EFFECT OF ADDITION OF NATURAL PLANT EXTRACT ON THE FATTY ACID COMPOSITION AND STABILITY OF SOME VEGETABLE OILS DURING 12 MONTHES STORAGE PERIOD

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Abstract

Changes occurring in the physical and chemical properties refractive index (RI), Peroxide value (PV), free fatty acid (FFA), diene and triene at 232 and 268 nm. stability and fatty acid composition of sunflower, soybean and their blend oils during storage for 12 months at room temperature in absence or presence rosemary and sage extracts (RE and SE) at ratio 200 ppm. and refined rice bran and sesame oil (RRBO and So) at ratio 3% as a rich source of natural antioxidant, were studied. The results flowed that. RI, PV, FFA and diene and triene at 232 and 268nm. of all previous these oils in absence and presence RE, SE, RRBO and So registered a progressive increase with increasing the storage period, but RE reduced the increase in these values compared to control oils flowed by RRBO and So then SE. On the other hand, stability of these oils were decreased by increasing storage time in absence and presence RE, SE, RRBO and So, while RE was more effective in preventing oils under study from oxidation when the oils were stored than other treated oils. During storage there is a gradual increase in $C_{16:0}$ and $C_{18:0}$ and a gradual decrease in $C_{18:1}$, $C_{18:2}$ and $C_{18:3}$ by increasing storage time of all oils under investigation, but additions of RE, SE, RRBO and So related to reduce the increase in saturated fatty acid and decrease in unsaturated fatty acid. Generally RE was superior to that of other addition increasing oils stability and quality.

Key words: Rosemary and sage extract, rice bran oil, sesame oil, physical and chemical properties, fatty acid composition and stability.

INTRODUCTION

The oils can be blended even to derive the protective advantage due to the presence of specific ingredient that offer protection against oxidation to improve frying recyclability (Toliwal *et. al.,* 2005).

Oxidation of lipids not only produces vanced odours, unpleasant flavours and discoloration, but can also decrease the nutritional quality and safety. Use of antioxidants is one of the methods that retard or prevent lipid oxidation, preserve the quality and extend the shelf-life of food products. To avoid the use of synthetic additives, in recent decades, interest in natural antioxidants increased, especially because of the belief that natural food ingredients are safer than synthetics. Among

the plants reported to have antioxidative activity, rosemary in its ground form or as an extract is widely used in many food applications. A number of components are responsible for the antioxidative properties of rosemary. The main antioxidative effect is attributed to three phenolic diterpenes: carnosic acid carnosal and rosmarinic acids (Helena and Veronika, 2006).

A power function was found to best represent the time dependence of the content of free radicals scavenged, as well as the content of β-carotene blaeched in the presence of rosemary extracts. (Petva *et. al.*, 2009).

Rosemary is cultivated for the valuable oil which can be extracted from the harvested plants when flower is in buds. It is well known that the activity of rosemary extracts in food industry and medicine belongs to the presence of some important antioxidant oil and phenolic components, to prevent oxidative degradation of oil and lipid cantaining foods. (Eva *et. al.*, 2003).

Extracts of many plants have been reported to have varying degrees of antioxidants activities in fats and oils. Results of these studies indicated clearly that the majority of the spices tested possessed some antioxidants activity, with rosemary (Rosmarinus officialis L.) and sage (Salvia officinalis L.) being the most potent. (Irwandi *et. al.*, 2000).

The addition of natural plant extract of rosemary and sage leaves and refined rice bran oil to some vegetable oils caused remarkable increase in the induction period and total tocopherols and reduced the peroxide value, acidity and K232 and 268 nm. of these oils. Also rosemary extract was superior to that of sage extract increasing oils stability and quality (Nahed 2010).

Several studies have been carried out on elucidating the physical and chemical properties of oil blends involving antioxidant properties of sesame oil which provides high levels of antioxidants and lignins, because of this, sesame oil is stable, and when mixed with other oils, actually increases the stability of the blend. (Gulla and Waghray 2011).

Rice bran is considered to be an important edible oil due to the presence of high percentage of unsaturated fatty acids and certain nutritionally and medicinally important minor constituents such as tocopherols, tocotrienols, sterols and oryzanol taking advantage of the valuable fact that micronutrient level are 50 adequate in rice bran oil. It was considered that value of any other edible oil could be remarkably increased by addition of even small amount of rice bran oil (Adhikari, 2002).

The aim of this work was to study the changes in the physical and chemical properties, fatty acid composition and stability of some oils as a results of addition rosemaiy and sage extracts and rice bran and sesame oils during storage.

MATERIALS AND METHODS

- **Materials:**

1- Sunflower and saybean oils: Refined sunflower and soybean oils without antioxidant were obtained from El-Ekhowa Co. for processing oils. El Sadat city.

2- Blended oil: Refined sunflowers and soybean oil were mixed at 1: 1 ratio.

3- Refined rice bran oil (RRBO) and sesame oil (So) were obtained from CME group, ACME/Chicago Board of trade, NYmex company.

4- Plant leaves: The rosemary and sage leaves were collected from rosemary and sage plants of faculty of Agricultural farm (Cairo University).

Methods:

1- Preparation of natural plant extract (NPE) of Rosemary and Sage leaves (Methanolic extract).

The fresh rosemary and sage leaves were washed by tap water to remove any earth particles then air dried at 40°C over night and ground to obtain fine powder. The dried grounded leaves were extracted at room temp with methanol: water (80: 20%) for 24 hours. Then extract was filtered through whatman paper (No.4). The filtrate of extracts were concentrated using rotary evaporator below 40°C under vacuum and air dried to remove the rest of solvent and ground to obtain a fine powder from NPE of rosemary and sage leaves.

2- Addition of NPE of rosemary, sage leaves, refined rice bran oil (RRBO) and sesame oil (3% So) to oils (oils investigated).

- Sunflower oil without any addition (control).
- Sunflower oil + 3% RRBO
- Sunflower oil + 3% So.
- Sunflower oil + 200ppm from NPE of Rosemary leaves.
- Sunflower oil + 200 ppm from NPE of sage leaves.
- Soybean oils without addition (control)
- Soybean oils + 3% RRBO
- Soybean oils + 3% So
- Soybean oil + 200 ppm from NPE of Rosemary leaves.
- Soybean oil + 200 ppm from NPE of sage leaves.
- Blended oil (sun + soy 1: 1) without any addition (control)
- Blended oil + 3% RRBO
- Blended oil + 3% So
- Blended oil + 200ppm from NPE of Rosemary leaves
- Blended oil + 200 ppm from NPE of sage leaves

3- Storage of samples:

Sunflowers, soybean and their blend oils in absence or presence rosemary extract (RE), sage extract (SE), Refined rice bran oil (RRBO) and sesame oil (So) were stored in dark glass bottles for 6 and 12 months at Room temp.

4- Physical and chemical properties of oils.

Refractive index: of oils was determined at 25°C according to A.O.A.C (2000) by using refractometer (NYRL – 3 poland)

- Acid and peroxid values: were determined according to the methods of A.O.A.C. (1995).
- Absorbency in ultraviolet at 232 and 268 nm. Ultraviolet and visible spectra were conducted using a pye unicum double beam recording spectrophotometer model sp1600, as described by Kates (1972). The samples were dissolved in freshly distil cyclohexan and the absorption were taken at 232 and 268nm.

5- Fatty acid composition:

The fatty acid methyl esters were prepared using trans-esterifiction with cold methanolic solution of potassium hydroxd the fatty acid methyl esters were identified by GC-capillary column according to the methods of IOOC (2001).

6- The stability of oils:

The oxidative stabilities of oils were estimated by using 679 Rancimat (Metrohn Herisou, co., swizerland) at 100°C with an air flow rate of 20 lit/hr according to the method described by Mendz *et. al.*, (1997).

RESULTS AND DISCUSSION

Changes in refractive index at 25°C for oils (RI):

Data in Table (1) illustrated that the change in RI at 25°C of sunflower, soybean and their blend oils during storage for 12 months at room temperature in control samples and treated sample with RE (200ppm), SE (200ppm), RRBO (3%) and So (3%). From the results in this table, it could be observed that the refractive index increased gradually during storage in all oils studied. The changes in refractive index of oils may be attributed to propagation of auto oxidation reaction. Also the results indicated that, the refractive index of storage treated sunflower, soybean and their blended oils with RE, SE, RRBO and So were lower than control samples during storage. Samples related to the phenolic compound of rosemary and sage extract and antioxidant in ricebran and sesame oil exhibited the decrease in the oil refractive index phenomenon (Nahed, 2010).

Table. 1. Changes in refractive index at 25° of studied oils during storage.

Oils	Control	6 month	12 month
Sunflower oil (control)	1.4739	1.4745	1.4749
Sunflower oil +RRBO	1.4737	1.4740	1.4742
Sunflower oil + RE	1.4732	1.4736	1.4741
Sunflower oil + SE	1.4732	1.4737	1.4744
Sunflower oil + So	1.4738	1.4742	1.4740
Soybean oil [control]	1.4736	1.4741	1.4745
Soybean oil + RRBO	1.4732	1.4735	1.4739
Soybean oil +RE	1.4720	1.4723	1.4737
Soybean oil + SE	1.4730	1.4734	1.4736
Soybean oil + So	1.4734	1.4738	1.4741
Blended oil [control]	1.4736	1.4743	1.4746
Blended oil + RRBO	1.4735	1.4740	1.4744
Blended oil + RE	1.4732	1.4736	1.4740
Blended oil + SE	1.4731	1.4737	1.4741
Blended oil + So	1.4736	1.4740	1.4743

RRBO → 3% Refined rice bran oil

RE → 200ppm from NPE of rosemary leaves

SE → 200ppm from NPE of sage leaves

So → 3% sesame oil.

Change in peroxide value

Storage changes in sunflower, soybean and their blend oils were measured by the peroxide formation of the final products of oxidation. The changes in the peroxide values of selected oils during storage are seen in Table (2). Peroxide values of sample oils and control stored for 12 months registered a progressive increase with the storage periode. Steady increase in the oil sample under study according to the extent of oxidation caused by the formation of hydroperoxides during oil oxidation was observed. It was observed that the increase in peroxide values of control samples were from 0.24, 0.63 and 0.52 meg/kg to 9.35, 8.04 and 8.97 meg/kg after the 6 months of storage and to 25.4, 18.63 and 20.65 meg/kg after the 12 months of storage in sunflower, soybean and, their blend oils respectively. But the presence of rosemary and sage extract at 200 ppm and also the refined rice bran and sesame oils at 3% in the previous oils reduced the peroxide values during storage for 6 and 12 months by more than 50% as compared to control oils. This may be due to the presence of natural antioxidants such as polyphenols and flavanoids components in

rosemary and sage extracts (Nahed 2010) and tocopherols, tocotrienols, sterals and oryzanol in rice bran oil (Adhikari, 2002) also sesame oil cantain high levels of antioxidants and lignins (Sankar *et. al.*, 2003).

Change in free fatty acid :

The changes in free fatty acid values, expressed as oleic acid percent of control samples (sunflower, soybean , and their blend) and treated sample with , rosemary and sage extract (200 ppm) , refined rice bran oil (3%) and sesame oil (3%) during storage for 12 monthe is depicted in Table (3). The FFA of control were seem to be 0.5, 0.62 and 0.58%, which increased slowly and steadily to 1.12,

Table. 2. Changes in peroxide value of studied oils during storage.

Oils	Control	6 month	12 month
Sunflower oil (control)	0.24	9.25	25.42
Sunflower oil +RRBO	0.14	6.93	14.62
Sunflower oil + RE	0.13	4.23	10.93
Sunflower oil + SE	0.19	8.25	17.30
Sunflower oil + So	0.20	5.42	13.75
Soybean oil [control]	0.63	8.04	18.63
Soybean oil + RRBO	0.40	7.03	15.73
Soybean oil +RE	0.16	3.75	9.51
Soybean oil + SE	0.39	7.74	16.03
Soybean oil + So	0.37	5.62	11.54
Blended oil [control]	0.52	8.97	20.69
Blended oil + RRBO	0.29	6.3	13.40
Blended oil + RE	0.38	4.0	9.71
Blended oil + SE	0.45	7.82	15.26
Blended oil + So	0.41	5.8	11.95

1.2 and 1.17% after storage period of 6 months and to 2.60, 2.7 and 2.34% after storage period of 12 months in sunflower, soybean and their blend oils respectively. The hydrolytic changes though not predominant, the formation of FFA was found to increase with the increase in time of storage, but the free fatty acids of these oils bended with rosemary and sage extract (200ppm) and with rice bran and sesame oils (3%) were lower after storage period of 6 and 12 months compared with control samples. This may be due to the high content of natural antioxidants in rosemary and sage extract and rice bran and sesame oils. On the other hand RE (rosemary extract)

was more effective in preventing oil from hydrolysis and oxidation when the oils samples were stored.

Table. 3. Changes in free fatty acids (FFA) of studied oils during storage.

Oils	Control	6 month	12 month
Sunflower oil (control)	0.50	1.12	2.6
Sunflower oil +RRBO	0.46	0.9	1.20
Sunflower oil + RE	0.34	0.72	1.01
Sunflower oil + SE	0.46	1.01	1.9
Sunflower oil + So	0.36	0.8	1.12
Soybean oil [control]	0.62	1.2	2.7
Soybean oil + RRBO	0.56	0.97	1.29
Soybean oil +RE	0.33	0.74	1.12
Soybean oil + SE	0.36	1.20	1.94
Soybean oil + So	0.54	0.82	1.18
Blended oil [control]	0.58	1.17	2.34
Blended oil + RRBO	0.20	0.95	1.24
Blended oil + RE	0.30	0.73	1.07
Blended oil + RE	0.32	1.14	1.92
Blended oil + So	0.23	0.82	1.15

Changes in diene and triene:

The changes in diene and triene value at 232 and 268nm. of sunflower soybean and their blend oils during storage in absence (control samples) and presence RE, SE, RRBO and So for 12 months at room temperature can be seen in Table (4). Higher increase in diene and triene values could be noticed between the initial and final period of storage control oils, but the increase in these values was reduced in treated samples with plant extracts (RE and SE) and RRBO and so, especially in presence of rosemary extract. The higher increase of diene and triene values at 232 and 268nm. in control samples indicated the deterioration and oxidation of oils during storage, but the addition of RE, SE, RRBO and So caused reduce in these values this may be due to, those products containing important minor and antioxidant components such as polyphenols and falvonoids in rosemary and sage extracts (Nahed 2010) and tocopherols, tocotrienols, sterols and oryzanol in rice bran oil (Gualla and Waghray, 2011) and lignins in sesame oil (Sankar *et. al.* 2003). These components when mixed with oils actually delay oil oxidation and increases the stability of oils (Nahed 2010).

Changes in stability of oils:

The presented data in Table (5) showed the changes of stability of sunflower, soybean and their blend oil in absence (control) and presence of RE, SE, RRBO and So during storage at for 12 months at room temperature. The stability of control oils recorded a higher decreased by increasing storage period, also there was a steady decrease in stability of these oils in presence of RE, SE, RRBO and So during storage, but this decrease was seem to be the least in comparison to control samples. The nutritional contribution of the three minor components of tocopherol,

Table. 4. Changes in diene and triene of studied oils during storage.

Oils	Control		6 month		12 month	
	232nm	268m	232nm	268m	232nm	268m
Sunflower oil [control]	2.627	1.593	2.795	1.612	2.964	1.631
Sunflower oil +RRBO	2.646	1.396	2.798	1.421	2.850	1.472
Sunflower oil + RE	2.517	1.481	2.683	1.485	2.750	1.590
Sunflower oil + SE	2.610	1.662	2.745	1.675	2.880	1.644
Sunflower oil + So	2.576	1.579	2.688	1.581	2.800	1.598
Soybean oil [control]	2.614	1.40	2.770	1.518	3.930	1.630
Soybean oil + RRBO	2.636	1.479	2.660	1.487	2.920	1.526
Soybean oil +RE	2.649	0.931	2.680	1.231	2.780	1.056
Soybean oil + SE	2.648	1.143	2.690	1.321	3.02	1.570
Soybean oil + So	2.583	1.459	2.650	1.485	2.940	1.550
Blended oil [control]	2.600	1.403	2.780	1.545	2.995	1.584
Blended oil + RRBO	2.657	1.684	2.6800	1.740	2.903	1.761
Blended oil + RE	2.399	1.230	2.560	1.432	2.654	1.352
Blended oil + SE	2.645	1.345	2.693	1.532	2.996	1.422
Blended oil + So	2.615	1.579	2.785	1.664	2.850	1.650

tocotrienols and δ-oryzanol in rice bran oil may have confermed this greater oxidative stability (Gutla and Waghrayo 2011), also sesame oil is stable, and when mixed with other oils, actually increases the stability of the blend (Nirmala *et. al.*, 1996 and Sankar *et. al.*, 2003), and also rosemary and sage are two plant sources of antioxidants that have been studied intensively and proven effective for stabilizing frying oils (Irwandi *et. al.*, 2000).

Table. 5. Changes in oxidative stability of studied oils during storage.

Oils	Control	6 month	12 month
Sunflower oil (control)	10.90	6.76	1.20
Sunflower oil +RRBO	12.02	7.16	6.10
Sunflower oil + RE	14.61	8.31	6.90
Sunflower oil + SE	13.50	5.21	5.20
Sunflower oil + So	11.53	8.13	7.09
Soybean oil [control]	14.52	8.92	5.50
Soybean oil + RRBO	15.41	8.87	6.00
Soybean oil +RE	16.1	10.20	7.60
Soybean oil + SE	15.40	8.41	5.10
Soybean oil + So	15.52	9.26	6.80
Blended oil [control]	11.91	7.50	4.20
Blended oil + RRBO	14.20	8.43	6.30
Blended oil + RE	15.00	9.33	8.60
Blended oil + SE	12.90	7.73	6.07
Blended oil + So	12.40	8.92	7.13

Changes in fatty acid composition of oil during storage:

Changes in fatty acid composition during storage for 6 and 12 months at room temperature for sunflower, soybean and their blend oils in absence or presence rosemary extract (RE), sago extract (SE) refined rice brane oil (RRBO) and sesame oil (So) are shown in Tables (6, 7 and 8). The results indicated that, during storage there was a gradual increase in $C_{16:0}$ and $C_{18:0}$ but a decrease in $C_{18:1}$, $C_{18:2}$ and $C_{18:3}$ of all previous oils in absence (control samples) or presence RE, SE, RRBO and SO (treated samples). This may probably be due to oxidative cleavage of these fatty acids on storage (Gulla and Waghray 2011), with regard the results in all tables, the gradual increase in saturated fatty acids ($C_{16:0}$ and $C_{18:0}$) and a decrease in unsaturated fatty acids ($C_{18:1}$, $C_{18:2}$ and $C_{18:3}$) of sunflower, soybean and their blend oils were reduced in presence RE flowed by So and RRBO then SE compared to control samples. This may be due to RE, SE, RRBO and So are rich source with antioxidants which prevent lipid oxidation.

In conclusion rosemary extracts more effective in preventing oils from oxidation than the other addition under study during storage.

Table. 6. Changes in the fatty acid compisiton of sunflower oils during storage.

Storage of sunflower oils	Fatty acid composition of sunflower oils											
	$C_{14:0}$	$C_{16:0}$	$C_{16:1}$	$C_{18:0}$	$C_{18:1}$	$C_{18:2}$	$C_{18:3}$	$C_{20:0}$	$C_{20:1}$	$C_{22:0}$	Total St.	Total unst
Control oils :												
zero time	-	6.55	-	4.45	23.12	64.48	0.14	0.26	0.17	0.63	11.99	88.01
6 month	0.07	9.33	0.13	6.22	20.54	62.42	0.10	0.49	-	0.70	16.81	83.19
12 month	-	11.15	0.13	7.05	18.32	60.90	0.04	0.51	0.16	0.74	19.45	80.55
Oils + 200ppm NPE of RE	0.07	6.39	0.08	4.18	23.29	64.56	0.22	0.29	0.18	0.74	11.67	88.33
zero time												
6 month	-	7.39	0.07	4.75	22.62	63.82	0.19	0.29	0.16	0.75	13.14	86.86
12 month	-	7.95	0.07	5.54	21.83	63.39	0.15	0.34	0.14	0.76	14.59	85.41
Oils + 200ppm NPE of SE												
zero time	0.07	6.32	0.08	4.28	23.66	64.47	0.16	0.28	0.14	0.77	11.72	88.28
6 month	-	8.90	0.06	5.09	21.89	62.71	0.13	0.29	0.15	0.78	15.06	84.94
12 month	-	10.04	0.05	6.32	20.35	61.92	0.10	0.31	0.12	0.79	17.46	82.54
Oils + 3% RRBO :	-	6.83	-	4.32	23.78	63.93	0.19	0.28	0.17	0.67	11.95	88.05
zero time												
6 month	-	8.06	0.05	5.20	21.81	63.60	0.15	0.29	0.17	0.67	14.22	85.78
12 month	-	9.62	0.04	6.32	20.74	62.0	0.12	0.32	0.15	0.69	16.94	83.06
Oils + 3% So:												
zero time	-	6.54	-	4.36	24.15	63.81	0.14	0.28	0.17	0.55	11.73	88.27
6 month	0.07	7.92	0.05	5.92	22.25	62.60	0.11	0.30	0.16	0.62	14.76	85.24
12 month	-	8.77	0.03	6.45	21.71	61.71	0.10	0.33	0.15	0.75	16.30	83.70

Table. 7. Changes in fatty acid composition of soybean oils during storage.

Storage of soybean oil	Fatty acid composition of soybean oil											
	$C_{14:0}$	$C_{16:0}$	$C_{16:1}$	$C_{18:0}$	$C_{18:1}$	$C_{18:2}$	$C_{18:3}$	$C_{20:0}$	$C_{20:1}$	$C_{22:0}$	Total St.	Total unst.
Control oils :												
zero time	-	10.83	-	4.59	23.06	54.09	6.52	0.36	0.19	0.36	16.14	83.86
6 month	0.08	13.50	0.14	6.70	20.83	51.97	6.29	0.41	0.16	-	20.69	79.31
12 month	-	14.81	0.12	8.28	19.75	49.97	5.95	0.44	0.12	0.56	24.09	75.91
Oils + 200ppm NPE of RE												
zero time	0.07	10.67	0.06	4.54	22.68	53.25	6.56	0.43	0.32	0.38	17.08	82.92
6 month	-	11.86	0.06	5.82	21.75	52.99	6.37	0.45	0.21	0.39	18.52	81.48
12 month	-	13.18	0.04	6.77	20.83	52.06	6.22	0.47	0.11	0.42	20.84	79.16
Oils + 200ppm NPE of SE												
zero time	0.07	10.84	0.05	4.73	22.62	53.28	6.46	0.37	0.25	0.37	17.30	82.70
6 month	0.07	12.50	0.04	6.69	20.06	52.57	6.18	0.39	0.20	0.40	20.05	79.95
12 month	-	14.38	0.03	8.29	18.73	51.6	5.97	0.43	0.14	0.43	23.53	76.17
Oils + 3% RRBO :												
zero time	-	11.02	-	4.50	23.42	52.96	6.25	0.36	0.20	0.35	17.17	82.83
6 month	0.08	12.80	0.12	6.70	22.59	50.81	6.02	0.38	0.15	0.35	21.66	78.39
12 month	-	14.35	0.1	2.98	20.48	49.77	5.96	0.41	0.13	0.39	23.13	76.87
Oils + 3% So:												
zero time	-	10.68	-	4.66	23.76	53.02	6.14	0.39	0.19	0.36	16.89	83.11
6 month	0.07	11.97	0.12	6.89	21.64	52.31	6.00	0.46	0.15	0.39	19.78	80.22
12 month	-	13.47	0.11	7.00	20.81	51.66	5.88	0.51	0.12	0.44	21.42	78.58

Table. 8. Changes in fatty acid composition of blended oils during storage.

Storage of blended oils	Fatty acid composition of blended oils											
	$C_{14:0}$	$C_{16:0}$	$C_{16:1}$	$C_{18:0}$	$C_{18:1}$	$C_{18:2}$	$C_{18:3}$	$C_{20:0}$	$C_{20:1}$	$C_{22:0}$	Total St.	Total unst.
Control oils :												
zero time	-	8.19	-	4.39	23.17	59.52	3.32	0.31	0.17	0.52	13.99	87.01
6 month	0.09	11.94	0.18	6.17	20.94	56.57	3.04	0.40	0.13	0.54	19.14	80.66
12 month	-	13.61	0.08	7.81	19.38	55.13	2.89	0.42	0.10	0.58	22.38	77.62
Oils + 200ppm NPE of RE												
zero time	0.07	8.97	0.15	4.34	23.88	59.35	3.26	0.08	0.20	0.67	13.20	86.79
6 month	0.07	9.11	0.10	5.62	22.83	58.97	3.16	0.34	0.12	0.68	15.82	84.18
12 month	-	9.63	0.06	6.12	22.18	57.83	3.00	0.47	-	0.71	16.93	83.07
Oils + 200ppm NPE of SE												
zero time	0.07	8.97	0.11	4.34	22.94	58.99	3.34	0.31	0.20	0.56	14.41	85.59
6 month	0.09	10.85	0.07	6.82	21.31	56.78	3.16	0.33	-	0.59	18.68	81.32
12 month	-	12.42	0.06	7.29	20.51	55.66	3.07	0.37	-	0.62	20.70	79.30
Oils + 3% RRBO :												
zero time	-	8.97	-	4.34	23.78	58.10	3.26	0.33	0.19	0.52	14.67	85.33
6 month	0.08	10.22	0.13	6.09	22.81	56.89	3.12	0.35	0.14	0.56	17.31	82.70
12 month	-	11.70	011	7.07	21.43	55.63	3.05	0.38	0.08	0.55	19.70	80.30
Oils + 3% So:												
zero time	-	8.62	-	4.44	23.98	58.31	3.18	0.33	0.18	0.49	14.35	85.65
6 month	-	9.45	0.14	5.85	23.73	56.69	3.10	0.38	0.15	0.51	16.19	83.81
12 month	-	10.35	0.12	6.92	22.48	56.06	3.02	0.42	0.10	0.53	18.22	81.78

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تأثير إضافة مستخلص نبات طبيعى على تركيب الأحماض الدهنية والثبات لبعض الزيوت النباتية أثناء التخزين لفترة 12 شهرا

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تم دراسة التغيرات التى تحدث فى الخواص الطبيعية والكيميائية [معامل الانكسار – رقم البيروكسيد – رقم الحموضة – القياس فى منطقة الـ .UV على طول موجى 232، 268 نانوميتر والثبات] وتركيب الأحماض الدهنية أثناء التخزين لزيوت عباد الشمس والصويا وخليطهم لمدة 6، 12 شهر على درجة حرارة الغرفة فى غياب أووجود مستخلص حصى ألبان والمرمرية بنسبة 200 جزء فى المليون وأيضاً إضافة زيت رجيع الكون المكرر والسمسم بنسبة 3% كمصدر غنى بمضادات الأكسدة الطبيعية. وقد تبين من النتائج الآتى. معامل الانكسار، رقم البيروكسيد والحموضة والقياس فى منطقة الـ UV على طول موجى 232، 268 تانوميتر لكل هذه الزيوت السابقة فى غياب أو وجود مستخلص حصى ألبان والمرمرية وزيوت رجيع الكون المكرر والسمسم سجلت زيادة تدريجية بزيادة فترة التخزين ولكن مستخلص حص البان سبب نقص الزيادة فى هذه الأرقام مقارنة بالكنترول يليه زيت رجيع الكون وزيت السمسم ثم مستخلص المرمرية– على الجانب الآخر ثبات هذه الزيوت نقص بزيادة وقت التخزين فى غياب أو وجود الـ SE, RE، RRBO، SO بينما مستخلص حص البان (RE) كان أكثر تأثير فى حماية الزيوت المخزنة موضع الدراسة من الأكسدة عن باقى الزيوت المعاملة مقارنة بزيوت الكنترول.

أثناء التخزين يوجد زيادة تدريجية فى حمض البالميتك وحمض الاستياريك ونقص تدريجى فى حمض الأوليك واللينوليك واللينوليتيك لكل الزيوت موضع الدراسة ولكن إضافة مستخلص حص البان والمرمرية وزيوت رجيع الكون والسمسم أدت إلى خفض الزيادة فى الأحماض الدهنية المشبعة وخفض النقص فى الأحماض الدهنية الغير مشبعة.

وعموماً تفوق مستخلص حصى البان على باقى الإضافات الأخرى وذلك من خلال زيادة ثبات الزيوت وخواص الجودة.