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Effect of Ethanol-Extracted Propolis on Fruit Quality and Storability of Balady Oranges During Cold Storage

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Abstract

This investigation was carried out during 2012 and 2013 seasons to study the effect of ethanol extracted propolis (EEP) at 2, 3 and 5% on fruit quality and storability of Balady Orange fruits during cold storage. Propolis was applied once or twice pre and post harvest then the fruits were stored at 5-7°C with 90±5 RH for ten weeks.

Prolonging cold storage significantly increased weight loss %, undesirable fruits %, TSS% and TSS/acid ratio while gradually decreased total acidity and vitamin C content. All propolis treatments significantly decreased fruit weight loss % and undesirable fruit % compared to untreated fruits. On the other hand, all treatments failed to show any significant effects on fruit quality parameters. No significant effects were observed due to using propolis once at post-harvest or twice pre and post-harvest. The best treatment was using EEP at 5% dipped once at post-harvest which prolong cold storage period without great reduction in fruit quality.

It is recommended to dip 5% (EEP) at post-harvest extend life and keep fruit quality of Balady Oranges during cold storage instead of using fungicides in order to save human health and environment.

Keywords: *Propolis, Fruit quality, Storability, Cold storage, Citrus.*

Introduction

Citrus is native tree for tropical and subtropical regions. Orange is one of the most important world crops and essential source of vitamin C (Economos and Clay, 1999).

No doubt that process of handling and storage for local or export market is an important and of vital interest as well as fruit production and its quality. Post harvest decay is the major factor limiting the extension of storage life of many fresh fruits (Kader, 2002).

Weight loss and fungal decay are the main factors limiting the storage life of Orange. Fungal diseases are controlled with chemical fungicides, which negatively affects human health and the environment, so there is a clear need for alternative natural materials for post-harvest disease control that reduce fungal decay in citrus fruits. Such as Chitosan treatment (Chien *et al*., 2007), essential oils treatments (Zigus and Erice, 2001; Saucedo-Pompa *et al*., 2007; Badawy, Ibtesam *et al*., 2011), ethanol extracted propolis (Yang *et al.,* 2010 and Masoud and Badawy, 2012) and biological control with yeast antagonists (Sallam, Nashwa *et al*., 2012).

Propolis (bee glue) is the resinous substance collected honey bees from various plant sources. The antifungal activity of propolis has been evaluated by Quiroga *et al*., 2006; Aly and Elewa, 2007; Ghasem *et al*., 2007 and Yang *et al*., 2010).

Thus, this study aimed to recognize the effect of ethanol-extracted propolis on the fruit quality and storability of Balady Oranges during cold storage.

Materials and Methods

This investigation was carried out throughout two successive seasons 2012 and 2013 on Balady Orange trees fruits in the experimental Orchard and Laboratory of Pomology Department, Faculty of Agriculture, Assiut University.

Preparation of propolis extracts:

Propolis extracts prepared as described by Boeru and Derevici (1978). 100 grams of propolis were frozen to -18°C, cut in small pieces, and ground in a chilled mortar then 10% ethanol extract propolis was prepared by adding 100 gram of propolis to 900 ml of 70% ethanol. The mixture was gradually heated in water bath for 24 hours at 70°C. Water was then added. The mixture was maintained at room temperature during preparation and was subsequently filtered. The extract was kept at 5°C in dark storage until use. The amount of dissolved principles was assessed by weight difference. The 2%, 3%, and 5% propolis extracts were prepared by dilution of the 10% propolis solution with 70% ethanol in the required proportions.

Plant material:

Thirty healthy Balady Orange trees were chosen for carrying out this experiment. They were nearly similar in vigor and productivity and receiving regular horticultural practices. The chosen trees were divided into ten groups. Each group contained three trees (replicates). Six groups were sprayed with 2%, 3% and 5% ethanol extracted propolis fifteen days before harvest dates, two groups for each one, other four groups sprayed with water. Fruits were harvested at the commercial maturity hand packed and carefully brought, soon after picking to laboratory. Fruits were washed with tap water, air dried. The ten treatments were arranged as follow:

1- Pre-harvest dipping with 2% ethanol extracted propolis (EEP).

2- Pre-harvest spraying + post harvest dipping with 2% EEP.

3- (Pre + post) harvests spraying with 2% EEP.

4- Pre-harvest spraying with 3% EEP.

5- Post harvest dipping with 3% EEP.

6- Pre-harvest spraying + post harvest dipping with 3% EEP.

7- Pre-harvest spraying with 5% EEP.

8- Post harvest dipping with 5% EEP.

9- Pre-harvest spraying + post harvest dipping with 5% EEP.

10- Control (spraying with water).

All fruits were weighed then stored at 5-7°C and 90±5% relative humidity. Each treatment was replicated three times and each replicate put as one layer in a carton box. Representative samples of each replicate were taken biweekly during storage period until the percentage of decay reached 50%. This factorial experiment including ten treatments and six storage periods with three replications.

Changes on some Physical and chemical properties were estimated biweekly as following:

(A) Physical characteristics:

1- Weight loss %:

The fruit weight was recorded and the percentage of weight loss was calculated by determination the progressive reduction in fruit weight during storage period relative to the original fresh weight at the beginning of storage.

2- Undesirable fruit percentage:

Calculated by dividing the number of undesirable fruits by the total number of fruits.

$$Fruit\ decay\ \% = \frac{The\ number\ of\ decayed\ fruits}{The\ total\ number\ of\ fruits}\ x\ 100$$

(B) Chemical characteristics:

1- Total soluble solids (TSS%):

TSS% in fruit juice was determined by using a hand refractometer.

2- Total acidity %:

Was determined by titrating juice against 0.1 N NaoH with phenol phethalin as an indicator and calculated as gram of citric acid as described in the A.O.A.C. (1995).

3- TSS/acid ratio:

These values were calculated by dividing the percentage of total soluble solids (TSS%) on the total acid percentage.

4- Vitamin C contents:

The 2,6-dichloroindophenol titrimetric method (AOAC, 1995) was used to determine the ascorbic acid of pressed fruit juice. Results were expressed as milligram of ascorbic acid/100 mL juice. All recorded data were tabulated and statistically analysed according to Snedecor and Cochran (1990) using L.S.D. at the level of 0.05 for made comparison between various treatments.

Results and Discussion

Fruit weight loss %:

Data illustrated in Table (1) showed that fruit weight loss percentage significantly increased by extending cold storage period for both treated and untreated fruits, during the two investigated seasons. This traits was slightly increased and gradually from the beginning of stored till ten weeks. The loss of fruit weight indicated the tendency to lose water in fruits, which occurs during the fruit storage. The fruit weight decrease due to its respiratory process, the transference of humidity and some processes of oxidation and the evaporation of moisture inside the fruits. Such findings are in agreement with Kader (1986), El-Shiekh and Abo-Goukh (2008) and Ozdemir *et al*. (2010). All treatments significantly reduced fruit weight loss percentage during cooling storage for ten weeks compared to untreated one (control). Using 5% EEP has the best result, which gave the least values (3.41 and 5.94%), (3.80 and 5.98%) and (4.24 and 6.23%) for (pre + post) harvest, post-harvest and pre-harvest treatments compared with control which recorded (11.73% and 13.00%) after ten weeks in the two studied seasons, respectively.

These results may be due to making a thin film of propolis (wax) surrounding the fruit peel, which contact as a semi permeable barrier against oxygen, carbon dioxide, moisture and soluble movements. Hence they can reduce the rates of the respiration, water loss and oxidation reaction (Baldwin *et al*., 1999).

The loss of water from fresh fruit after harvest is a serious problem, causing shrinkage and weight loss. Surface coatings have been used widely in fruits to reduce dehydration in fruits, reduce water loss, retain the shriveling of the fruit skin, delay the fruit decay, and thereby delay the decline in fruit quality.

These finding are in agreement with Hagenmaier and Baker (1996), Ozdemir and Dundar (1999 and 2001). Ozdemir *et al*. (2010) and Ren *et al*. (2010) who found that fruit weight loss decreased by treatment with several concentrations of propolis extracts during cold storage.

- Undesirable fruits percentage:

Data in table (2) show the effect of ethanol extracted porpolis applications on undesirable fruits percentage of Orange fruit during the cold storage at 5-7°C in 2012 and 2013 seasons. It was clear from the data that results took similar trend during the two studied seasons.

Table 1. Effect of Ethanol Extracted-Propolis on weight loss percentage of Balady Oranges under cold storage during 2012 and 2013 seasons.

Treatments EEP conc. (B) / Week (A)	EEP 2% conc.			EEP 3% conc.			EEP 5% conc.			Control	Mean
	Pre.	Post	Pre + Post	Pre.	Post	Pre + Post	Pre.	Post	Pre + Post		
2012 season											
Beginning of storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2nd week	1.47	1.52	1.21	0.94	0.69	0.03	1.40	1.18	1.36	3.40	1.70
4th week	2.80	2.63	2.65	2.39	2.40	2.18	2.00	1.30	1.87	3.52	2.56
6th week	4.54	3.50	3.50	3.07	2.37	2.43	2.72	2.42	2.30	5.20	3.54
8th week	5.61	4.13	3.94	5.46	3.50	2.91	4.03	3.33	3.11	8.50	5.13
10th week	6.89	5.87	4.46	5.88	5.03	6.16	4.24	3.80	3.41	11.73	6.75
Mean	**3.55**	**2.94**	**2.63**	**2.96**	**2.33**	**2.29**	**2.40**	**2.01**	**2.01**	**5.39**	
LSD 5%	**A: 0.236**			**B: 0.300**			**AxB: 0.736**				
2013 season											
Beginning of storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2nd week	1.50	1.56	1.51	1.31	1.36	1.34	1.16	1.25	1.30	2.76	1.72
4th week	1.84	1.63	1.84	1.69	1.55	1.53	1.54	1.52	1.50	4.23	2.28
6th week	3.03	2.91	2.89	2.85	2.74	2.77	2.59	2.56	2.56	5.68	3.50
8th week	5.18	5.17	5.08	4.11	4.06	4.07	3.28	3.13	3.00	10.50	5.73
10th week	8.54	8.03	7.76	6.72	6.38	6.20	6.23	5.98	5.94	13.00	8.40
Mean	**3.35**	**3.22**	**3.18**	**2.78**	**2.68**	**2.65**	**2.47**	**2.41**	**2.38**	**6.03**	
LSD 5%	**A: 0.102**			**B: 0.132**			**AxB: 0.321**				

Table 2. Effect of Ethanol Extracted-Propolis on undesirable fruits percentage of Balady Oranges under cold storage during 2012 and 2013 seasons.

Treatments EEP conc. (B) / Week (A)	EEP 2% conc.			EEP 3% conc.			EEP 5% conc.			Control	Mean
	Pre.	Post	Pre + Post	Pre.	Post	Pre + Post	Pre.	Post	Pre + Post		
2012 season											
Beginning of storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2nd week	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4th week	0.44	0.00	0.40	0.23	0.21	0.51	0.00	0.41	0.26	13.93	3.69
6th week	4.12	2.11	1.66	1.62	1.56	2.50	1.27	1.45	1.45	30.48	12.13
8th week	17.51	15.85	18.55	13.87	13.07	12.61	12.15	10.39	11.00	42.00	20.92
10th week	41.62	45.24	41.67	35.11	32.03	31.54	25.70	22.36	20.40	55.67	38.56
Mean	**10.62**	**10.53**	**10.38**	**8.47**	**7.81**	**7.85**	**6.52**	**5.77**	**5.52**	**23.68**	
LSD 5%	**A: 0.416**		**B: 0.286**		**AxB: 0.699**						
2013 season											
Beginning of storage	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2nd week	0.24	0.15	0.09	0.00	0.00	0.00	0.00	0.00	0.00	2.96	0.77
4th week	0.63	0.64	0.60	0.51	0.59	0.54	0.42	0.47	0.44	11.32	3.23
6th week	2.77	3.38	3.08	3.07	2.47	2.43	2.34	1.85	2.20	26.00	8.47
8th week	13.35	13.56	13.89	12.93	12.73	12.28	9.60	9.28	9.17	38.40	18.50
10th week	26.06	25.44	24.50	12.84	13.26	12.51	13.32	13.74	13.23	59.82	27.86
Mean	**7.18**	**7.20**	**7.03**	**4.89**	**4.84**	**4.63**	**4.28**	**4.22**	**4.17**	**23.08**	
LSD 5%	**A: 0.195**		**B: 0.130**		**AxB: 0.319**						

Data in permentioned table showed that undesirable fruits percentage significantly increased by extending cooling storage period tell ten weeks, for both treatments and control during the two studied seasons.

In response of propolis application, it was apparent that all treatments significantly reduced the undesirable fruits percentage during cold storage for ten weeks compared with control. Treatments with 5% gave the least undesirable fruits percentages as an average of two studied seasons (20.40 and 13.23%), (22.36 and 13.74%) and (25.70 and 13.32%) for (pre + post) harvest, post harvest and pre-harvest treatments compared with control which recorded (55.67 and 59.82%), respectively. Such results may be due to the antifungal activity of propolis constituents such as caffeic acid, peterostilbene and sakuranetin (Ghisalberti, 1979). The decay percentage of fruits slightly increased and gradually from the beginning of cold storage till ten weeks.

These findings are in agreement with those obtained by Tripathi and Dubey (2001), Tian, X.J. (2008), Candir *et al*. (2009), Ozdemir *et al*. (2010), Yang *et al*. (2010) and Masoud and Badawy (2012). Who reported that EEP was effective in preventing fungal decay in several fruits during storage.

Fruit chemical properties:

From Tables (3, 4, 5 and 6) noticed that prolonging cold storage at 5-7°C for ten weeks slightly increased total soluble solids and TSS/acid ratio while decreased total acidity and vitamin C content in both treatments and untreated one (control) during the two studied seasons. This result may be due to loosing amount of fruit moisture and organic acids in metabolism activities. This

finding are in agreement with Attia (1995), Trifiro *et al*. (1995), Kabasakalis *et al*. (2000), DelCaro *et al*. (2004), Mareilla *et al*. (2006), Ajibola *et al*. (2009), Badawy *et al*. (2011) and Sallam, Nashwa *et al.* (2012).

On the other hand, propolis treatments failed to show any significant effects on fruit chemical properties compared to control. These findings are in agreement with Ozdemir *et al*., 2010. After ten weeks of cold storage the best treatments was post-harvest or (pre and post) harvest treatments with 5% EEP. Which recorded (16.67 and 16.17%), (0.98 and 0.99%), (17.01 and 16.33%) and (36.90 and 34.60%) for TSS, total acidity, TSS/acid ratio and vitamin C content, respectively in the two studied seasons.

According to the previous results, it could be concluded that dipping the Balady Orange fruits after harvest with 5% propolis (EEP) would keep the fruits and maintain their quality for long period under cold storage.

Table 3. Effect of Ethanol Extracted-Propolis on Total Soluble Solids percentage (TSS%) of Balady Oranges under cold storage during 2012 and 2013 seasons.

Treatments EEP conc. (B) / Week (A)	EEP 2% conc.			EEP 3% conc.			EEP 5% conc.			Control	Mean
	Pre.	Post	Pre + Post	Pre.	Post	Pre + Post	Pre.	Post	Pre + Post		
2012 season											
Beginning of storage	15.83	15.59	15.67	15.60	15.67	15.58	15.60	15.80	15.83	15.60	15.60
2nd week	15.83	15.75	16.33	15.93	15.83	16.91	15.43	15.80	16.33	15.93	15.93
4th week	15.83	15.64	16.33	15.93	15.83	15.95	15.60	15.96	16.33	15.93	15.93
6th week	16.33	16.23	16.33	16.20	16.17	17.05	16.27	16.13	16.83	16.60	16.60
8th week	16.33	16.76	16.33	16.10	16.50	17.42	16.77	16.47	16.83	16.60	16.61
10th week	16.33	16.76	16.00	16.27	16.67	16.92	16.93	16.67	17.33	16.77	16.67
Mean	**16.08**	**16.16**	**16.17**	**15.91**	**16.11**	**16.64**	**16.10**	**16.14**	**16.58**	**16.24**	
LSD 5%	**A:**	**0.294**	**B:**	**N.S.**	**AxB:**	**N.S.**					
2013 season											
Beginning of storage	13.83	13.67	13.63	13.83	13.66	13.83	13.83	13.83	13.33	13.83	13.73
2nd week	14.33	14.50	14.63	14.50	14.49	14.33	14.17	14.33	14.00	14.33	14.36
4th week	14.83	14.83	14.97	14.83	14.99	14.83	14.83	14.67	14.83	14.67	14.83
6th week	14.83	15.00	15.47	15.17	14.99	15.83	15.17	15.00	15.33	15.00	15.18
8th week	15.00	15.50	15.63	15.33	15.49	16.17	15.67	16.17	15.50	15.67	15.61
10th week	15.50	15.50	16.03	15.67	15.99	16.17	15.67	16.17	15.67	16.00	15.84
Mean	**14.72**	**14.83**	**15.06**	**14.89**	**14.94**	**15.19**	**14.89**	**15.03**	**14.78**	**14.92**	
LSD 5%	**A:**	**0.199**	**B:**	**N.S.**	**AxB:**	**N.S.**					

Table 4. Effect of Ethanol Extracted-Propolis on Total Acidity percentage of Balady Oranges under cold storage during 2012 and 2013 seasons.

Treatments EEP conc. (B) / Week (A)	EEP 2% conc.			EEP 3% conc.			EEP 5% conc.			Control	Mean
	Pre.	Post	Pre + Post	Pre.	Post	Pre + Post	Pre.	Post	Pre + Post		
2012 season											
Beginning of storage	1.69	1.59	1.57	1.60	1.60	1.60	1.60	1.58	1.55	1.55	1.59
2nd week	1.48	1.47	1.48	1.44	1.47	1.49	1.48	1.43	1.43	1.48	1.47
4th week	1.45	1.45	1.48	1.44	1.44	1.47	1.47	1.47	1.45	1.46	1.46
6th week	1.42	1.42	1.47	1.42	1.46	1.47	1.42	1.42	1.44	1.43	1.44
8th week	1.26	1.26	1.24	1.27	1.24	1.23	1.22	1.22	1.26	1.27	1.25
10th week	0.94	0.99	0.96	0.96	0.94	0.95	0.96	0.98	0.93	0.93	0.95
Mean	**1.36**	**1.36**	**1.37**	**1.36**	**1.36**	**1.37**	**1.36**	**1.35**	**1.34**	**1.35**	
LSD 5%	**A:**	**0.498**	**B:**	**N.S.**	**AxB:**	**N.S.**					
2013 season											
Beginning of storage	1.27	1.28	1.31	1.26	1.30	1.26	1.31	1.29	1.27	1.30	1.29
2nd week	1.23	1.21	1.22	1.22	1.25	1.23	1.21	1.23	1.22	1.23	1.23
4th week	1.19	1.19	1.18	1.18	1.22	1.18	1.17	1.20	1.17	1.18	1.19
6th week	1.12	1.13	1.09	1.11	1.13	1.14	1.14	1.12	1.13	1.13	1.12
8th week	1.10	1.07	1.10	1.08	1.04	1.11	1.11	1.10	1.08	1.10	1.09
10th week	1.03	1.01	1.06	1.04	0.97	1.04	0.98	0.99	1.04	1.03	1.02
Mean	**1.16**	**1.15**	**1.16**	**1.15**	**1.15**	**1.16**	**1.15**	**1.16**	**1.15**	**1.16**	
LSD 5%	**A:**	**0.032**	**B:**	**N.S.**	**AxB:**	**N.S.**					

Table 5. Effect of Ethanol Extracted-Propolis on TSS/Acid Ratio of Balady Oranges under cold storage during 2012 and 2013 seasons.

Treatments EEP conc. (B) / Week (A)	EEP 2% conc.			EEP 3% conc.			EEP 5% conc.			Control	Mean
	Pre.	Post	Pre + Post	Pre.	Post	Pre + Post	Pre.	Post	Pre + Post		
2012 season											
Beginning of storage	9.37	9.81	9.98	9.75	9.79	9.74	9.75	10.00	10.21	10.65	9.91
2nd week	10.70	10.71	11.34	11.06	10.77	11.35	10.43	11.05	11.42	10.76	10.96
4th week	10.92	10.79	11.34	11.06	10.99	10.85	10.61	10.86	11.26	10.91	10.96
6th week	11.50	11.43	11.11	11.41	11.08	11.60	11.46	11.36	11.69	12.39	11.50
8th week	12.96	13.30	13.17	12.68	13.31	14.16	13.75	11.50	13.36	13.07	13.13
10th week	17.37	16.93	16.67	16.95	17.73	17.81	17.64	17.01	18.63	18.03	17.47
Mean	**12.14**	**12.16**	**12.27**	**12.15**	**12.28**	**12.59**	**12.27**	**11.96**	**12.76**	**12.64**	
LSD 5%	**A:**	**0.332**	**B:**	**N.S.**	**AxB:**	**N.S.**					
2013 season											
Beginning of storage	10.89	10.68	10.40	10.97	10.51	10.98	10.56	10.72	10.50	10.64	10.69
2nd week	11.65	11.98	11.99	11.79	11.59	11.65	11.71	11.65	11.48	11.65	11.71
4th week	12.46	12.46	12.69	12.46	12.29	12.57	12.68	12.23	12.68	12.43	12.50
6th week	13.24	13.27	14.19	13.54	13.27	13.89	13.31	13.39	13.57	13.27	13.49
8th week	13.64	14.49	14.21	13.94	14.89	14.57	14.12	14.70	14.35	14.25	14.01
10th week	15.05	15.35	15.12	15.21	16.48	15.55	15.99	16.33	15.07	15.53	15.57
Mean	**12.82**	**13.04**	**13.1**	**10.98**	**13.17**	**13.20**	**13.06**	**13.17**	**12.94**	**12.96**	
LSD 5%	**A:**	**0.350**	**B:**	**N.S.**	**AxB:**	**N.S.**					

Table 6. Effect of Ethanol Extracted-Propolis on Vitamin C of Balady Oranges under cold storage during 2012 and 2013 seasons.

Treatments EEP conc. (B) / Week (A)	EEP 2% conc.			EEP 3% conc.			EEP 5% conc.			Control	Mean
	Pre.	Post	Pre + Post	Pre.	Post	Pre + Post	Pre.	Post	Pre + Post		
2012 season											
Beginning of storage	41.44	41.50	41.50	41.00	41.37	41.40	41.39	41.44	41.50	41.45	41.40
2nd week	39.55	39.61	39.70	39.52	39.60	39.66	39.50	39.51	39.55	39.50	39.57
4th week	38.57	38.44	38.50	38.59	38.60	38.62	38.49	38.48	38.52	38.50	38.53
6th week	38.30	38.40	38.41	38.40	38.39	38.34	38.37	38.30	38.30	38.41	38.36
8th week	37.30	37.35	37.41	37.37	37.39	37.35	37.40	37.40	37.33	37.36	37.37
10th week	36.96	37.00	36.90	36.94	37.00	37.00	36.93	36.90	37.00	37.00	36.96
Mean	**38.69**	**38.72**	**38.74**	**38.64**	**38.73**	**38.73**	**38.68**	**38.67**	**38.70**	**38.70**	
LSD 5%	**A: 1.86**			**B: N.S.**			**AxB: N.S.**				
2013 season											
Beginning of storage	39.40	39.46	39.50	39.44	39.50	39.50	39.43	39.50	39.46	39.50	39.47
2nd week	38.00	38.08	38.10	38.00	38.18	38.09	38.00	38.11	38.07	38.13	38.08
4th week	37.59	37.67	37.70	37.54	37.59	37.54	37.62	37.66	37.70	37.59	37.62
6th week	36.80	36.90	36.80	36.82	36.85	36.91	36.80	36.91	36.89	36.82	36.85
8th week	36.28	36.40	36.38	36.29	36.36	36.33	36.30	36.38	36.40	36.40	36.35
10th week	34.70	34.72	34.66	34.63	34.70	34.66	34.59	34.65	34.60	34.65	34.66
Mean	**37.13**	**37.21**	**37.19**	**37.12**	**37.20**	**37.17**	**37.12**	**37.20**	**37.19**	**37.18**	
LSD 5%	**A: 1.362**			**B: N.S.**			**AxB: N.S.**				

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تأثير المستخلص الكحولي لصمغ النحل (البروبوليس) علي القابلية للتخزين وجودة ثمار البرتقال البلدي أثناء التخزين المبرد

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الملخص

أجريت هذه الدراسة خلال موسمي ٢٠١٢ ، ٢٠١٣ بكلية الزراعة جامعة أسيوط بهدف دراسة تأثير المستخلص الكحولي لصمغ النحل (البروبوليس) علي جودة ثمار البرتقال البلدي خلال التخزين المبرد.

أدت إطالة فترة التخزين المبرد علي درجة حرارة ٥-٧°م لمدة عشرة أسابيع إلي زيادة معنوية في كل من النسبة المئوية للفقد في وزن الثمرة والنسبة المئوية للثمار التالفة. كما أحدثت زيادة طفيفة في نسبة المواد الصلبة الذائبة الكلية والحموضة الكلية والنسبة المئوية للمواد الصلبة الذائبة إلي الحموضة بينما أدت إلي نقص طفيف وتدريجي في الحموضة ومحتوي الثمار من فيتامين ج.

أدت المعاملة بالمستخلص الكحولي لصمغ النحل (البروبوليس) بتركيزات ٢ ، ٣ ، ٥% قبل أو (قبل + بعد) أو بعد الجمع إلي نقص معنوي في النسبة المئوية للفقد في وزن الثمرة والثمار التالفة. وكانت أفضل المعاملات هي المعاملة بالمستخلص الكحولي لصمغ النحل (البروبوليس) بتركيز ٥% مقارنة بالتركيزين الآخرين، كما كانت المعاملة (قبل + بعد) الجمع وبعد الجمع فقط هي أفضل المعاملات ولم يكن هناك فروق معنوية بين هاتين المعاملتين.

ومن جهة أخري لم يكن هناك تأثير معنوي لمعاملة المستخلص الكحولي لصمغ النحل بتركيز ٢، ٣ ، ٥% علي الصفات الكيميائية (المواد الصلبة الذائبة الكلية ، الحموضة الكلية ، نسبة المواد الصلبة الذائبة الكلية، محتوي الثمار من فيتامين ج) مقارنة بالكنترول.

مما سبق يمكن التوصية بغمر ثمار البرتقال البلدي بالمستخلص الكحولي لصمغ النحل (البروبوليس) بتركيز ٥% مرة واحدة بعد الجمع لتقليل الفقد في وزن الثمار ونسبة الثمار التالفة مع المحافظة علي صفات جودة الثمار وإطالة مدة بقائها تحت ظروف التخزين المبرد.