The Effect of Some Environmentally Safe Treatments in Storability of Valencia Orange Fruits

Layla Tabbara*(1), Nazmy. Abdel Hameid(2) and Alaa. Bondok(2)

(1). Horticulture Research Department, General Commission for Scientific Agricultural Research, Syria.

(2). Department of Horticulture, Faculty of Agriculture, Ain Shams University, Cairo, Egypt.

(*corresponding author: Layla Tabbara-, Email: l.tabbarah@gmail.com)

Received:2/01/202 3 Accepted:14/02/2023

Abstract

This investigation was carried out during two successive seasons 2016 and 2017 on fruits of Valencia orange. The fruit samples were collected from orange orchard belonging to Wadi 3 by randomly from all over the orchard. An experiment was conducted to evaluate the influence of some environmentally safe treatments to improve the storability of Valencia fruits during 2016 and 2017 seasons, which was Jojoba oil (1,3,5) %, castor oil (0.5, 1,2) %, yeast(1,2,3)%, seaweed(1,2,3)%, hot water (45°C and commercial wax were used for proposed study, after that, fruits were stored at a temperature of 5 ° C and 95% of relative humidity for 60 days, it was determine the physical and chemical characteristics (fruits weight loss - juice ratio- TSS/TA - total phenols). Results indicated that, castor oil (2 and 1) % and jojoba oil 5% reduced weight loss%, and deterioration phenols increase and increased juice ratio and TSS/TA rate, with significant differences compared to control. So the results show that, coating orange fruits with castor oil (1-2) % and jojoba oil (5) % the most effective in improve the storability of orange fruits Valencia orange.

Key word: Valencia orange, Jojoba oil, castor oil, commercial wax, hot water, yeast, seaweed.

Introduction

Citrus is considered the most common popular fruit in the world and it takes second or third position after grapevines and apples. And citrus as Many fruits from tropical and subtropical origin exhibit a physiological disfunction when exposed to low temperature. Several physiological and biochemical alterations occur in response to chilling stress and often termed “chilling injury”. Citrus is a major export produce of Egypt. The total cultivated area for orange is about 133236 ha (333090 feddan), and total production is estimated at 2750000 ton/year (Gain, 2015). Valencia is the most important citrus fruits in Egypt which are available during winter. Under Egyptian conditions there are common practices to store mature Valencia until the suitable time for marketing, Valencia is the most important citrus fruits in Egypt which is available during winter. Under Egyptian conditions there are common practices to store mature Valencia until the suitable time for marketing (Abdel Wahab and Rashid, 2012). Valencia is non climactric, with persistently low respiration and ethylene production rates (Kader and Arpaia, 2002). Also, Due to their higher water content and nutrient composition, citrus fruit is very susceptible to infection by microbial pathogens during the period between harvest and consumption (Tripathi and Dubey, 2003), pathological and physiological

diseases cause aconsiderable losses of citrus fruits during storage and transportation. A new approach to the control of postharvest pathogens, while maintaining fruit quality, has been implemented by the application of essential oil amended coatings to citrus. This approach eliminates the need for synthetic fungicides, thereby complying with consumer preferences, organic requirements and reducing environmental pollution, excellent disease control was achieved with the amended coatings, while measured quality parameters indicated that overall fruit quality was maintained. Moreover, moisture loss was decreased significantly in fruit treated with essential oil enriched coatings. Essential oils are volatile, natural, complex compounds characterized by a strong odour and are formed by aromatic plants as secondary metabolites. (EOs) ethereal oils are also aromatic oily liquids obtained by steam or hydro-distillation from plant materials such as flowers, buds, seeds, leaves, twigs, bark, herbs, wood, fruits and roots (Solgi and Ghorbanpour, 2014). Kamel, (2014) found that treating Valencia orange fruits by immersing it in seaweed extract at 1% was maintained fruit quality longer time comparing to Imazalil and control treatments. Wax coating on citrus fruit is often used to increase glossiness of the peel. Moreover, waxing of the fruits reduce chilling injury. However, it may cause off flavor development and peel disorder (Cohen *et al.,* 1990). Sometimes may be added fungicides. Commercial producers began waxing citrus to extend shelf life in the 1920s and 1930s. The appearance of citrus at the market place is often the only quality that affects the price paid and the potential for reorders. For this the packinghouse manager is usually very concerned with the coating that he uses on his fruit (David, 1981). Also revealed that coating Washington Navel orange fruits with jojoba oil led to reduce fruit decay, weight loss and increasing life (Abd El-Moneim and Abd El-Mageed, 2006). Abd El-Motty and El-Faham, (2013) stated that Jojoba oil treatment decreased decay, weight loss and delayed the changes in firmness in the first and second seasons in peach fruit compared to control during the storage period. Tarabih and El-Metwally, (2014) reported that boric acid (1.0%)+jojoba oil (0.1%) treatment was the most effective treatment in decreasing disease infection percentage of the tested pathogenic fungi as well as weight losses, fruit decay, total loses in fruit, also the peel thickness was significantly higher with boric acid at 1.0% combined with jojoba oil at 0.1%, in their study on the effect of Jojoba oil and boric acid as postharvest treatments on the shelf life of Washington Navel Orange fruits. Castor oil is as jojoba oil very important in improving the storability of fruits, Singh *et al*, (2003) reported the effect of various extracts such as neem leaf extract, castor oil and Neem oil on citrus fruits and reported that, among these extracts Neem oil was the best in retaining most of biochemical characteristics such as TSS (16.01B^{o}), titratable acidity (0.38 %), pectin (0.98 %) and ascorbic acid content (20.56 mg/100 ml juice) as compared to control fruits in which the values for these parameters were 12.03ºB, 0.23%, 0.55% and 15.68 mg/100 ml juice, respectively, after 12 days of storage. Porat *et al*., (2000) said that Postharvest storage experiments using various organically grown citrus cultivars such as ‘Minneola’ tangerines, ‘Shamouti’ oranges and ‘Star Ruby’ red grapefruit, showed that hot water brushing (HWB) at 56°C for 20s reduced decay development by 45–55%. The HWB treatment at 56°C did not cause surface damage, and did not influence fruit weight loss or internal quality parameters. found that soluble solids content, total sugars and reducing sugars content were increased in 4% seaweed extract treated fruit stored either at room temperature or in cold storage in navel orange fruit. Omar, (2014) found that soluble solids content, total sugars and reducing sugars content were increased in 4% seaweed extract treated fruit stored either at room temperature or in cold storage in navel orange fruit. Sallam *et al*., (2012) found that the use of yeast on orange tree as biocontrol of green mold decreased fruit weight loss and the undesirable fruits percentage during cooling period (5° C) for nine weeks compared with control.

Objectives

The present study aimed to evaluate the application of some safe treatments of natural materials as a means to reduce deterioration of orange, and their effects on physical and chemical properties orange fruits during cold storage.

MATERIALS AND METHODS

Plant material:

This investigation was carried out during two of successive seasons 2016 and 2017. where the sample of Valencia orange obtained from orange orchard belonging to Wadi Elnetron by randomly from all over the orchard.

Methods:

The fruits were harvested at consuming maturity depending on TSS/TA indicator, (Valencia ≈ 9.5 in 25 February) fruits were used immediately after harvested, surface washed with tap water and then air dried. Fruits randomly divided into 15 equal groups; each group represent as one as follows for five minutes:

1- Commercial Wax We obtained the fruits which treated with Commercial wax from Daltex Station.
2- Fruit dipping in jojopa oil 1%, Fruit dipping in jojopa oil 3%, Fruit dipping in jojopa oil 5%for 5 min
3- Fruit dipping in Castor oil 1\2%, Fruit dipping in Castor oil 1%, Fruit dipping in Castor oil 2%for 5 min
4- Fruit dipping in yeast 1%, Fruit dipping in yeast 2%, Fruit dipping in yeast 3%for 5 min
5- Fruit dipping in seaweed 1%, Fruit dipping in seaweed 2%, Fruit dipping in seaweed 3%for 5 min
6- hot water at 45c^{o} for 5 min
7- Control (without any treatment)

Each treatment was comprised three replicates, each replicate considered as one box (3kg/box). After that all treatments were stored on 5^{o} C±1 and 95% Relative humidity for 60 days. The following properties were determined at the beginning of storage and 15- days intervals throughout the storage period, then marketing life at 20^{o} C±2 for 7 days.

Physical and chemical properties:

Fruits weight loss

The initial weight of orange fruits was recorded in each treatment and at 15 days intervals, then fruit weight loss% was calculated by weighing the same fruits at each intervaland at the end of cold storage duration using the following formula:

$$\text{weight loss\%} = \frac{w1 - w2}{w1} \; x \; 100$$

where w1 is initial weight of fruit samples and w2 is weight of fruit samples after each storage periods.

Juice (%)

Fruit juice was extracted and weighed then calculated as percentage of fruit weight for each treatment according to formula as:

$$\text{Juice (\%)} = \frac{juice\ weight}{fruit\ weight} \; x \; 100$$

Total Soluble Solids/ Total Acidity

It was recorded by dividing TSS value by total acidity value.

Determination of Total Phenolic Content (mg/g fresh weight):

Total phenolic contents of the fruit extracts measured using a modified colorimetric Folin-Ciocalteu method with further slight modifications (Singleton and Rossi, 1965). Fruit extracts (0.5 ml) were placed in a test tube. Folin-Ciocalteu reagent (2.5 ml) was added to the solution and allowed to react for 3 min. The reaction was neutralized with 2 ml of sodium carbonate (7.5 %). Absorbance at 765

nm was read after 30min. Gallic acid was used as standard and data were expressed as mg Gallic acid equivalents (GA)/ g FW.

Statistical analysis

This experiment was designed as completely randomize design.The means were analyzed using SASS 9.1 statistical software and means were compared by Duncan's multiple range test (DMRT) at 0.05 level (Steel et al., 1997).

Results and Discussion

Weight loss percentage

Data in table (1) show some of environmentally safe treatments before storage on Weight loss% on Valencia during 2016 and 2017 seasons.

Results showed that the weight loss percentage was increased during storage period, the lowest weight loss percentage found in commercial wax with insignificant differences compared to all treatments except seaweed 3%, hot water and control in the first season, but in the second one with insignificant differences just compared with jojoba oil (3,5) %, castor oil (1,2) %. control and hot water were the most looser treatments, which had the highest weight loss percentage with insignificant differences with yeast (1,2,3) %, seaweed (1-2-3) % in the two season plus jojoba oil (1%) and castor oil (0.5)% in the first season. Jojoba oil (3,5)% and castor oil (1,2)% have the same effect as commercial wax in combination with cold storage reducing the weight loss% of fruits, it may be due to the effects of oil as permeable barrier against oxygen, carbondioxide and moisture, thereby reducing respiration, water loss and oxidation reaction rates (Baldwin et al., 1999; Park, 1999; Kamel, 2014).It is worth mentioning that wax, castor oil and jojoba oil are films composed of lipids exhibit good water vapor barrier properties, whereas yeast and seaweed are films made of polysaccharides or proteins usually have suitable mechanical and gas barrier properties but show poor water vapor barrier properties(Diab et al., 2001; Hagenmaier and Shaw, 1992; Hagenmaier and Baker, 1993). This reduction in weight loss was probably due to the effects of these coatings as permeable barrier against oxygen, carbon dioxide, moisture and solute movement, thereby reducing respiration, water loss and oxidation reaction rates (Baldwin et al., 1999), also (plooy et al., 2009) show that there is closer contact between the essential oils and fruit surfaces, allowing exposure of each fruit to similar concentrations of inhibitor over a longer period. In addition to maximum weight loss in control is due to the high rate of transpiration and respiration (Baldwin et al., 1999; Park, 1999; Grierson, 1987; Yaman and Bayoindirli, 2002). These results indicated that the application of wax or castor oil or jojoba oil in combination with low temperature storage play an effective role in reducing the percentage weight loss of the Valencia fruits. The recorded results go in line with findings of Abd El-Moneim and Abd El-Mageed, 2006 revealed Washington Navel orange fruits with jojoba oil led to reduce fruit weight loss.

Table (1): Effect of some environmentally safe treatments before storage on weight loss% on Valencia orange fruits, during 2016-2017 seasons

Treatment	60 Days in cold storage	
	2016	**2017**
	60	60
CommercialWax	4.35 c	4.13 d
jojopa oil 1%	5.98 a-c	6.28 a-c
jojopa oil 3%	5.61 a-c	5.53 b-d
jojopa oil 5%	5.10 bc	5.65 b-d
Castor oil1/2%	5.20 bc	6.25 a-c
Castor oil 1%	5.26 bc	5.23 cd

Castor oil 2%	4.78 c	5.20 cd
yeast 1%	6.07 a-c	6.83 a-c
yeast 2%	6.11 a-c	6.93 a-c
yeast 3%	6.33 a-c	6.75 a-c
seaweed 1%	6.38 a-c	6.87 a-c
seaweed 2%	6.13 a-c	6.63 a-c
seaweed 3%	6.85 ab	6.67 a-c
hot water	7.13 ab	7.37 ab
Control	7.63 a	7.77 a
LSD	2.0	2.0

Means having the same letter(s) in the same column are not significant at a 0.05 level.

Juice%:

Table (2) shows the effect of some environmentally safe treatments before storage on Juice% in orange fruits, during 2016-2017 seasons.

The results at table 2 revealed that the juice% was increased during storage period, the highest juice% was found in commercial wax with insignificant differences compared to jojoba oil (1 ,3 ,5)% and castor oil (0.5 ,1 ,2)% in the two seasons, yeast (2 ,3)% and seaweed (2 ,3)% in the first season and seaweed (1 ,2 ,3)% in the second one have had juice% more than control in a significant differences and less than commercial wax also in significant differences, control and hot water treatment the lowest percentage of juice content, and have had the lowest juice% with insignificant differences compared to yeast (1)% and seaweed (1)% in the first season and compared to yeast (1 ,2 ,3)% in the second season and the hot water in two season.

Table (2): Effect of some environmentally safe treatments before storage on juice% in Valencia orange fruits, during 2016-2017 seasons

Treatment	60 Days in cold storage			
	2016		**2017**	
	0	60	0	60
CommercialWax	54.66 a	64.63 a	51.74 a	63.67 a
jojopa oil 1%	55.67 a	62.80 ab	51.84 a	61.07 a-c
jojopa oil 3%	54.95 a	63.00 ab	52.15 a	62.57 a-c
jojopa oil 5%	54.87 a	63.50 ab	51.96 a	62.93 ab
Castor oil1/2%	56.50 a	62.40 ab	52.53 a	61.23 a-c
Castor oil 1%	55.56 a	62.67 ab	53.13 a	62.72 a-c
Castor oil 2%	56.37 a	64.73 a	51.98 a	63.53 a
yeast 1%	54.59 a	60.33 cd	51.34 a	59.83 cd
yeast 2%	55.64 a	61.57 bc	52.28 a	59.90 cd
yeast 3%	56.14 a	60.41 bc	51.74 a	59.90 cd
seaweed 1%	55.69 a	60.11 cd	53.55 a	60.03 bc
seaweed 2%	54.65 a	60.59 bc	51.35 a	60.08 bc
seaweed 3%	55.68 a	60.58 bc	52.75 a	60.07 bc
hot water	55.17 a	59.79 cd	53.73 a	57.13 d
Control	54.77 a	58.87 d	53.76 a	56.63 d
LSD	3.0	3.0	3.0	3.0

Means having the same letter(s) in the same column are not significant at 0.05level.

The results showed that the fruits treated with commercial wax, castor oil and jojoba oil revealed the highest juice content during storage as compared to other treated fruits and control, may be due to continues transpiration from the surface of the fruits (which were treated with hot water and non-

treated) as a result of more dehydration (Thomas et al., 2005). As for fruits which were treated with wax and oils may be its juice percentage was more than the rest of the fruits due to less water loss from surface of fruits were coating with oil and wax (Bisen et al., 2012). Mohapatra et al., (2010) reported that the increase in moisture content of pulp was occurred due to increase in sugar content in the pulp as a result of starch hydrolysis to sugar on banana, also might be due to the fact that the wax, castor oil, and jojoba oil acted as a barrier which had checked the losses of the moisture from the fruit surface (Rokaya et al., 2016). These results were in agreement with Erkan et al., (2005), they found that Juice yield of the oranges increased during the first 2 months of the storage but it decreased during the rest of storage period.

TSS/TA

Data in table (3) show the effect of some environmentally safe treatments before storage on TSS/TA in Valencia orange fruits, during 2016 and 2017 seasons storage

The results showed that TSS/TA increased during storage period, the significant results found in commercial wax compared to jojoba oil (1 ,3 ,5)%, castor oil (0.5 ,1 ,2)%, yeast (1 ,3)% and seaweed (1 ,2 ,3)% in the first season, and compared to jojoba oil (1 ,3 ,5)% and castor oil (0.5 ,1 ,2)% in the second season, seaweed (1 ,2 ,3)% in the second season had TSS/TA more than a control in significant differences and less than commercial wax also in significant differences, control had the lowest TSS/TA with insignificant differences compared to yeast (2)% and hot water in the first season and compared to yeast (1 ,2 ,3)% and hot water in the second season.

A significant increase of TSS/TA was found in all treatments at the end of the storage as compared to harvest time, the increase in TSS/TA during storage was attributed to higher decrease in TA in comparison with the TSS (Meighani et al., 2015). Typical sour-sweet taste of citrus fruits is determined by the relationship between the soluble solid content (SSC) and the titratable acidity (TA). Organic acids predominate in unripe citrus fruits, which give them a sour taste unacceptable to consumers. In contrast, the content of organic acids is low in ripe fruits, which are perceived as sweet (Marcilla et al, 2006). Rab et al., (2010) stated that the increasing of storage duration, increased TSS/Acid ratio is the result of increased TSS content in the fruits. While slow increase in control and hot water (1-2-3) % and seaweed (1-2-3) % probably due to the decrease in acid content is caused by the use of acids in the fruit as a source of energy by respiration and the conversion of organic acids to form sugar (Burton, 1985) and (Willis et al., 1998). Maybe the high concentration of TA in control and hot water result of transformation in part of TSS to acids (Badawy et al, 2011). Also (Shahid and Abbasi, 2011) suggest that Slow decrease in acidity in control treatment might be due to the formation of carbonic acid (acidosis) or it might be due to the Anaerobic respiration of sugars resulting in production of acids. while, decrease in acidity in commercial wax and castor oil (0.5-1-2) % and jojoba oil (1-3-5) % might be due to the fact that as fruit ripens, it diminishes its malic and citric acid contents and favored the formation of sugars (Martinez et al., 1997).

Table (3): Effect of some environmentally safe treatments before storage on TSS/TA in Valencia orange fruits, during 2016-2017 seasons

Treatment	60 Days in cold storage			
	2016		**2017**	
	0	2016	0	60
CommercialWax	11.34 a	19.69 a	11.06 a	20.45 a
jojopa oil 1%	11.23 a	18.06 ab	11.31 a	18.14 a-c
jojopa oil 3%	11.98 a	19.38 a	11.16 a	18.26 a-c
jojopa oil 5%	11.45 a	18.92 a	11.02 a	19.56 ab
Castor oil1/2%	10.70 a	17.65 ab	11.31 a	18.70 ab

Castor oil 1%	11.71 a	19.38 a	11.07 a	19.55 ab
Castor oil 2%	11.31 a	19.64 a	10.82 a	20.35 a
yeast 1%	10.94 a	15.89 a-c	10.94 a	14.79 cd
yeast 2%	10.96 a	15.20 bc	10.57 a	14.46 cd
yeast 3%	10.94 a	16.11 a-c	10.46 a	14.47 cd
seaweed 1%	11.85 a	16.67 a-c	10.94 a	15.75 bc
seaweed 2%	10.95 a	16.86 a-c	11.20 a	16.21 bc
seaweed 3%	11.69 a	16.11 a-c	10.34 a	16.20 bc
hot water	11.06 a	13.77 c	10.45 a	12.78 d
Control	11.73 a	12.91 c	10.57 a	12.10 d
LSD	2.0	4.0	2.0	4.0

Means having the same letter(s) in the same column are not significant at 0.05 level.

These results further affirmed the findings of El-Eleryan, (2015) who reported that coating with chitosan+green tea was the best in gave higher values SSC:acid ratio and ascorbic acid content on Washington navel orange.But on the contrary of Rokaya et al., (2016) who found that the minimum total soluble solids and maximum titrable acidity were recorded in the fruits treated with wax plus bavistin, in experiment was carried out during 2012-2013 with the objective of assessing the effect of different postharvest treatments on quality and shelf life of mandarin, and Martinez-Romero et al, 2005 who found that treated cherries and grapes with vapors of eugenol, thymol or menthol showed significantly lower soluble solids:titratable acidity ratio than controls.

The total phenols (mg/g fresh weight):

Data in table (4) show the effect of some environmentally safe treatments before storage on total phenols (mg/g fresh weight) in valancia fruits, during 2016-2017 seasons.

The results showed that total phenols (mg / g fresh weight) were increased during Storage period, the lowest total phenols were found in commercial wax with insignificant differences compared to jojoba oil (1- 3-5)% and castor oil (0.5-1-2)% in the two seasons, seaweed (1-2-3)% and yeast (2-3)% in the first season, and just seaweed (1-2-3)% in the second one insignificant have had less total phenols than control and more than commercial wax also in significant differences, control revealed the highest total phenols with insignificant differences compared to yeast (1, 2, 3)% and hot water in the first season and compared to yeast (1-2-3)% and hot water in the second season.

Cell membrane is the primary cell structure affected by chilling injury CI on the fruits (Rui et al., 2010), Cell membrane phase transition from a flexible liquid crystalline to a solid-gel structure that occurs at chilling temperature increments the risk of loss of controlled cell membrane semipermeability (Lyons, 1973). If the fruit is exposed to chilling temperatures for too long, cell membranes rupture takes place, causing leakage of intracellular water, ions and metabolites, which can be monitored by determination of electrolyte leakage (Sharom et al., 1994). Electrolyte leakage is an effective parameter to assess membrane permeability and therefore is used as an indicator of membrane integrity (Marangoni et al., 1996). Fruits of many citrus cultivars may develop CI when exposed to low non-freezing temperatures (Pantastico et al., 1968; Henriod et al., 2005). oranges less-sensitive species compared to other species CI may be manifested as bronze non-depressed extended areas or superficial scald in the flavedo (Alférez et al., 2005),Phenolic compounds are plant secondary metabolites that constitute one of the most common and widespread groups of substances in plants (Harborne, 1989).Plant phenolics may be divided in two classes: (1) preformed phenolics that are synthesized during the normal development of plant tissues and (2) induced phenolics that are synthesized by plants in response to physical injury, infection or when stressed by suitable elicitors

such as heavy metal-salts, UV-irradiation, temperature, etc. (phytoalexins) (Nicholson and Hammerschmidt, 1992; Hammerschmidt, 2003), many phenolics, especially phenolic acids, are directly involved in the response of plants to different types of stress and accumulates in plant tissues of infected or in nearby areas are also observed in the affected areas caused by mechanical factors, (Benhammou, 2012; Hamauzu, 2006).

Table (4): Effect of some environmentally safe treatments before storage on total phenols (mg / g fresh weight) in Valencia orange fruits, during 2016-2017 seasons

Treatment	60 Days in cold storage			
	2016		2017	
	0	60	0	60
CommercialWax	0.231a	0.386c	0.241a	0.392c
jojopa oil 1%	0.239a	0.408c	0.239a	0.410c
jojopa oil 3%	0.241a	0.398c	0.232a	0.400c
jojopa oil 5%	0.235a	0.390c	0.234a	0.399c
Castor oil1/2%	0.237a	0.402c	0.237a	0.405c
Castor oil 1%	0.234a	0.389c	0.234a	0.400c
Castor oil 2%	0.236a	0.387c	0.235a	0.385c
yeast 1%	0.239a	0.574ab	0.237a	0.480b
yeast 2%	0.240a	0.571ab	0.240a	0.485b
yeast 3%	0.239a	0.565ab	0.239a	0.497b
seaweed 1%	0.237a	0.543b	0.241a	0.467b
seaweed 2%	0.232a	0.545b	0.237a	0.470b
seaweed 3%	0.239a	0.539b	0.232a	0.462b
hot water	0.237a	0.579ab	0.233a	0.581a
Control	0.240a	0.598a	0.235a	0.592a
LSD	0.01	0.05	0.01	0.04

Means having the same letter(s) in the same column are not significant at a 0.05 level.

Conclusion and recommendations

The results showed that, coating orange fruits with castor oil (1-2) % and jojoba oil (5) % the most effective in improve the storability of orange fruits Valencia orange. Coating fruits with castor oil (1-2) % and jojoba oil (5) % improved the physical and chemical properties, it reduced weight loss %, increased juice%, TSS/TA rate, decrease phenols increase with significant differences compared to control. Our conclusion about castrol oil and jojoba oil should be further tested by conducting systematic research studies for increasing the shelf life for other Varieties of citrus.

Reference

Abd El-Moneim, E. A .A. And M. A. Abd El-Mageed (2006) Effect Of Some Oil Emulsions And Wax Treatment On Prolonging Storage Period Of Washington Navel Orange Fruits And Its Volatile Components. J. Applied Sci. Res., 2: 405-417.

Abd El-Motty, Elham Z. And Sawsan Y. El-Faham (2013) Effect Of Oil Coating And Different Wrapping Materials On Prolonging Storage Periods Of Florida Prince Peach Fruits. Journal Of Applied Sciences Research, 9(4): 2927-2937

Abdel-Wahab, Sahar M. And I. A. S. Rashid (2012). Safe Postharvest Treatments For Controlling Penicillium Molds And Its Impact Maintaining Navel Orange Fruits Quality. American-Eurasian J. Agric. & Environ. Sci., 12 (7): 973-982.

Alférez, F.; J. M. Sala; M. T. Sánchez–Ballesta; M. Mulas; M. T. Lafuente And L. A. Zacarias (2005) Comparative Study Of The Postharvest Performance Of An ABA-Deficient Mutant Of

Oranges. I. Physiological And Quality Aspects. Postharvest Biology And Technology: 37: 222–231.

Badawy, F. M. Ibtesam; M. A. Nashwa Sallam; A. R. Ibrahim And M. R. Asran (2011) Efficacy Of Some Essential Oils On Controlling Green Mold Of Orange And Their Effects On Postharvest Quality Parameters. Plant Pathology Journal, 10: 168-174.

Baldwin, E. A.; J. K. Burns; W. Kazokas; J. K. Brecht; R. D. Hagenmaier; R. J. Bender And E. Pesis (1999). Effect Of 2 Edible Coatings With Different Permeability Characteristics On Mango (*Mangifera Indica L.*) Ripening During Storage. Postharvest Biol. Technol., 17: 215-220.

Benhammou, N. (2012) Activité Antioxydante Des Extraits Des Composes Phénoliques De Dix Plantes Médicinales De l'Ouest Et Du Sud-Ouest Algérien. Thése Doctorat. Université Aboubakr Belkaïd.Tlemcen. 174 P

Bisen, A.; S. K. Pandey And N. Patel (2012) Effect Of Skin Coatings On Prolonging Shelf Life Of Kagzi Lime Fruits (Citrus Aurantifolia Swingle). J Food Sci Technol. 2012 Dec; 49(6): 753–759.

Burton, W. G. (1985) Postharvest Physiology Of Food Crops. Longman Scientific And Technical. New York. USA.

Cohen, E.; Y. Shalom And I. Rosenberger (1990) Postharvest Ethanol Build Up And Off-Flavor In Murcott Tangerine Fruit. J .Amer. Soc. Hort. Sci., 115(5): 9-15.

David, J. H. 1981. Innovations In Citrus Waxing-An Overview. Proc. Fla. State Hort. Soc. 94:258-263. 1981.

Diab, T.; C. G. Biliaderis; D. Gerasopoulos And E. Sfakiotakis (2001) Physicochemical Properties And Application Of Pullulan Edible Films And Coatings In Fruit Preservation. Journal Of Science And Food Agriculture ;81:988-1000.

Plooy, W.; T. Regnier And S. Combrinck (2009) Essential Oil Amended Coatings As Alternatives To Synthetic Fungicides In Citrus Postharvest Management. Postharvest Biology And Technology 53 : 117–122

El-Eleryan, Eman E. (2015) Effect Of Chitosan And Green Tea On The Quality Of Washington Navel Orange During Cold Storage. American Journal Of Plant Physiology 10(1):43-54

Erkan, M.; M. Pekmezci And C. Y. Wang. (2005.Hot Water And Curing Treatments Redice Chilling Injury And Maintain Post-Harvest Of 'Valencia' Orange. International Journal Of Food And Technology, 40, 91-96.

Gain (2015). Citrus Annual 2015 USED Forign Agriculure Sercice. Global Agricultural Information Network

Grierson, D. 1987. Senescence In Fruits. Hort. Sci. 22: 859-862.

Hagenmaier, R. D. And P. E. Shaw (1992) Gas Permeability Of Fruit Coating Waxes. J. Am. Soc. Hort. Sci. 117, 105–109.

Hagenmaier, R. D. And R. A. Baker (1993) Reduction In Gas Exchange Of Citrus Fruit By Wax Coatings. J. Agric. Food Chem. 41, 283–287

Hamauzu, Y. (2006) Role And Evolution Of Fruit Phenolic Compounds During Ripening And Storage. Stewart Postharvest Review, 2:5

Hammerschmidt, R. (2003) Physiol. Mol. Plant Pathol. 62, 125.

Harborne, J. B. (1989) Methods In Plant Biochemistry, Vol. 1 Plant Phenolics, Dey, P.M. And Harborne, J.B. (Eds.), Academic Press, London, 1.

Henriod, R. E.; M. R. Gibberd And M. T. Treeby (2005) Storage Temperature Effects On Moisture Loss And The Development Of Chilling Injury In 'Lane Late'navel Orange. Australian Journal Of Experimental Agriculture: 45:453–458.

Kader, A.A. And M. L. Arpaia (2002). Postharvest Handling System. Subtropical Fruit. In: Kadder, A. A. (Ed), Postharvest Technology Of Horticultural Grops. Regents Of The University Of California, Division Of Agricultural And Natural Resources, Oakland, CA, Pp: 375-384.

Kamel, H. M. (2014). Impact Of Garlic Oil, Seaweed Extract And Imazalil On Keeping Quality Of Valencia Orange Fruits During Cold Storage. Journal Of Horticultural Science & Ornamental Plants 6 (3): 116-125.

Lyons, J. M. (1973) 'Chilling Injury In Plants'. Annual Review Of Plant Physiology, 24(1973):445–466.

Marangoni, A. G.; T. Palma And D. W. Stanley (1996). 'Membrane Effects In Postharvest Physiology'. Postharvest Biology And Technology, 7(3): 193-217

Marcilla, A.; M. Zarzo And M. A. Del Río (2006) Effect Of Storage Temperature On The Flavour Of Citrus Fruit. Spanish Journal Of Agricultural Research 4(4), 336-344

Martinez, E.; M. A. Jimenez ; B. Segui-Real ; J. Vandekerckhove ; I. V. Sandoval (1997) Folding Of The Presequence Of Yeast Papi Into An Amphipathic Helix Determines Transport Of The Protein From The Cytosol To The Vacuole. *J Mol Biol* 267(5):1124-38

Martinez-Romero, D.; S. Castillo; J. M. Valverde; F. Guillen; D. Valero And M. Serrano (2005) The Use Of Natural Aromatic Essential Oils Helps To Maintain Postharvest Quality Of 'Crimson' Table Grapes. Acta Hort 682:1723–1729

Meighani, H.; M. Ghasemnezhad And D. J. Bakhshi (2015) Effect Of Different Coatings On Post-Harvest Quality And Bioactive Compounds Of Pomegranate (*Punicagranatum* L.) Fruits. J Food Sci Technol. 52(7): 4507–4514.

Mohapatra, D.; M. Sabayasachi And S. Namrata (2010) "Banana And It"S By Products Utilisation: An Overview,"Journal Of Scientific And Industrial Research 69: 323-329

Nicholson, R. And R. Hammerschmidt 1992, Ann. Rev. Phytopathol. 30, 369.

Omar, A. E. K. (2014) Use Of Seaweed Extract As A Promising Post-Harvest Treatment On Washington Navel Orange (Citrus Sinensis Osbeck). Biological Agriculture & Horticulture. Http://Dx.Doi.Org/10.1080/01448765.2014.890543

Pantastico, E. B.; J. Soule And W. Grierson (1968) Chilling Injury In Tropical And Subtropical Fruits: Limes And Grapefruit. Tropical Regional American Society Of Horticultural Science: 12: 171–183.

Park, H. J. (1999). Development Of Advanced Edible Coatings For Fruits. Trends Food Sci. Technol., 10: 254-260.

Porat, R.; A. Daus; B. Weiss; L. Cohen; E. Fallik; S. Droby. (2000). Reduction Of Postharvest Decay In Organic Citrus Fruit By A Short Hot Water Brushing Treatment. Postharvest Biology And Technology. Volume 18, Pages 151–157

Rab, A.; S. Haq; S. A. Khalil And S. G. Ali (2010) Fruit Quality And Senescence Related Changes In Sweet Orange Cultivar Blood Red Uni-Packed In Dfifferent Packing Materials. Sarhad J. Agric. Vol. 26, No. 2, P 221-227

Rokaya, P. R.; D. R. Baral; D. M. Gautam; A. K. Shrestha And K. P. Paudyal (2016) Effect Of Postharvest Treatments On Quality And Shelf Life Of Mandarin (Citrus Reticulata Blanco). American Journal Of Plant Sciences, 7, 1098-1105.

Rui, H.; S. Cao; H. Shang; P. Jin; K. Wang And Y. Zheng (2010)' Effects Of Heat Treatment On Internal Browning And Membrane Fatty Acid In Loquat Fruit In Response To Chilling Stress'. Journal Of The Science Of Food And Agriculture, 90(9):1557–1561.

Sallam, M. A. Nashwa; Ibtesam F. M. Badawy And A.R. Ibrahim (2012) Biocontrol Of Green Mold Of Orange Using Some Yeasts Strains And Their Effects On Postharvest Quality Parameters. International Journal Of Pathology 3(1): 14-24.

Sharom, M.; C. Willemot And J. E. Thompson (1994) 'Chilling Injury Induces Lipid Phase Changes In Membranes Of Tomato Fruit'. Plant Physiology, 105(1): 305-308

Singh, Dinesh; R. K. Thakur And D. Singh (2003) Effect Of Pre Harvest Sprays Of Fungicides And Calcium Nitrate On Post-Harvest Rot Of Kinnow In Low Temperature Storage. Plant Disease Research : 18(1): 9-11.

Singleton, V. And J. R. Rossi (1965) Colorimetry Of_Totaln Phenolics Wit Phosphomonolybdic / Phosphotungstic Acid Reagents. Am. J. Enol. Vitic.,_16: 144-158.

Solgi, M And M. Ghorbanpour (2014) Application Of Essential Oils And Their Biological Effects On Extending The Shelf-Life And Quality Of Horticultural Crops. Trakia Journal Of Sciences, No 2, Pp 198-210.

Steel, R. G. D.; J. H. Torrie And Q. Dickey (1997) Principles And Procedures Of Statistics. A Biometrical Approach 3 Ed. Mcgraw Hill Book Co. Inc. New Rd York. USA.

Tarabih, M. E. And M. A. El-Metwally. (2014) Effect Of Jojoba Oil And Boric Acid As Postharvest Treatments On The Shelf Life Of Washington Navel Orange Fruits. International Journal Of Agricultural Research 9(1): 1-16.

Thomas, S. A.; E. M. Bosques; S. Stelik And F. Sanchez. (2005) J Phys IV France.;125:889–892.

Tripathi, P. And N. Dubey. (2003) Exploitation Of Natural Products As An Alternative Strategy To Control Postharvest Fungal Rotting Of Fruit And Vegetables. Postharvest Bioltechnol 32, 235–245.

Wills, R. B. H.; B. Mcglasson; D. Graham, And D. Joyce (1998) Postharvest: An Introduction To The Physiology And Handling Of Fruits, Vegetables And Ornamentals. 4th Ed. UNSW Press.

تأثير بعض المعاملات الآمنة بيئيًا في زيادة القدرة التخزينية لثمار برتقال فالنسا

ليلى تباره * [(1)] ونظمي عبد الحميد [(2)] وعلاء بندق[(2)]

(1). قسم بحوث البساتين ، الهيئة العامة للبحوث العلمية الزراعية ، سورية.

(2). قسم البساتين ، كلية الزراعة ، جامعة عين شمس ، القاهرة ، مصر.

(* للمراسلة: د. ليلى تبارة ، البريد الإلكتروني: l.tabbarah@gmail.com).

تاريخ الاستلام:2023/01/2 تاريخ القبول: 2023/02/14

الملخص

أجري هذا البحث خلال موسمين متتاليين 2016 و 2017 على ثمار برتقال فالنسيا. حيث جمعت عينات الفاكهة بشكل عشوائي من بستان البرتقال التابع لوادي النطرون من جميع أنحاء البستان. أجريت تجربة لتقييم تأثير بعض المعالجات الآمنة بيئياً لتحسين قابلية تخزين ثمار فالنسيا خلال موسمي 2016 و 2017 ، وهي زيت الجوجوبا (1،3،5) ٪ ، زيت الخروع (0.5 ، 1،2) ٪ ، تم استخدام الخميرة (1،2،3) ٪ ، الأعشاب البحرية (1،2،3) ٪ ، الماء الساخن (45 درجة مئوية والشمع التجاري للدراسة المقترحة، بعد ذلك ، تم تخزين الثمار عند درجة حرارة 5 درجات مئوية و 95 ٪ من الرطوبة النسبية لمدة 60 يوم تم تحديد الخصائص الفيزيائية والكيميائية (فقدان وزن الثمار

– نسبة العصير – TSS / TA – الفينولات الكلية) وأظهرت النتائج أن زيت الخروع (2 و 1)٪ وزيت الجوجوبا 5٪ قللوا من فقدان الوزن. ٪ ، وفينولات التدهور وزيادة نسبة العصير ومعدل المواد الصلبة الذائبة / TA مع وجود فروق معنوية مقارنة بالشاهد، لذلك أوضحت النتائج أن طلاء ثمار البرتقال بزيت الخروع (1–2)٪ وزيت الجوجوبا (5)٪ هو الأكثر فاعلية في تحسين قابلية تخزين ثمار البرتقال برتقال فالنسيا

الكلمات المفتاحية: برتقال فالنسيا, زيت الجوجوبا، زيت الخروع، الشمع التجاري، الماء الساخن، الخميرة، الأعشاب البحرية.