Research Journal of Chemical and Environmental Sciences
Res J. Chem. Environ. Sci. Vol 7 [4] August 2019: 44-52
Online ISSN 2321-1040
CODEN: RJCEA2 [USA]

Website: www.aelsindia.com/rjces.htm

RJCES

ORIGINAL ARTICLE

Comparative Study of The Chemical Composition of Pure Argan Oils And Virgin Olive

Miloudi Hilali[1]*
[1]Laboratory of Plant Chemistry and Organic and Bioorganic Synthesis , Faculty of Science, University Mohamed-V, Av. Ibn Battouta, BP 1014 Agdal-Rabat, Morocco
*Corresponding author. E mail: hilali400@yahoo.com

ABSTRACT
Argan oil has indeed remarkable nutritional qualities. It is an oil rich in monounsaturated fatty acids (43.15% oleic acid: omega 9) and polyunsaturated (38.86% linoleic acid: omega 6). The level of linoleic acid (vitamin F) is three times higher in argan oil than in olive oil (linoleic acid 10.83%). The tocopherol content of argan oil is 717 mg/kg (olive oil: 320 mg / kg). Argan oil is very rich in gamma tocopherol (631 mg/kg) (olive 30 mg / kg) which gives it a protective effect against free radicals. Argan oil is rich in phytosterols. These belong to the delta 7 stigmastane family. The major sterols in argan oil are schottenol and spinasterol. Schottenol is shown to be anticarcinogenic with a pronounced cytotoxic potential. These chemical compounds, fatty acids, tocopherols, sterols and triglycerides give argan oil a high nutritional value, they ensure the proper physiological functioning of cell membranes and enhance the preventive action of argan oil against diseases chronic.
Keywords: *Argan, Olive, Fatty Acids, Sterols, Polyphenols, Triglycerides.*

Received 13.03.2019 Accepted 19.05.2019

INTRODUCTION

The Argan tree (*Argania spinosa,* Skeels L., Sapotaceae) is an endemic tree in southwestern Morocco, where it plays a very important socio-economic and environmental role. It is deeply rooted in the daily lives of rural people and plays a fundamental role in their livelihoods. The argan tree produces a very valuable vegetable oil from its grains and its oil has not been widespread in the world until recently. In Morocco, this oil is used to water the food, almost as with olive oil, but recent discoveries of the health benefits of this oil have led to its wider export. Food argan oil known for millennia by the people of southwestern Morocco. This oil is prepared from roasted almonds. This preparation step gives the oil its perfumed taste, reminiscent of the hazelnut grill. Thanks to the work of Moroccan chemists and biologists, argan oil is known for its exceptional nutritional qualities. In addition to the nutritional value, argan oil also has many pharmacological properties, especially in the field of cardiovascular diseases and cancers [1]. This gives argan oil a unique added value in terms of health. Great efforts have been made to promote argan oil by improving its extraction technology and by giving forest users the benefit of this added value through the creation of cooperatives in the region of production and marketing of the argan oil. argan oil [2-3]. The aim of this work is therefore to make a comparative study of the physicochemical composition of pure argan oil and virgin olive oil, in order to contribute a conclusion on the exceptional nutritional qualities of olive oil. argan.

MATERIAL AND METHODS

Preparation of oils

Preparation of different samples of argan oil and olive oil

The argan oil was prepared by extraction, by the mechanical pressing method in the cooperative of Tidzi (Essaouira province, southern Morocco) according to methods already described: extraction by mechanical pressing (roasted almonds [2-4-5] Olive oil was prepared by mechanical extraction at a company in Ouezzane (northern Morocco).

Physicochemical analyzes of oils

Determination of acidity, the peroxide value, the refractive index of the absorbance in the ultraviolet, the saponification number, the unsaponifiable content, were measured according to the standardized

methods of reference respectively. ISO 660 [6], ISO 3960 [7], ISO 6320 [8], ISO 3656 [9], ISO 3657 [10], NFT.60.205 NOV 1975 [11]

Determination of composition and nature in total sterols

Reference ISO 6799 [12]

Operating mode

2.5 g of argan oil are weighed into a 20 ml flask. 25 ml of a solution of potassium hydroxide (1N of ethanol) is added thereto. The flask is heated under reflux for 30 minutes until the solution becomes clear.

Then, 25 ml of distilled water is added to stop the reaction. The extraction of the unsaponifiable is carried out using 75 ml of hexane or petroleum ether. The organic phase is subjected to a series of washing with 15 ml of mixture (water / ethanol 95 °) (90/10) in a separatory funnel. The hexane phase is transferred from the top of the ampoule into a 100ml flask. After evaporation of the solvent using a rotary evaporator, the unsaponifiable material is recovered. The unsaponifiable agent, diluted with 300 µl of hexane or petroleum ether, is filtered. Unsaponifiable is obtained according to the standard NFT 50-205. It is fractionated by high performance liquid chromatography (HPLC) on a silica column (25cm × 4 mm). The HP is equipped with a 205 nm-254 nm UV detector. The eluent is an isooctane / isopropanol (99/1) mixture whose flow rate is 1.2 ml / min. The duration of the analysis is 15 min, the sterol fraction recovered according to standard NF 12228 May 1999, is evaporated to dryness. The sterols are converted to silylated derivatives (TMS) using a mixture of pyridine, hexamethyldisilazane (HMDS) and trimethylchlorosilane (TMCS), (9/1/1), (v / v / v). The pyridine was evaporated to dryness and the silylated derivative is diluted with 60 µl of heptane or hexane. The TMS sterols are analyzed by gas chromatography (GC) on an apolar column (Chroma pack) (30m × 0.32mm, DI: 0.25µm, phase: CPSIL8CB).

The HP Hewlett Packard 6890 GC Series Chromatograph is equipped with a FID detector (T °: 300 ° C). The carrier gas is nitrogen and its flow rate is 1 ml / min (P.E: 8.6 bar). The analysis is performed in temperature programming (200 ° C up to 270 ° C with a speed of 10 ° C / min and an isotherm at 270 ° C for 35 min). The silylation reaction of sterols is shown in Figure 1 below:

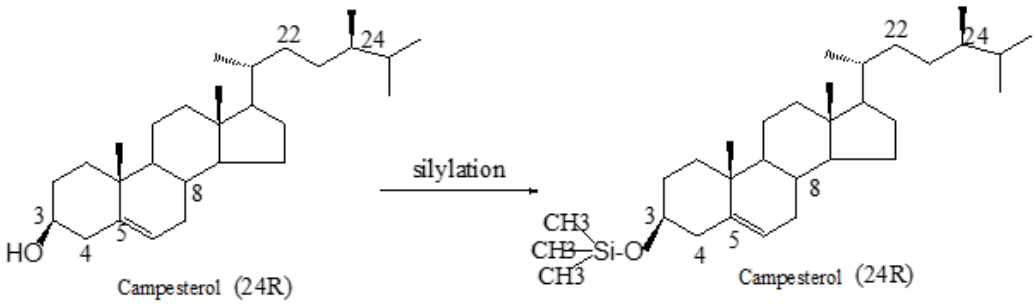

Figure 1: the sterol structure with silylation

Analysis of cis fatty acids

Reference: NF ISO 5509 COFRAC code: CC30 [13]

Operating mode

The test sample of argan oil 1g is supplemented with 0.5 ml of methanolic KOH for HPLC (minimum 98%) and 10 ml of methanol in a 100 ml flask. The mixture is refluxed for 15 minutes until the solution is clear. Then 1 ml of heptane is added to the reaction mixture after cooling. The heptanic phase containing the methyl esters is transferred to a test tube and then a solution of sodium carbonate Na_2CO_3 is added. This neutralizes all free acids by giving sodium salts with a release of carbon dioxide. The methyl esters, which are in the organic phase, are removed using a 2 ml cone pipette and placed in a test tube.

The methyl esters undergo a series of washing. 20 .mu.l are taken from the esters which are placed in a tube of nominal capacity of 2 ml and then filled with heptane.

The fatty acid methyl esters are analyzed by GC gas chromatography.

The HP Hewlett Packard 6890 GC Series GC chromatograph is equipped with a divider (T: 240 °C) and a FID (T: 260 °C) injector. The carrier gas is nitrogen (PE: 12.4 bar). The analysis is carried out in temperature programming (140 ° C to 200 ° C with a speed of 10 ° C / min and an isotherm at 200 ° C for 40 min) on a capillary column (polyethylene glycol) (30 m × 0 , 32 mm, DI: 0.25 µm).

The reaction of the methyl esters of the triglyceride fatty acids is as follows:

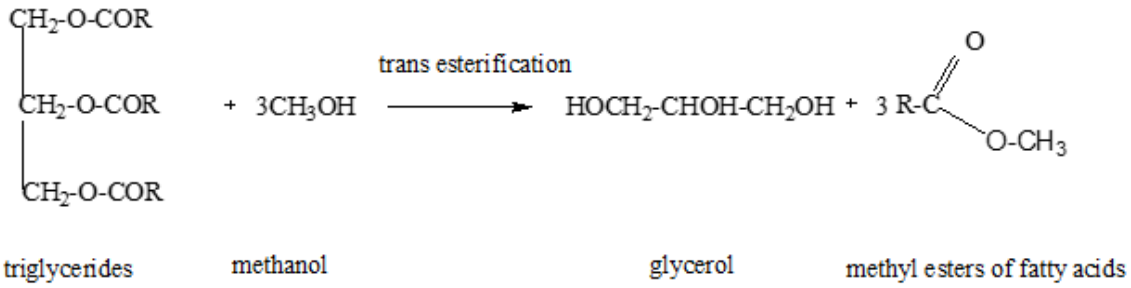

Figure 2: The reaction of methyl esters of triglyceride fatty acids

Tocopherol analysis [14]

Operating mode

In a 25 ml volumetric flask, 2 g of argan oil are diluted with 2,2,4 trimethyl pentane. The test sample is added to 2, 2, 4 trimethyl pentane up to the mark, then mixed thoroughly. The tocopherols are analyzed by HPLC, on a silica column (25 cm × 4 mm), according to the AOCS method, official method CE8-89 revised 1990 updated 1992 [10]. The SHIMADZU brand device is equipped with a fluorimetric detector (excitation wavelength 290 nm - emission wavelength 330 nm). The elution is carried out with a mixture (isooctane / isopropanol) (99/1) with a flow rate of 1.2 ml / min during the analysis time (20 min).

Triglyceride analysis

Reference: IUPAC No. 2.0 324 [15]

Operating mode

To 0.15 g of the argan oil are added 0.5 ml of hexane and 15 ml of a mixture of hexane / diethyl ether (87/13). This solution is poured into a supelco brand cartridge with 0.5 g of silica gel previously activated with hexane. The triglyceride fraction is thus separated from the diglycerides and monoglycerides. It is recovered in a 100 ml flask. It is subjected to analysis after evaporation of the solvent and dilution with 1.5 ml of acetone. The triglycerides are analyzed by HPLC on a reverse phase C18 column (250 mm × 4.6 mm, Φ silica 5 µm), according to IUPAC Method No. 2.0324. The HPLC apparatus is equipped with an HP refractometric detector 10 47A. Elution is carried out with a mixture (acetonitrile / acetone) (v / v) with a flow rate of 0.5 ml / min during the analysis time (90 min).

RESULTS AND DISCUSSION

3.1. Physico-chemical constants

The main physico-chemical constants of argan and olive oils are summarized in Table 1.

Table 1: Main physico-chemical constants of argan oil and olive oil.

Constants / sample	Argan	Olive
Acidity in %	0.33	0,8
Peroxide index in meq of O_2/kg	1.23	12
Unsaponifiable rate in%	1.0	2.0
Saponification index	197.9	190
Refraction index at 20 ^{0}c	1.468	1.468
Iodine number	98.1	90.0
Specific extinction at 270 nm (k270).	0,228	0,22

Figure 3: Main physicochemical constants of argan oil and olive oil.

Our results show that the physicochemical constants of argan and olive oils are very similar and overlap almost totally from these results we have noted that the peroxide index of olive oil is higher (12 in meq of O2 / kg) compared to argan oil (1.23 in meq of O2 / kg) [16]. This index makes it possible to evaluate the degree of oxidation of the unsaturated fatty acids of the fat (rancidity), for oils or edible fats, or for cosmetic purposes.

Fatty acid analysis

Table 2 presents the results of the fatty acids obtained in the Laboratory on pure samples of argan oil and olive oil.

Table 2: Main fatty acid of argan oil and olive oil

Fatty acid / Type sample.	**Argan**	**Olive**
Myristic C14:0	0.15	0.2
Palmitic C16:0	11.57	9.20
Palmitoléic C16:1	0.09	0.41
Stearic C18 :0	5.32	3.15
Oleic C18 :1	43.15	74.42
Linoleic C18 :2	38.86	10.83
Linolenic C18 :3	0.12	0.83
Arachidic C20 :0	0.33	0.43
Gadoléic C20 :1	0.37	0.44
Behenic C22 :0	0.12	-

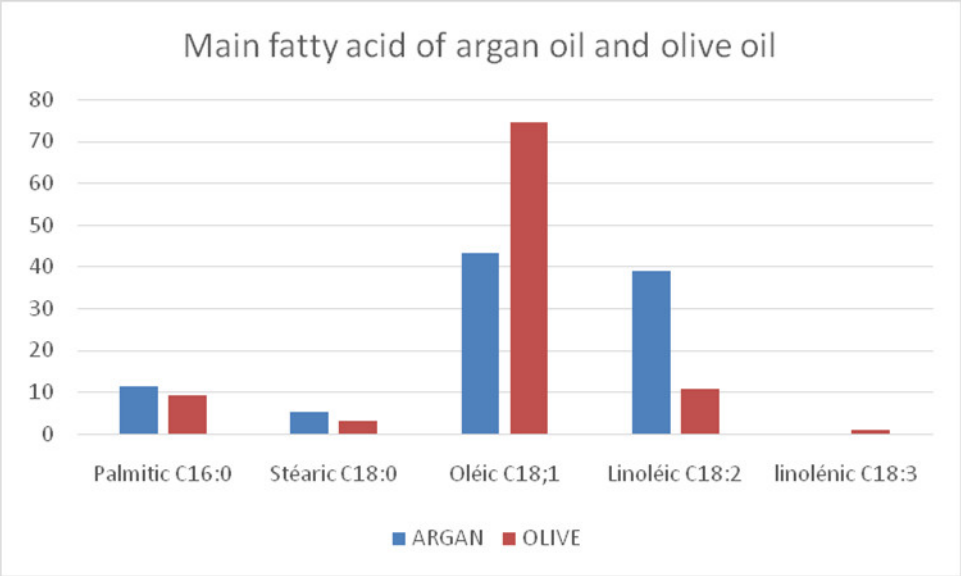

Figure 4: Main fatty acid of argan oil and olive oil

Argan oil contains 80% unsaturated fatty acids. It is oleic (C18: 1 ω-9) -linoleic (C18: 2 ω-6) and contains 38% of essential fatty acids: linoleic acid (38%) (Vitamin F). [16,17]. On the other hand, the percentage of linoleic acid in olive oil is 10.83%. This acid is said to be essential because it can not be synthesized by the body and must be provided by the diet. Unsaturated fatty acids play a vital role in the prevention of cardiovascular disease and the family of omega 6 (such as linoleic acid) is essential for the growth of children is higher in argan oil [18- 19]. Our result shows that the percentage of oleic acid is higher in 74% olive oil compared to 43% argan oil. The oleic acid content (43%) makes argan oil and olive particularly interesting in the regulation of cholesterol.

Sterols analysis

Table 3 shows the results of Sterols obtained at the Laboratory on pure samples of argan oil and olive oil

Table 3: Composition of sterols from argan oil and olive oil

Sterols / Type sample.	Argan	Olive
Cholesterol	-	0.13
Campesterol	0.29	2.85
Stigmasterol	-	-
Stigmasta 8,22 diene 3β-ol	4.40	-
β-sitosterol	-	86.13
Spinasterol	36.21	-
Δ5avenasterol	-	8.43
Schottenol	47.75	-
Δ7 avenastérol	5.00	0.38
Total Sterols mg/100g	154,3	182.7

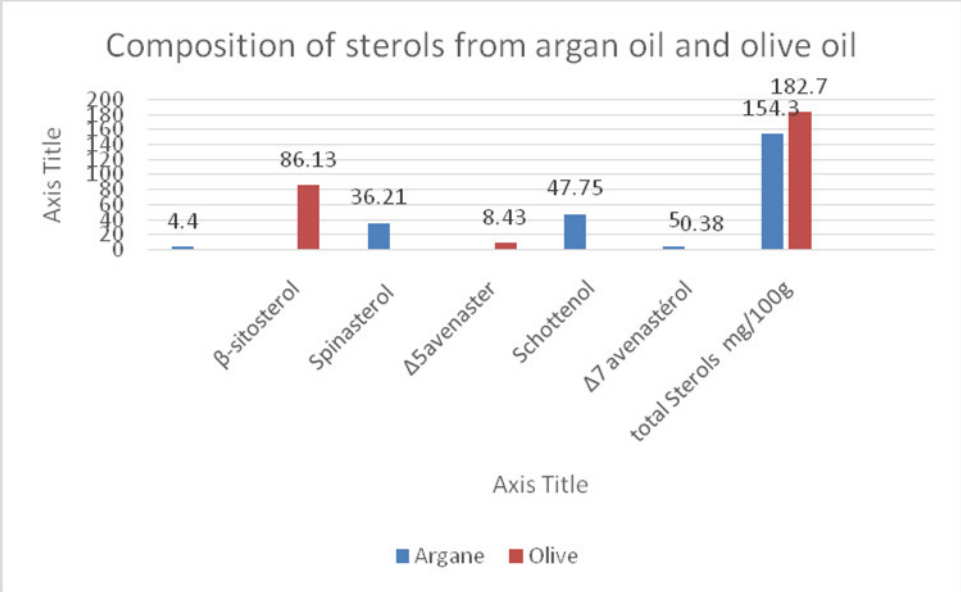

Figure 5: Composition of sterols from argan oil and olive oil

The total sterol content of argan oil is 154 mg / 100g fat [17]. This is not negligible compared to Olive oil which contains 182.7% mg / 100g [20]. The major products in argan oil are schottenol (47.75%) (or Δ-7-stigmasterol) and spinasterol (36.21%) (Figure 6). Schottenol and spinasterol are rarely found in vegetable oils and are characteristic of argan oil. Argan oil does not contain β-sitosterol (Δ-5-stigmasterol), but our result shows that olive oil is rich in β-sitosterol (Δ-5-stigmasterol) (86,13 %) and does not contain schottenol and spinasterol.

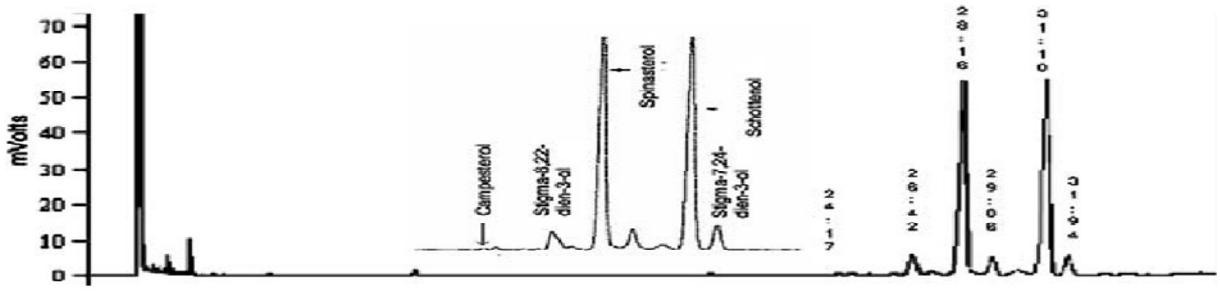

Figure 6: Steril Chromatogram (CPG) of Argan Oil

Triglyceride analysis

The triglycerides of the argan oil and the olive oil analyzed are grouped in Table 4.

Table 4: Triglyceride Composition of Argan Oil and Olive Oil

sample	LLL	LLO	LLP	LOO	LOP	PPL	OOO	POO	OPP	LPS	PPP	SOO	SOP
Argan	7.86	13.21	6.36	14.69	14.16	2.22	11.15	14.58	4.48	0.36	0.49	4.44	2.40
Olive	0.27	3.25	2.40	16.55	6.29	0.54	39.02	15.74	2.11	-	-	5.01	1.05

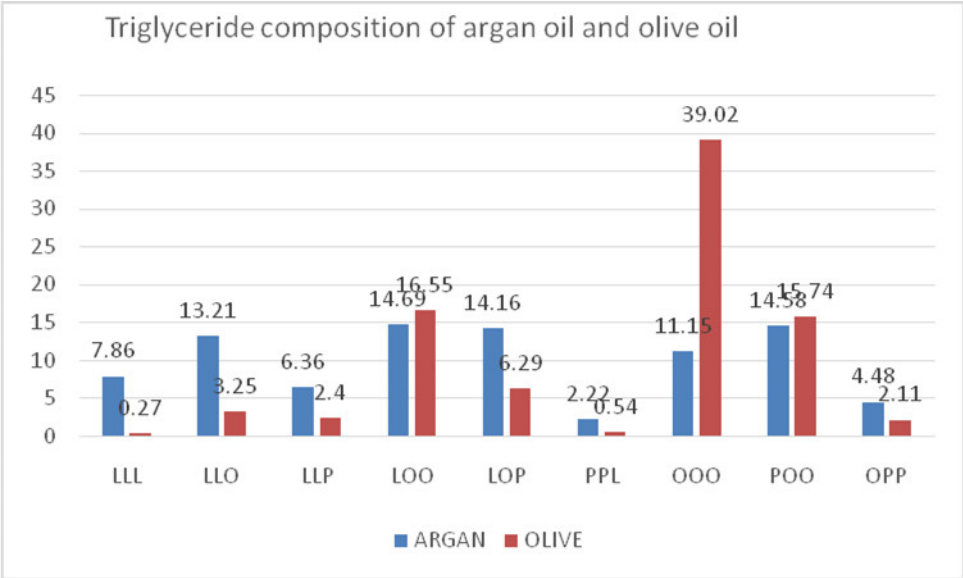

Figure 7: Triglyceride composition of argan oil and olive oil

Argane Olive oils are characterized by the presence of five major triglycerides (OOO, OEL, POL, OOL and OOP). The study of the triglyceride fraction of pure argan oil shows that the percentage of triglyceride OOO is 11.15% [17]. On the other hand, olive oil has higher percentages of this triglyceride (39% olive). Our results also show that the percentages of LLL, LLO and LOP. In argan oil are higher than in olive oil.

Tocopherol analysis

In vegetable oils there are four groups of tocopherols (a, b, g and d). Tocopherols possess both a vitaminic capacity (vitamin E in particular tocopherol) and antioxidant properties [21]. The tocopherol contents of argan oil and olive oil are given in Table 5 [17].

Table 5: Tocopherol composition (mg / kg)

Sample	γ-tocopherol	δ-tocopherol	α-tocopherol	β-tocopherol	Total
Argan oil	631.3	59.5	26.6	-	717.4
Olive oil	30	-	270	8	310

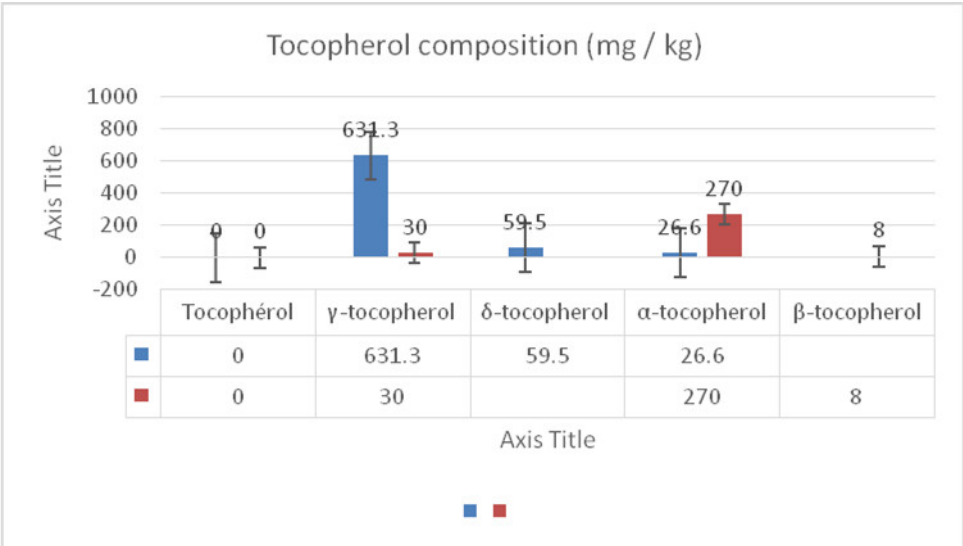

Figure 8: Tocopherol composition (mg / kg)

Tocopherols have vitamin E activity. This vitamin is a powerful antioxidant that captures free radicals and neutralizes destructive oxidation [21]. Argan oil is richer in tocopherol (717 mg / kg) than olive oil (320 mg / kg) [16]. Argan oil is rich in γ-tocopherol (80-90%) and is consistent with published data [16-22]. The work of Jiang and Coll [23] demonstrated that γ-tocopherol has a higher antioxidant capacity than α

tocopherol (vitamin E) in In vivo tests. Argan oil is very rich in gamma tocopherol which gives it aprotective effect against free radicals. These are the cause of aging of the skin and would be involved in several diseases such as cancer or cardiovascular disease.The analyzes of tocopherols olive oil shows that olive oil is richer in α-tocopherol (270%) is contains a percentage of γ-tocopherol is lower (30%) [16].

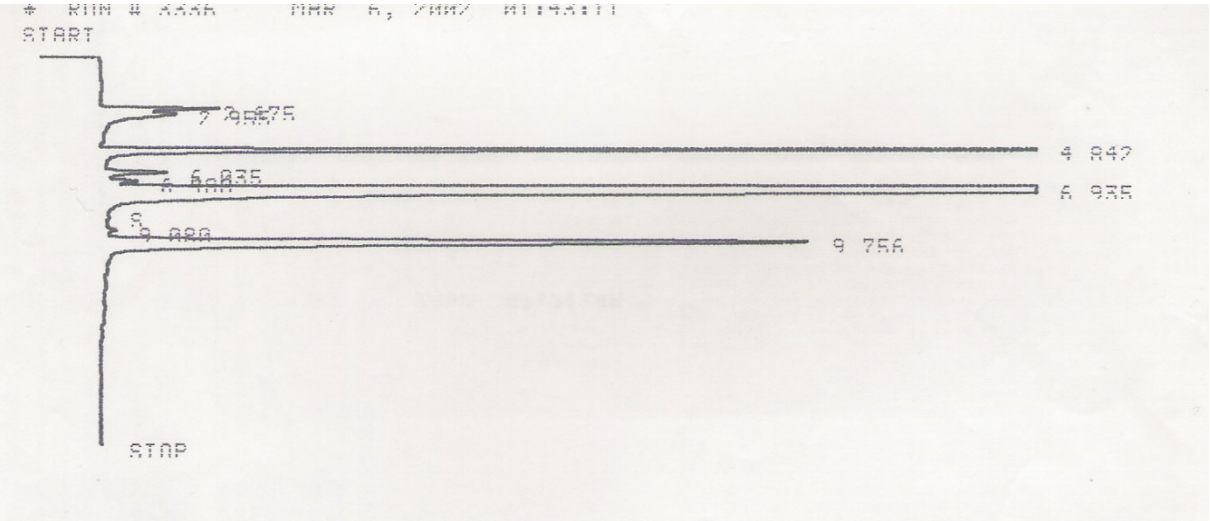

Figure 9: Chromatogram of the tocopherols of argan oil

REFERENCES

1. Derouiche, A., Cherki, M., Drissi, A., Bamou, Y., El Messal, M., Idrissi-Oudghiri, A., Adlouni, A. (2005). Nutritional intervention study with argan oil in man: effects on lipids and apolipoproteins. *Annals of Nutrition and Metabolism*, *49*, 196-201.
2. Charrouf, Z. (2002). Promotion of the argan tree: Results and prospects. In 5th Symposium Natural Products of Plant Origin. University of Quebec, Quebec, Canadá (pp. 261-270).
3. Charrouf, Z. (2012). Promotion of the argan tree for sustainable management of the argan grove. OIFIEPF: Lyon, 5-9.
4. Charrouf, Z., El Kabouss, A., Nouaim, R., Bensouda, Y., Yaméogo, R. (1997). Study of the chemical composition of argan oil according to its mode of extraction. Al-Biruniya, 13, 35-39.
5. Gonet, W. Progress in research on argan oil extraction at the household level. Argan Tree Study Days, (1988), 23-24.
6. ISO 660: (1996). Animal and vegetable fats and oils - determination of acid number and acidity.
7. ISO 3960: (2001). Animal and vegetable fatty substances - determination of the peroxide index.
8. ISO 6320: (2000). Animal and vegetable fats - determination of the refractive index.
9. ISO 3656: (2002). Animal and vegetable fats - determination of absorbance in ultraviolet expressed in the form of specific extinction in ultraviolet light.
10. ISO 3657: (2002). Animal and vegetable fats and oils - determination of the saponification index.
11. NF T60.205 Norm Afnor (1973) the board of directors of the French standardization association by decision n ° 2005-05 February 2005.
12. ISO 6799: (1991). Animals and vegetable fats and oils - determination of the composition of the sterol fraction - method by gas chromatography.
13. ISO 5509: (2000). Animal and vegetable fats and oils - preparation of methyl esters.IUPAC.1987 International of pure and Applied Chemistry. Determination of tocophérols in vegetable oils fats by HPLC; Method 2432 In Standart Methods for the Analysis of oils, fats and derivatives, Paquot C, Haufenne A, (Eds) Blackwell Scientfic publications, Oxford 2432/1-2432/7.
14. EC/2568/91(2003). Commission of the European communities. regulation 2568/97 on the characteristics of olive oil and olive –residue oil and on relevant methods of analysis, Official Journal of the European Community, L-248, 1-109.
15. Hilali, M., Charrouf, Z., Aziz Soulhi, A. E., Hachimi, L., Guillaume, D. (2005). Influence of origin and extraction method on argan oil physico-chemical characteristics and composition. *Journal of Agricultural and Food Chemistry*, *53*, 2081-2087.
16. Amaral, J. S., Casal, S., Citová, I., Santos, A., Seabra, R. M., & Oliveira, B. P. (2006). Characterization of several hazelnut (Corylus avellana L.) cultivars based in chemical, fatty acid and sterol composition. *European Food Research and Technology*, *222*, 274-280.
17. Charrouf, Z. (2002). Argan oil, a prodigious vitality born on the edge of the desert…. Medical expectation, 9, 1-8.
18. Chaumont, J. P., Millet-Clerc, J. (2011). Phyto-aromatherapy applied to dermatology. Lavoisier.
19. A. Karleskind. Manuel des corps gras. Tec& Doc, Lavoisier Ed., Paris, **1992**

20. Charrouf, M. H. (1984). *Contribution to the chemical study of Argania spinosa (L.) oil (Sapotaceae)* (Doctoral dissertation).
21. Gharby, S., Harhar, H., Kartah, B. E., Monfalouti, H. E., Denhez, C., Hilali, M., Charrouf, Z. (2013). Can fruit-form be a marker for argan oil production?. *Natural product communications*, *8*, 1934578X1300800106.
22. Rossell, J. B., & Pritchard, J. L. R. (1991). *Analysis of oilseeds, fats and fatty foods*. Elsevier Science Publishers Ltd. pp: 261-319.

CITE THIS ARTICLE

Miloudi Hilali. Comparative Study of The Chemical Composition of Pure Argan Oils And Virgin Olive . Res. J. Chem. Env. Sci. Vol 7 [4] August 2019. 44-52

