for samples collected from all regions and different storage ages are given in TABLE 2.

TABLE 2 : Measured acidity in FFA% of olive oil samples in different regions for 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
1	1.18	1.72	0.94	0.51	0.45			0.44					
2			0.70	0.53				0.50	0.67			0.77	
3	1.55	2.53		0.56	1.49	1.03	0.80	1.96	0.96		0.96	1.88	0.56
4	2.64			1.96	2.07	1.80	1.12						1.03
5	3.97							1.56	1.18				
6					2.40		2.50	4.77				2.00	
7					2.88				1.20				
8					2.94			5.25			3.92		
13	8.79									4.40			
14	9.09	5.09	5.98							5.04			
15	11.13	5.77	5.72			3.81					7.07		3.95
16	13.01					4.49				9.49			4.60
19						5.02	4.00						5.22

The range of acidity extends from 0.44% for the 1 year storage age (L₈) to 13.01% for the 16 years storage (L₁).

Three samples of crop 2013 (L₄, L₅, and L₈) are extra virgin, while the other three samples of the same crop are virgin (L₁, L₂, and L₃). The five samples of crop 2012 are all extra virgin. In general, the olive oil sample are good for human consumption up to 10 years storage age.

The relationship between acidity and storage age for the collected samples from L₁ and L₈ are shown in Figure 1 and 2 respectively.

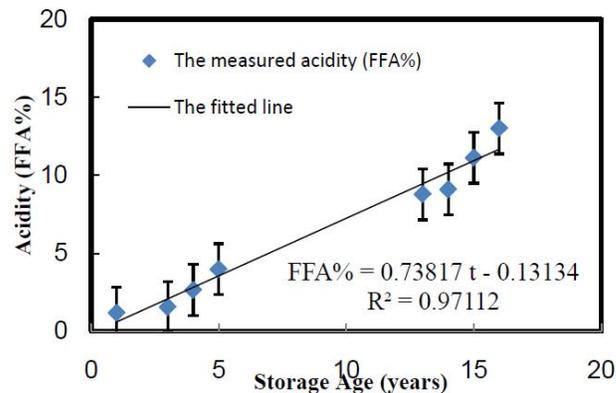


Figure 1: Measured acidity versus storage age of olive oil samples of L₁

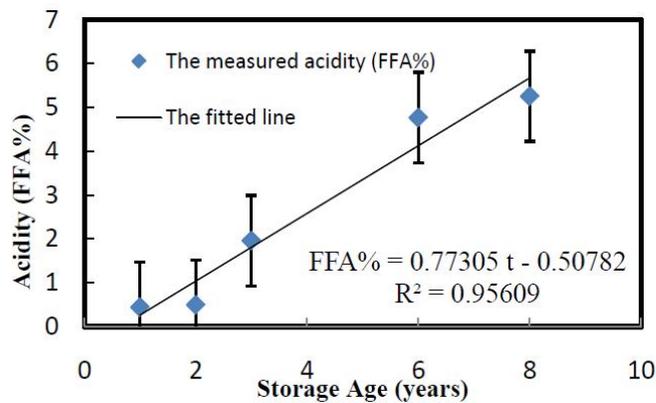


Figure 2: Measured acidity versus storage age of olive oil samples of L₈

The olive oil acidity increases as the storage age of the sample increases. The relationship between olive oil acidity and storage age is shown to be linear.

DISCUSSION AND CONCLUSION

Eight samples from L1 and five samples from L8 are 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 experimental results of acidity showed that the quality of olive oil samples varies from Extra virgin to Lampante olive oil according to TABLE 1. The samples showed that the acidity increase with storage age. For example, the acidity was measured to be 0.44% (Extra virgin) for crop 2012 of L₈ and, 1.56% (Virgin) for crop 2008 of L₇, 3.18% (Ordinary virgin) for crop 2001 of L₆, and 9.94% (Lampante) for crop 1997 of L₁₀.

Falque found that the value of the acidity of the extra - virgin olive oils is 0.39%. (Falque *et al.*, 2007). These values are close to the extra - virgin olive oils value of acidity of crop 2012 of L₈ (0.44%).

REFERENCES

- [1] C.Eromosele, N.Paschal; "Characterization and Viscosity Parameters of Seed Oils from Wild Plants", *Bioresource Technology*, **86** 203–205 (2003).
- [2] E.Falque, A.I.Mendez; "Effect of storage time and container type on the quality of extra-virgin olive oil", *Since Direct Food Control*, **18**, 521–529 (2007).
- [3] <http://www.naooa.org/>, NAOOA, North American Olive Oil Association (2013).
- [4] IOOC, International Olive oil Council, "Trade standards applying to olive oil and olive pomace oil", E. /Conv. /Doc. no.1 /16 November 2000. International Olive Oil Council, Madrid, Spain (2000).
- [5] T.Nierat, S.Musameh, I.Abdelraziq; "Temperature and Storage Age (Weekly Basis)-Dependence of Olive Oil Viscosity in Different Locations in Palestine", *MSAIJ* **9(11)**, 445-451 (2013).
- [6] J.F.Reid, A.C.Hansen, C.E.Goering; "Quantifying Diesel Injector Coking with Computer Vision", *ASAE*, **32(5)**, 1503-1506 (1989).
- [7] The World Bank 2012, West Bank and Gaza Program, "Brief Overview of the Olive and the Olive Oil Sector in the Palestinian Territories", <http://go.worldbank.org/MBK9GU1TD0>.