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RESEARCH PAPER

Long Term Effect of Different Packaging Materials on Biochemical Properties of Wild Apricot Kernel Oil

Tejpal Singh Bisht[1], Satish Kumar Sharma[2] and Binayak Chakraborty[3]

[1]Krishi Vigyan Kendra, Ranichauri, Uttarakhand University of Horticulture and Forestry, Bharsar-249 199 (Pauri), Uttarakhand, India
[2]Department of Horticulture, College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar- 263145 (Udham Singh Nagar), Uttarakhand, India
[3]College of Agriculture, Navasri Agricultural University, Waghai- 394 730 (The Dangs), Gujarat, India
Corresponding author: tejpalbisht23@gmail.com

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Abstract

A study was conducted to evaluate the storage stability of wild apricot kernel oils in different packages. Oil extracted through oil expeller were stored for 6 months at ambient conditions (13.17 to 18.47^{O}C temperature and 60 to 70 % RH) in 4 types of packaging material and evaluated for the changes in quality at periodic intervals of 3 months. The packaging materials were transparent plastic bottles (TPB), amber coloured plastic bottles (ACPB), transparent polyethylene pouches (TPP) and aluminium laminated pouches (AP). With the advancement of storage, the iodine value (IV) of wild apricot kernel oil exhibited steady decline from initial mean level of 99.90 to 92.12 g I_2/100g whereas the acid value of oil exhibited steady increase from initial mean level of 3.74 to 9.78 mg KOH/g. Saponification value of wild apricot kernel oil exhibited only a marginal change i.e. 190.7 to 191.6 mg KOH/g after 6 months of storage. There were however, no significant change in the refractive Index of wild apricot oil. In brief, storage of wild apricot kernel oil packed in ACPB up to 6 months did not exhibit any adverse change in its physico-chemical quality and the values were well within the acceptable limits prescribed by PFA (Prevention of Food Adulteration Act).

Keywords: Wild apricot, kernel oil, Iodine value, saponification value, referactive index

Edible oil production is an important sector of the food processing industry. There are several species of plants in the world whose oil can be utilized for human consumption for both edible and non-edible purposes. Though around 40 oilseeds are known, only around a dozen oilseeds crops have become commercially important including ten seed crops and three tree crops. These oil seed crops (mostly annual) of commercial importance are groundnut, rapeseed-mustard, sesame, soybean, sunflower, cottonseed, safflower, niger, castor and linseed. The three major tree oil crops are palm, olive and coconut. Besides these, the kernels of some other tree crops i.e. apricot, almond, walnut, hazelnut, peach can also be utilized for oil extraction purposes for edible and non-edible uses. The oils of tree fruits and kernels are also becoming popular very fast for various foods, pharmaceutical and cosmetic industries (Nagaraj, 2009, Sharma *et al.*, 2011).

Large scale requirement and local shortages of oils for various edible and non-edible uses have prompted the identification of many new sources of oil during the last few decades. In future all the oil crops will gain greater attention in future as they are renewable and biodegradable in nature (Bisht *et al.*, 2013). Most of these oilseeds and their products have wide utility in the specialty oils sector and are mostly used for non-edible

purposes. Soap and detergents, paint and varnish, lubricants, pesticides and medicines, cosmetics, bio-diesel fuel industry are the major consumers of these oilseeds. Amongst the oil crops, wild apricot kernel is a good source of edible oil containing high unsaturated fatty acids. Apricot oil is also used as a substitute of almond oil in national and international markets. Stone fruit kernel oil can be extracted using various methods viz., manual grinding and pressing, oil press (power *ghani*), solvent extraction, oil expeller and table oil expeller. Use of oil press (power *ghani*) has been practiced for oil extraction from stone fruit kernels. Apricot kernels are reported to contain 40 to 47% oil but only 35% is extractable by cold pressing. Rest about 12 % is wasted in the cake (Sharma *et al.,* 2011). In present time, wild apricot oil has high demand in market. Besides, apricot oil is also used in various cosmetic and pharmaceutical preparations such as massage oil for joint pains, for new born babies and as anti-wrinkle lotion etc. Generally, apricot fruits contain 11.7-22.2 per cent stone, which yield 30.7-33.7 per cent kernel, which may be both sweet as well as bitter in taste (Gupta *et al.*, 2009; Gupta and Sharma, 2009).

Both types of kernels can be utilized for extraction of oil. The apricot oil comprises of monoenoic and dienoic fatty acids. One of the major causes of spoilage during the storage of oils is oxidation. It is of great economic concern to the food industry because it leads to the development of various off-flavours and off-odours generally called rancidity, which reduces their shelf-life (Nawar, 1985). Kamboj (2002) have reported the storage of kernel oil expressed by using oil press up to 6 months did not exhibit any adverse changes in chemical constituent of the oil. Oil packed either in transparent or coloured bottles remained well within the minimum specifications for almond oil as per PFA specification. During storage up to 6 months at room temperature (14.1-28.4^{O}C), the olive oil packed in either of the packages (transparent or coloured bottles) had registered an increase in their free fatty acid (FFA), peroxide value (PV), saponification value (SV) and unsaponifiable matter with corresponding decline in IV and total phenols. The oil packed in coloured/opaque glass bottles exhibited comparatively less changes in quality characteristics during storage (Sharma *et al.*, 2006c). Sophia *et al.* (2006) reported packing of walnut oil in amber coloured glass bottles and storage at low temperature (3-7^{O}C) exhibited a significant improvement in retention of various quality attributes upto 6 months of storage. Oil packed in amber coloured glass bottles (ACGB) indicated minimum changes in quality attributes and were found to be more shelf-stable than the transparent bottles (TB) after 6 months of storage (Sharma *et al.*, 2006a). The storage stability of oils was evaluated up to 6 months at 20^{O}C, after packaging in transparent glass bottles (TGB), amber coloured glass bottles (ACGB) and polyethylene (PE) pouches. Oil packed in ACGB and PE pouches exhibited comparatively lower change in quality characteristics after 6 months than the oil stored in TGB (Gupta and Sharma, 2009b). The authors in their previous study standardized the process protocol for the improvement of efficiency of oil extraction from wild apricot kernels by using enzymes (Bisht *et al.*, 2013). Present investigations were undertaken to evaluate the wild apricot kernel oil during storage in different packages.

Materials and Methods

Oil Extration

Apricot oil extracted without use of any enzyme (commercial method in Postharvest Technology Laboratory, Department of Horticulture, G.B. Pant University of Agriculture and Technology, Hill Campus, Ranichauri, Tehri-Garhwal, Uttarakhand, India) which atpresent comes under the Uttarakhand University of Horticulture and Forestry, Bharsar, Pauri, Uttarakhand, India) were stored for 6 months at ambient conditions (13.17 to 18.47 ^{O}C temperature and 60 to 70 % RH) in 4 types of packaging material and evaluated for the changes in quality at periodic intervals of 3 months. The packaging materials were transparent plastic bottles (TPB, 200 ml capacity), amber coloured plastic bottles (ACPB, 200 ml capacity), transparent polyethylene pouches (TPP, 25 gauge, 200 ml capacity) and aluminium laminated pouches (AP, 200 ml capacity).

Quality Analysis

The specific gravity of oil was measured using specific gravity bottles according to the standard method (Ranganna, 1997). The refractive index of oil was determined using Abbe's refractometer (Model Advance Research Inst. Co., New Delhi) by placing 2-3 drop of oil sample on the prism. During the process the temperature of oil was maintained at 40^{O}C by holding the oil samples in water bath (AOAC, 1995). Acid value of apricot kernel oils was estimated by titrating a known weight of sample (5g) with addition of 50 ml alcohol against 0.1 N NaOH solution using phenolphthalein as an indicator (AOAC, 1995). Iodine value of apricot kernel oil was estimated according to Wijs Procedure. Saponification value of apricot kernel oil was estimated according to the standard method (AOAC, 1995). The quality attributes of kernel oils from various fruits were compared with

the quality standards of almond oil as specified in the Prevention of Food Adulteration (PFA) Act and Rules (Anon, 1996).

Statistical Analysis

Wild apricot oil extracted by best enzymatic treatment along with control was evaluated for quality characteristic. The quality parameters of wild apricot kernels oil were analyzed statistically by Completely Randomized Design (CRD) described by Cochran and Cox (1967).

Results and Discussion

Quality Changes

The storage stability of wild apricot kernel oil was evaluated after packing in transparent plastic bottle (TPB), amber coloured plastic bottle (ACPB), polyethylene pouch (PP) and aluminium pouch (AP) at periodic interval of initial, 3 months and 6 months of storage under ambient conditions (10 to 29^{O}C temperature and 55 to 75 % RH). The results, presented in the Table 1 to 4, and the trend shown in Figure 1, are discussed as under.

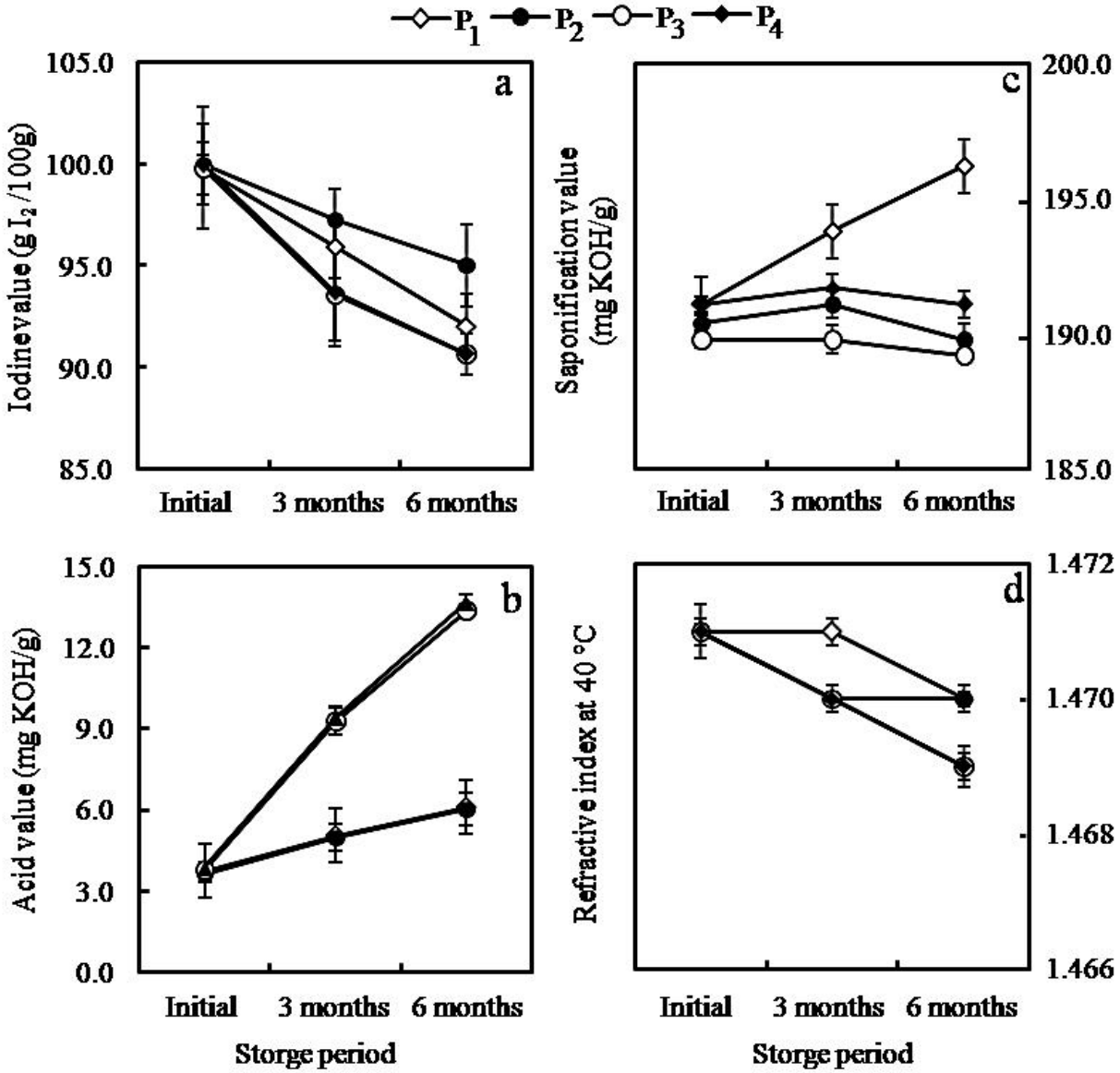

Fig. 1: Effect of packaging material on the iodine value (a), acid value (b), saponification value (c) and refractive index at 40^{O}C (d) of wild apricot kernel oils during storage periods. P_1= Transparent plastic bottle, P_2= Amber coloured plastic bottle, P_3= Polyethylene pouch and P_4= Alluminium pouch. The vertical bar denotes standard error (**n = x**)

Table 1: Effect of packaging material on the iodine value (IV) of wild apricot kernel oils during storage

Packaging Material	Iodine value (g I2/100g)			
	Initial	3 months	6 months	Mean (S)
Transparent Plastic Bottle	99.82	95.93	92.04	95.93
Amber Coloured Plastic Bottle	99.99	97.28	95.03	97.45
Polyethylene Pouch	99.82	93.56	90.69	94.69
Alluminium Pouch	99.99	93.73	90.69	94.80
Mean (T)	99.90	95.13	92.12	
		$CD_{0.05}$	SE	
Packaging Material (T)		0.05	0.023	
Storage Interval (S)		0.04	0.020	
T × S		0.30	0.140	

Table 2: Effect of packaging material on the acid value of wild apricot kernel oil during storage

Packaging Material	Acid value (mg KOH/g)			
	Initial	3 months	6 months	Mean (S)
Transparent Plastic Bottle	3.73	5.04	6.09	4.94
Amber Coloured Plastic Bottle	3.62	4.96	6.01	4.86
Polyethylene Pouch	3.77	9.27	13.37	8.80
Alluminium Pouch	3.84	9.42	13.67	8.97
Mean (T)	3.74	7.16	9.78	
		$CD_{0.05}$	SE	
Packaging Material (T)		0.01	0.004	
Storage Interval (S)		0.01	0.004	
T × S		0.06	0.028	

Table 3: Effect of packaging material on the saponification value of apricot kernel oils during storage

Packaging Material	Saponification value (mg KOH/g)			
	Initial	3 months	6 months	Mean (S)
Transparent Plastic Bottle	191.1	193.8	196.2	193.7
Amber Coloured Plastic Bottle	190.4	191.1	189.8	190.4
Polyethylene Pouch	189.8	189.8	189.2	189.8
Alluminium Pouch	191.1	191.7	191.1	191.3
Mean (T)	190.7	191.6	191.6	
		$CD_{0.05}$	SE	
Packaging Material (T)		0.14	0.050	
Storage Interval (S)		0.10	0.043	
T × S		0.60	0.270	

Table 4: Effect of packaging material on the refractive index of apricot kernel oils during storage

Packaging Material	Refractive Index 40°C			
	Initial	3 months	6 months	Mean (S)
Transparent Plastic Bottle	1.471	1.471	1.470	1.470
Amber Coloured Plastic Bottle	1.471	1.470	1.470	1.470
Polyethylene Pouch	1.471	1.470	1.469	1.470
Alluminium Pouch	1.471	1.470	1.469	1.470
Mean (T)	1.471	1.470	1.470	
		$CD_{0.05}$	SE	
Packaging Material (T)		NS	0.0002	
Storage Interval (S)		NS	0.0002	
T × S		NS	0.0003	

Iodine value (IV)

With the advancement of storage, the iodine value (IV) of wild apricot kernel oil exhibited steady decline from initial mean level of 99.90 to 92.12 g I_2/100g after 6 months of storage under ambient conditions (Table 1). Minimum changes were recorded in the oil packed in amber coloured plastic bottles with mean level of 97.45 g I_2/100g after 6 months of storage while the maximum changes (mean level 94.69 g I_2/100g) were recorded in samples packed in polyethylene pouches. According to PFA specifications, the iodine value range for almond oil was 90-109.

Among the packaging materials used, the ACPB showed a protective influence in checking the fall of iodine value (95.03) when compared with the IV of oil packed in TPB (92.04), PP (90.69) and AP (90.69) after 6 months of storage. Kamboj (2002) reported that with the advancement in period of storage, the iodine value in kernel oil of apricot exhibited only a slight decrease. According to Raghav *et al.* (1999), the oxidation of oils is reported to cause decrease in unsaturated fatty acids, which is responsible for decrease in Iodine Value (IV). Sharma *et al*. (2006c) reported the mean value of iodine of olive oils, ranged from 76.8-79.9 during six months of storage, while those packed in transparent and coloured glass bottles were 78.3 and 78.7 respectively. Sharma *et al*. (2006a) extracted reported the kernel oil from peach, plum and apricot fruit kernels and showed a significant decrease in the Iodine Value (IV) 102-91.6, 97.8-88.2 and 100.4-90.1 respectively with the increase in storage time. Sharma *et al*. (2005) and Sophia *et al*. (2006) have also reported a decline in Iodine Value (IV) in stone fruit kernel oils and walnut kernel oils. Thus, wild apricot kernel oil packed in all the packaging materials exhibited Iodine Value (IV) within the prescribed range for almond oil.

Acid Value (AV)

Acid value (AV) is the measure of hydrolytic rancidity of oils and generally increases during storage (Thimmaiah, 1999). With the advancement of storage, the acid value of wild apricot kernel oil exhibited a steady increase from initial mean level of 3.74 to 9.78 mg KoH/g after 6 months of storage under ambient conditions (Table 2). Minimum changes were recorded in the oil packed in amber coloured plastic bottles with mean level of 4.86 mg KoH/g after 6 months of storage while the higher changes (mean level 8.80 – 8.97 mg KoH/g) were recorded in the samples packed in polyethylene and aluminium laminated pouches.

Kamboj (2002) found the mean acid value after six months of storage increased 22.17 mg KoH/g from their initial value of 19.75 mg KoH/g in kernel oil of apricot, the oil packed in coloured glass bottle however, showed a significantly less increase in the acid value. Sophia *et al*. (2006) reported AV being the measure of hydrolytic rancidity increased from initial mean value of 2.46 to 2.96, during 6 months of storage. The oil extracted from apricot kernels had a significant increase in Acid value (AV) from initial values of 3.6-5.9 mg KoH/g (Gupta and Sharma, 2009b), while, Sharma *et al.* (2006a) reported that the kernel oil extracted from apricot fruit kernels showed Acid value (AV) 2.9-7.0 mg KOH/g. However, the oil packed in ACPB showed a significantly lesser increase in the acid value than TB, PP and AP upto 6 months of storage. Thus, ACPB is best packaging material, exhibiting its protective effect in preserving the oil quality during storage.

Saponification Value (SV)

Saponification value of wild apricot kernel oil exhibited only a marginal changes during 6 months of storage (Table 3). The saponification value of wild apricot kernel oil slightly increased from its initial level of 190.7 mg KoH/g to 191.6 mg KoH/g after 6 months of storage. However, these changes were very less due to the effect of packaging material. According to the PFA specifications, the saponification value range for almond oil was 186-195 mg KoH/g.

Sharma *et al*. (2006c) reported the SV in olive oils during 6 months of storage ranged from 189.5-192.0 with respective mean values of 190.9 and 190.7 for the oil packed in transparent and coloured glass bottles. Sophia *et al*. (2006) documented the SV of walnut kernel oil increased to 194.9 from the initial value of 192.6 after 6 month of storage. The oil extracted from apricot kernels showed a significant increase in Saponification value (SV) from initial values 192.8-195.5 mg KoH/g (Gupta and Sharma, 2009b), while, Sharma *et al.* (2006a) showed saponification value (SV) of 192.0.-197.9 mg KOH/g in the kernel oil extracted from apricot fruit kernels. Thus, wild apricot kernel oil packed in all the packaging materials except TPB exhibited SV within the prescribed range for almond oil even after 6 months of storage, under ambient conditions.

Refractive Index (RI)

There were no significant changes in the refractive Index of wild apricot oil packed in different packaging material during 6 months of storage at ambient conditions. The mean level of refractive Index ranged from 1.470 to 1.471. However, packaging material did not affect the RI of the oil samples during storage.

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