Physicochemical Characteristics and Storage Stability of Palm Olein and Red Palm Olein

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ABSTRACT

Two types of oils, namely palm olein (POL) and red palm olein (RPOL) were characterized from the physicochemical point of view and after storage in clear and amber bottles at room temperature for one year. The latter is done to assess their oxidative stability and to monitor the degradation of tocopherols, tocotrienols and carotenes during the entire storage period. Methods employed included determination of peroxide value (PV), *p*-anisidine value (*p*-AV), acid value (AV) and free fatty acids (FFA). The results have shown that there was a significant increase ($P \leq 0.05$) in each of PV, *p*-AV, AV and FFA for both POL and RPOL during the storage period for 6 and 12 months. Moreover, there was a significant decrease ($P \leq 0.05$) during the period of storage in total tocopherols and tocoterienols as well as in carotenes for both POL and RPOL. Slight changes in fatty acid composition was observed for both POL and RPOL during storage for 12 months, no significant differences could be observed in this regard during the entire period of storage. Red palm olein exhibited higher storage stability than palm olein. Storage of POL and RPOL in amber bottles was superior in terms of maintaining storage stability of oils as compared to their clear counterparts.

Keywords: peroxide value, p-anisidine value, acid value, tocopherols, tocotrienols, carotenes, fatty acid composition, red palm olein, palm olein, oxidative stability.

INTRODUCTION

The use of palm oil as cooking and frying oil as well as in manufacturing shortening is increasing world wide (Nor Aini & Miskandar, 2007, Wai Lin, 2007). Palm oil is extracted from the pericarp layer of the oil palm fruit. It is produced from the species *Elaeis guineensis*, which originates from the west coast of Africa (Southworth, 1985, Merwe *et al.*, 2003). Palm oil is a fruit-coat fat which is low in sterols and rich in pro-vitamin A and vitamin E. Moreover, up to 50% of its fatty acids are unsaturated and linoleic acid represents up to 11% of the total acids. Its composition makes it an edible oil of nutritional importance and endows it with an inherent stability to oxidation (Clegg, 1973, Nwokolo & Smartt, 1995, Gee, 2007).

Palm oil is usually fractionated into a solid fraction; stearin, and a liquid fraction, olein. Both fractions of palm oil are used for various applications in food industry, but palm olein is most commonly used (Augustin & Berry, 1983, Merwe *et al.*, 2003). A novel process has been applied in order to produce edible oil, which is rich in important phytochemicals such as vitamin E, carotenoids and sterols. Red palm oil is an unique product derived from palm oil. Its bright red colour is indicative of high level of carotenoids, which are powerful antioxidants (Hekmat & Hains, 2003, Koh & Wan, 2003, Al-Sager *et al.*, 2004).

Tochopherols are minor components in oils and fats, and they are of great importance in crude palm oil to keep it stable against oxidation during the long shipment and storage time. Tochopherols are important nutritionally factors because of their vitamin E activity (Wong *et al.*, 1988, Butt *et al.*, 2006). Moreover, Clegg (1973) stated that tocopherols, particularly α and γ-tocopherols are powerful antioxidants. It is worth to mention that unlike most common vegetable oils, which have negligible contents of tocotrienols, palm oil contains usually high levels of tocotrienols. Furthermore, recent studies showed that tocotrienols of palm oil exhibit anticancer properties (Al-Sager *et al.*, 2004).

Therefore, the present study was undertaken to assess and compare the physicochemical characteristics of palm olein (POL) and red palm olein (RPOL). Moreover, the storage stability of these two oils, as well as the degradation of different natural antioxidants during the entire storage period for one year at room temperature were also studied.

MATERIALS AND METHODS

Materials supply

Palm olein (POL) has been kindly supplied by Misr Gulf Oil Processing Co., Suez, Egypt, whereas, red palm olein was kindly secured by Carotino SDN BHD Company, Malaysia.

Plastic bottles (clear and amber) made from polyethylene tetraphathalate were purchased from El-Henawy factory, Ras-El Soda, Alexandria, Egypt.

Methods

Storage stability of oils

Red palm olein and palm olein were packed in two different kinds of bottles, clear and amber and stored for one year at room temperature (23 –37°C).

Physiochemical properties and stability indices

Oil colour was assessed using Lovibond Tintorneter (Model F, Inter-Science Son. BHD No. 1383). Refractive index was determined using the refractometer (Atago 1T, Japan, No. 53825) according to ISO (1997). The slip melting point was determined using AOCS Cc 3-25, (1997) method. The cloud point was determined using AOCS Ce 6-25, (1997), while the specific gravity was measured by means of pycnometer (Ca 50 ml) as described by AOAC (920.212) (2000). Oil impurities were determined as described in ISO 663 (1998). Iodine value was determined according to the ISO 3961 (1996), while the saponification value was determined using ISO 3657 (2002). The unsaponifiable matter was determined according to AOCS Ca 6 B-53 (2001). Peroxide value and free fatty acids (965.33) were determined according to AOAC (972.28) (2000), whereas the *p*-anisidine value was determined according to IUPAC (1979).

Fatty acid composition

The fatty acid methyl esters (FAMEs) were prepared using borontriflouride (BF3) methanol (20%) method as mentioned by AOCS Ce 1-62 (1997). The FAMEs were analyzed using HP 6890 GC equipped with Supelco SPTM-2340, USA fused silica capillary column (60 m length, 0.25 mm diameter and 0.2 mm thickness). Quantification was performed by the computer control using area normalization (AOCS Ce 2-62, 1997). Standard FAMEs used in the present study were obtained from Supelco (Supelco FAME Mix RM-6, Supelco 07631- 1AMP).

Determination of tocopherols and tocotrienols by HPLC

About 0.1 g of sample was weighed and transferred into 10 ml volumetric flask and made up to volume with n-hexane. The solution was filtered and 20 ml were injected into column (Jones Chromatography, UK. Genesis Silica of 25 cm length × 4.6 mm inside diameter × 4.6 inch outside diameter and column temperature 30ºC) using Waters 2695 separations Module HPLC (Waters Corporation USA) equipped with auto injector (Aglient Technologist G 1313A ALS, DE 14917 581, UK) and a fluorescence detector (Aglinet Technologist G 1321 A DE 14903748, UK). The mobile phase comprised of a mixture of n–hexane: iso-propanol (99.5: 0.5, v/v), was set at a flow rate of 1.4 ml/min and the run time was set for 22 min. Pure tocopherols (Sigma St. Louis, MO, USA) and tocotrienols (95.4%) developed by Malaysian Palm Oil Board (MPOB) were used as standard references (These tocotrienols were extracted from palm oil and were traceable to Merck individuals α, β, γ and δ tocotrienols). The standard solutions were prepared by taking 0.1 ml from each standard into 10 ml volumetric flask and made up to volume with n-hexane to get 100 ppm. Calibration curves (1, 3 and 5 ppm) were conducted. The content of tocopherols and tocotrienols were expressed as wt% of the total weight of the sample. Quantification was performed by the computer control using area normalization (ISO, 9936, 1997).

Total carotenes determination

Total carotenes content of oils were determined by spectrophtometric analysis at 446 nm using (Cary- IE- UV- Visible, Varian No. 94071244, UK) as described by AOAC (941.15) (2000) and calculated as β-carotene in mg/ kg using Cary Windows UV software No. 8510162500.

Statistical analysis

All determinations were carried out in triplicates. Data were subjected to analysis of variance and Duncan's multiple range test to separate the treatment means as outlined by Steel & Torrie (1980). The analysis was computed using the SAS program.

RESULTS AND DISCUSSION

Physiochemical properties

Physical and chemical characteristics of palm olein (POL) and red palm olein (RPOL) are shown in Table (1). The two oils varied considerably in terms of colour, since POL exhibited values of 2.3R–20Y, while RPOL had values of 50R–20Y. The two oils had similar refractive index value at 50°C (1.455), and had statistically an equal specific gravity and slip point being 0.905 and 0.903 at 50°C, 24.0 and 23.8°C, respectively. However, cloud point varied considerably for POL (11.5°C) and RPOL (8.5°C). The presented data are in good agreement with other published data (Swe *et al.*, 1994, O'Brien, 2004, Gee *et al.*, 2007, Yew Ai, 2007). Also, Nor Aini *et al.* (1998) found the same results for all the determined physical properties of commercial red palm oleins obtained from local Malaysian refineries except for cloud point. They found that cloud point ranged from 2.6 to 3.0°C. They also mentioned that cold stability of oils can be influenced by their cloud points.

Data presented in Table (1) reveal that POL and RPOL were mostly comparable for their respective values of moisture content 0.026 and 0.021%, iodine value 56.6 and 56.7, saponification value 207 and 209, unsaponifiable matter 1.32 and 1.30%, respectively. These observations are in accordance with those reported by Mayamol *et al.* (2007). Also, RPOL is characterized by a lower content of impurities as compared to POL. Such impurities; i.e., gums, phospholipids and trace metals may act as crystal promoters and thereby shorten the storage stability of the oil and also elevate its cloud point. This may be one of the reasons for the higher stability of RPOL as compared to POL.

Storage stability of POL and RPOL

As shown in Table (2), peroxide value (PV) increased significantly ($P \leq 0.05$) from 2.6 and 1.5 in POL and RPOL, respectively, either in the clear or amber bottles to 4.5 and 4.0, 3.3 and 2.8 for the corresponding oleins, after storage for 6 months in the aforementioned two types of bottles, respectively. Moreover, after storage for 12 months, PV of POL packed in clear and amber bottles increased significantly and reached up to 8.5 and 7.7, respectively. It was obvious that PV of RPOL followed the same trend during the entire storage period reaching the corresponding values of 6.8 and 6.2, respectively. Obvious difference in *p*-anisidine value (*p*-AV) could be traced between POL (5.02) and RPOL (0.2) at zero time as shown in Table (2). The point of interest is that RPOL exhibited very low content of *p*-anisidine value as compared with that of POL (5.02) which reflects the highest stability of RPOL due to the presence of high level of antioxidants comparing with POL. It is worth to notice that *p*-AV for POL after 6 months of storage didn't change being 5.2 and 5.05 in clear and amber bottles, respectively, whereas the *p*-AV of RPOL increased significantly after storage for 6 months reaching 0.7 in clear bottles and 0.5 in amber bottles. Moreover, after storage for 12 months, the *p*-AV of RPOL increased significantly in both

Table 1: Physicochemical properties of palm olein (POL) and red palm olein (RPOL)

Characteristics	POL	RPOL
Colour	2.3 R-20Y	50R-20Y
Refractive index (50°C)	1.455±0.00	1.455±0.00
Specific gravity (50°C)	0.905±0.02	0.903±0.02
Slip point (°C)	24.0±0.05	23.80±0.03
Cloud point (°C)	11.5±0.07	8.50±0.12
Moisture (%)	0.026±0.003	0.021±0.008
Impurities (%)	0.64±0.02	0.48±0.00
Iodine value	56.6±0.54	56.70±0.42
Saponification value	207.00±1.05	209.00±1.72
Unsaponification matter (%)	1.32±0.04	1.30±0.05

Results are mean values of three determinations ± standard deviation.

Table 2: Changes in storage stability of palm olein (POL) and red palm olein (RPOL) in different bottles

Storage period (Month)	Parameter	POL		RPOL	
		C	A	C	A
Zero	Peroxide value (meq peroxide/Kg)	$2.6^{az}\pm0.12$	$2.6^{az}\pm0.12$	$1.5^{bz}\pm0.22$	$1.5^{bz}\pm0.22$
	p-Anisidine value	$5.02^{az}\pm0.08$	$5.02^{az}\pm0.08$	$0.2^{bz}\pm0.02$	$0.2^{bz}\pm0.02$
	Acid value	$0.2^{az}\pm0.02$	$0.\ 2^{az}\pm0.21$	$0.25^{bz}\pm0.30$	$0.25^{bz}\pm0.03$
	FFA (%)	$0.09^{az}\pm0.08$	$0.09^{az}\pm0.08$	$0.12^{bz}\pm0.20$	$0.12^{bz}\pm0.2$
6	Peroxide value (meq peroxide/Kg)	$4.5^{ay}\pm0.25$	$4.0^{by}\pm0.33$	$3.3^{cy}\pm0.11$	$2.80^{dy}\pm0.05$
	p-Anisidine value	$5.2^{ay}\pm0.05$	$5.05^{by}\pm0.08$	$0.7^{cy}\pm0.07$	$0.50^{dy}\pm0.05$
	Acid value	$4.07^{ay}\pm0.15$	$2.87^{by}\pm0.23$	$0.5^{cy}\pm0.08$	$0.50^{cy}\pm0.3$
	FFA (%)	$1.88^{ay}\pm0.04$	$1.33^{by}\pm0.1$	$0.23^{cy}\pm0.02$	$0.23^{cy}\pm0.15$
12	Peroxide value (meq peroxide/Kg)	$8.5^{ax}\pm0.15$	$7.7^{bx}\pm0.23$	$6.8^{cx}\pm0.13$	$6.20^{dx}\pm0.12$
	p-Anisidine value	$6.2^{ax}\pm0.02$	$5.5^{bx}\pm0.03$	$2.0^{cx}\pm0.02$	$1.80^{dx}\pm0.04$
	Acid value	$5.6^{ax}\pm0.23$	$5.3^{bx}\pm0.22$	$0.7^{cx}\pm0.34$	$0.60^{dx}\pm0.04$
	FFA (%)	$2.6^{ax}\pm0.12$	$2.46^{bx}\pm0.11$	$0.32^{cx}\pm0.25$	$0.28^{dx}\pm0.03$

C : Clear bottles. A : Amber bottles. FFA: Free Fatty Acids.

Results are mean values of three determinations ± standard deviation.

Means in a row not sharing the same letter (a, b, c and d) and means in a column not sharing the same letter (x, y and z) are significantly different at $P \leq 0.05$.

clear (2.0) and amber (1.8) bottles. However, it was still less than one third of the *p*-AV of POL stored in clear (6.2) or amber (5.5) bottles for 12 months.

Data given in Table (2) indicate that acid values (AV) of POL and RPOL were 0.20 and 0.25 at zero time, respectively. Dramatic elevation more than ten times of AV was noticed for POL stored in clear (4.07) or amber (2.87) bottles after 6 months of storage as compared to their counterparts at zero time. Moreover, AV reached 5.60 and 5.30 in clear and amber bottles, respectively after 12 months of storage. The point of interest is that the AV of RPOL after storage for 6 and 12 months in clear and amber bottles which was 0.50 and 0.70, 0.60, respectively didn't follow the same dramatic elevation trend for POL after the same storage period, the increase in AV was only double or three times as its value at zero time. This finding further confirms the higher stability of RPOL as compared to POL.

Table (2) shows that the free fatty acids (FFA) of POL stored in clear bottles dramatically increased from 0.09 to 1.88 and 2.60% after storage for 6 and 12 months, respectively, whereas FFA of POL stored in amber bottles increased to 1.33 and 2.46% after storage for 6 and 12 months, respectively. On the other hand, RPOL exhibited considerably lower FFA content than POL regardless the type of bottles since it reached only 0.23 and 0.32% in clear bottles and 0.23 and 0.28% in amber bottles after 6 and 12 months of storage, respectively.

It was clear that storage of both POL and RPOL in amber bottles was superior to their counterparts stored in clear bottles. All stability parameters (PV, *p*-AV, AV and FFA) used, confirmed such observation during the entire period of storage. Data presented here agree with those published by Nkpa *et al.* (1990, 1992). Moreover, values belonging to RPOL were always lower than their counterparts for POL which reflects the higher stability of RPOL.

Change in fatty acid composition during storage

The results of the present study (Table 3) in this respect are in accordance with those reported by other authors (Nor Aini *et al.*, 1998, Tan & Che-Man, 2000, Mayamol *et al.*, 2007) regarding the fatty acid composition of POL and PROL. Although, there were few changes in fatty acid composition during the entire storage period, for both POL and RPOL, no significant differences could be traced in the FA composition during storage up to 12 months at room temperature. Also, slight decreases in the unsaturated fatty acids to saturated fatty acids ratio (U/S) was noticed with extension of storage period

Table 3: Changes in fatty acid composition of palm olein (POL) and red palm olein (RPOL) during storage in different bottles

Storage period (Month)	Fatty Acid (%)	POL		RPOL	
		C	A	C	A
Zero	Lauric (C12:0)	0.2	0.2	0.2	0.2
	Myristic (C14:0)	1.1	1.1	1.0	1.0
	Palmitic (C16:0)	40.2	40.2	39.3	39.3
	Margaric (C17:0)	0.1	0.1	0.1	0.1
	Stearic (C18:0)	4.3	4.3	4.2	4.2
	Arachidic (C20:0)	0.5	0.5	0.4	0.4
	TSFA	46.4^{ax}	46.4^{ax}	45.1^{bx}	45.1^{bx}
	Palmitoleic (C16:1)	0.2	0.2	0.2	0.2
	Oleic (C18:1)	42.5	42.5	43.6	43.6
	TMUFA	42.8^{bx}	42.8^{bx}	43.9^{ax}	43.9^{ax}
	Linoleic (C18:2)	10.7	10.7	10.5	10.5
	Linolenic (C18.3)	0.3	0.3	0.5	0.5
	TPUFA	11.0^{ax}	11.0^{ax}	11.0^{ax}	11.0^{ax}
	U/S	1.16:1.00	1.16:1.00	1.22:1.00	1.22:1.00
	Others	0.2	0.2	0.2	0.2
6	Lauric (C12:0)	0.2	0.2	0.2	0.2
	Myristic (C14:0)	1.1	1.1	1.0	1.0
	Palmitic (C16:0)	40.1	40.2	39.4	39.5
	Margaric (C17:0)	0.2	0.1	0.1	0.1
	Stearic (C18:0)	4.2	4.2	4.2	4.2
	Arachidic (C20:0)	0.4	0.4	0.4	0.4
	TSFA	46.2^{ax}	46.2^{ax}	45.2^{bx}	45.3^{bx}
	Palmitoleic (C16:1)	0.2	0.2	0.2	0.2
	Oleic (C18:1)	42.5	42.4	43.6	43.4
	TMUFA	42.7^{bx}	42.6^{bx}	43.8^{ax}	43.6^{ax}
	Linoleic (C18:2)	10.6	10.5	10.5	10.5
	Linolenic (C18.3)	0.3	0.3	0.5	0.5
	TPUFA	10.9^{ax}	10.8^{ax}	11.0^{ax}	11.0^{ax}
	U/S	1.16:1.00	1.15:1.00	1.21:1.00	1.21:1.00
	Others	0.5	0.5	0.2	0.2
12	Lauric (C12:0)	0.2	0.2	0.2	0.2
	Myristic (C14:0)	1.1	1.1	1.0	1.0
	Palmitic (C16:0)	40.0	40.1	39.5	39.5
	Margaric (C17:0)	0.1	0.1	0.1	0.1
	Stearic (C18:0)	4.2	4.2	4.2	4.2
	Arachidic (C20:0)	0.4	0.4	0.4	0.4
	TSFA	46.0^{ax}	46.1^{ax}	45.3^{bx}	45.4^{bx}
	Palmitoleic (C16:1)	0.2	0.2	0.5	0.2
	Oleic (C18:1)	42.6	42.5	43.4	43.4
	TMUFA	42.8^{bx}	42.7^{bx}	43.9^{ax}	43.6^{ax}
	Linoleic (C18:2)	9.9	10.5	10.4	10.4
	Linolenic (C18.3)	0.3	0.3	0.5	0.5
	TPUFA	10.2^{ax}	10.8^{ax}	10.9^{ax}	10.9^{ax}
	U/S	1.15:1.00	1.15:1.00	1.21:1.00	1.20:1.00
	Others	0.3	0.4	0.2	0.2

C : Clear bottles. A : Amber bottles.
TSFA : Total saturated fatty acids. TMUSFA : Total monounsaturated fatty acids.
TPUSFA : Total polyunsaturated fatty acids. U/S: Unsaturated : Saturated fatty acids.
Means in a row not sharing the same letter (a, b and c) and means in a column not sharing the same letter (x, y and z) are significantly different at $P \leq 0.05$.

for POL or RPOL packed in clear or amber bottles. These slight decreases in U/S ratio during storage resulted from the decrease in oleic and linoleic acids content with an increase in palmitic acid.

Changes in tocopherols, tocotrienols and carotenes during storage

Table (4) shows the antioxidants content in POL and RPOL stored in clear and amber bottles for 12 months. It was obvious that RPOL usually contains higher amount of different antioxidants (α-tocopherol, α-tocotrienol, β-tocotrienol, γ-tocotrienol and δ-tocopherol) than their counterparts present in POL. Such differences in antioxidant contents are responsible for the high stability of RPOL as compared to POL (Bonnie & Choo, 2000). There was a significant decrease for each antioxidant, with the extension of storage period. In all cases, the decrease in each antioxidant was more pronounced of oils stored in clear bottles as shown in Table 4. It was obvious that as much as storage period was elongated, the decrease in different antioxidants was more pronounced. It can be seen that RPOL contains higher amounts of total tocotrienols and α-tocopherol (820 ppm) than POL (504.0 ppm) as shown in Table (4). Data presented here are mostly comparable to those published by Bonnie & Choo (2000). Notwithstanding, storage of POL and RPOL in clear bottles resulted in significant declines in total tocotrienols and α-tocopherol from 504 and 820 ppm at zero time, to 453 and 792 ppm after 6 months, respectively and to 425 and 737 ppm after 12 months of storage at room temperature. The losses in total-tocotrienols and α-tocopherol of POL and RPOL stored in amber bottles for the same entire period (12 months) were less than those stored in clear bottles. It was obvious that storage of either POL or RPOL in amber bottles was significantly capable of maintaining different antioxidants unlike the clear bottles.

Table 4: Changes in tocopherols, tocotrienols and carotenes content of palm olein (POL) and red palm olein (RPOL) during storage in different bottles

Storage period (months)	Antioxidants (ppm)	POL		RPOL	
		C	A	C	A
Zero	α–Tocopherol	104.0	104.0	173.0	173.0
	α–Tocotrienol	165.0	165.0	254.0	254.0
	β–Tocotrienol	17.9	17.9	26.7	26.7
	γ–Tocotrienol	167.0	167.0	261.5	261.5
	δ–Tocotrienol	49.0	49.0	104.0	104.0
	Total tocotrienols & α–tocopherol	504^{bx}	504^{bx}	820^{ax}	820^{ax}
	Carotenes	10.0^{bx}	10.0^{bx}	580.0^{ax}	580.0^{ax}
6	α–Tocopherol	85.6	94	164	171
	α–Tocotrienol	137.0	151.0	241.0	251.7
	β–Tocotrienol	16.8	17.9	26.3	25.6
	γ–Tocotrienol	166.0	159.0	256.0	260.7
	δ–Tocotrienol	47.6	48.8	103.7	103.6
	Total tocotrienols & α–tocopherol	453^{by}	471^{cy}	792^{by}	813^{ay}
	Carotenes	3.0^{dy}	5.0^{cy}	537.0^{by}	576.0^{ay}
12	α–Tocopherol	83.6	86.6	154.7	170.5
	α–Tocotrienol	131.0	138	227.0	245.9
	β–Tocotrienol	14.0	13..08	23.9	28.3
	γ–Tocotrienol	148.0	154.0	236.5	261.8
	δ–Tocotrienol	47.0	48.0	94	109.9
	Total tocotrienols & α–tocopherol	425.0^{dz}	440.0^{cz}	737.0^{bz}	817.0^{az}
	Carotenes	2.0^{cz}	2.0^{cz}	520^{bz}	549^{az}

C : Clear bottles. B : Amber bottles.

Means in a row not sharing the same letter (a, b and c) and means in a column not sharing the same letter (x, y and z) are significantly different at $P \leq 0.05$.

The α-tocotrienol and γ-tocotrienol were higher than β and δ tocotrienols. Both α and δ toctrienols are higher in RPOL (254.0 and 261.5 ppm, respectively) than in POL (165 and 167 ppm, respectively).

Previous studies did not determine the different classes of tocotrienols (α, β, γ and δ). This is the first time to determine the different classes of tocotrienols accurately at zero time in POL and RPOL and also observing the degradation of these antioxidants during storing for different periods (6 and 12 months).

Data presented in Table (4) show that RPOL contains 58 folds of carotenes (580 ppm) as compared to POL (10 ppm). Moreover, the decline in carotene contents was more drastic (80%) in POL after storage for 12 months and it became 2.0 ppm in both clear and amber bottles. On the other hand, there was also a significant decrease in carotene contents in RPOL from 580.0 ppm at zero time to 520.0 and 549.0 ppm after storage for 12 months in clear and amber bottles, respectively.

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الخصائص الفيزيوكيماوية والثبات التخزيني لزيت أوليين النخيل وزيت أوليين النخيل الأحمر

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دُرِسَت الخصائص الفيزيوكيماوية لكل من زيت أوليين النخيل وزيت أوليين النخيل الأحمر، وكذا ثباتهما التخزيني عند تعبئة كل منهما في نوعين من العبوات (شفافة، وكهرمانية) ثم التخزين على درجة حرارة الغرفة لمدة عامٍ. وتم تقويم حالة الثبات التخزيني وكذا تتبع تكسر مركبات التوكوفيرولات، والتوكوترينولات والكاروتينات بعد ٦، ١٢ شهراً من التخزين.

أوضحت النتائج ارتفاعاً معنوياً في كل من معايير الثبات التخزيني التالية: رقم البيروكسيد، قيمة البارا أنسيدين، قيمة الحامض، نسبة الأحماض الدهنية الحرة. وكانت التغيرات أكثر وضوحاً في حالة زيت أوليين النخيل مقارنة بزيت أوليين النخيل الأحمر، وكذا في حالة العبوات الشفافة مقارنة بالعبوات الكهرمانية وتبين حدوث انخفاض معنوي في محتويات كلا النوعين من الزيت من التوكوفيرولات والتوكوترينولات الكلية والكاروتينات مع تقدم التخزين، وكان معدل الانخفاض أكبر في حالة زيت أوليين النخيل مقارنة بزيت أوليين النخيل الأحمر وكذا في حالة العبوات الشفافة مقارنة بالعبوات الكهرمانية.

وعلى الرغم من حدوث تغيرات طفيفة في تركيب الأحماض الدهنية خلال تخزين كلا النوعين من الزيت إلا أنه لم توجد فروق معنوية في هذا الصدد خلال عملية التخزين تحت ظروف هذه الدراسة.