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Technological Studies on Jerusalem Artichoke, Carrot and Turnip

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Abstract

This work aimed to study the effect of calcium spraying on total vegetation during growth period on the shelf life of vegetables turnip, carrot and Jerusalem artichoke as a fresh tubers, and after pickling process. The results revealed that treating vegetables by spraying in(18% Cao) and carbomax (30 % Cao) solutions in spraying by rate 1 gram / 1 liter water after month from planting vegetables by rate once every week until harvesting season ,calcium chloride was added to a samples without spraying calcium for comparing fresh tubers . The obtained data showed that the spraying micronate lead to increasing. The shelf life of both turnip and carrot by rate 2 days, compared the Jerusalem artichoke by rate 3 days in fresh state comparing with control sample. Carbomax spraying lead to increasing of shelf life of turnip (3 days) while lead on increasing the shelf life of both carrot and Jerusalem artichoke by rate 5 days in fresh state comparing with control sample. In pickling process, the calcium added or sprayed lead to increasing the period shelf life obliviously, which added Cao lead to increasing. The shelf life of prickled turnip from 63 days in control sample to 95 days and increasing the shelf life of prickled carrot from 94 days in control to 122 days, too increasing the shelf life of pickled Jerusalem artichoke from 340 days in control sample to 351 days and that, is was nearly with sprayed calcium micronate

While Carbbomax sprayed lead to on increasing of the shelf life of pickled turnip from 63 days in control sample to 97 and lead to increasing the shelf life of prickled carrot from 94 days in control sample to 125 days, too increasing the shelf life of prickled Jerusalem artichoke from

340 days in control sample to 355 days .Finally in organoleptic evaluation ,the pickled which sprayed or added calcium for it had got a high score than control samples in all characteristics and over all acceptability.

Key Words Spraying, Carbbomax,calcium - pickled turnip- Carbbomax

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Introduction

Alzamora et al (2005) this contribution brings together report of progress in the development of functional fruit and vegetable matrices enriched with probiotics and minerals (calcium and zinc). Main aspects discussed are the kinetics of matrix fortification, the viability of some active compounds and the interactions between calcium, the cell structure and the mechanical properties of fruit and vegetable tissues. Vacuum and/or atmospheric impregnation techniques seem to be feasible technologies for exploitations of fruit and vegetable tissues as new matrices into which functional ingredients can be successfully incorporated, providing novel functional product categories and new commercial opportunities.

Many studies have examined the effects of calcium on fruit firmness and decay after harvest, but few have focused on compositional changes in cell walls of fruits throughout storage (**Chardonnet *et al* 2003;).** To the best of our knowledge, few data exists regarding the effect of postharvest calcium dipsin cell wall physicochemical attributes of peach fruits and it has been mainly focused on qualitative characteristics **(Wills & Mahendra, 1989)** or fungal resistance **(Conway, et.al, 1992)**.As well as from calcium chloride, which has been extensively used in fresh fruits **(Chardonnet et al., 2003; (Manganaris et al (2007**) The effects of postharvest calcium applications on cell wall properties and quality attributes of peach fruits (Prunus persica L. Batsch,cv. 'Andross') after harvest or cold storage up to 4 weeks .The fruits were immersed in deionised water or in different calcium sources (calcium chloride, calcium lactate and calcium propionate) at two calcium concentrations (62.5 and 187.5 mM Ca). Calcium concentration profiles in fruits (peel and flesh), in cell wall and in pectin fractions were determined. The calcium content in the peel increased up to 2.7-fold, whereas flesh increased up to 74%, 1 day after immersion. The increase of flesh was accompanied by increase of cell wall calcium, which corresponded to a significant increase of calcium in the water-insoluble pectin fraction. However, calcium became saturated in the water-insoluble, but not water-soluble, pectin fraction with 62.5 mM Ca treatment. Treatment with 62.5 mM Ca salts was as effective as higher concentrations of calcium chloride flesh browning symptoms were characterized by reduced ethylene production, and reduced activities of the pectin modifying enzymespoly-galacturonase and pectin-methyl-esterase. All rights reserved..Postharvest calcium dips can increase calcium content considerably compared to pre harvest sprays, without causing fruit injury, depending on salt type and calcium concentration. Postharvest calcium application maintains cell turg or, membrane integrity, tissue firmness and delays membrane lipid catabolism, extending storage life of fresh fruits (**Garcia etal., 1996**;. **Babu et a.,l 2015**Study was to examine the effectiveness of different Ca+2 treatments on the post harvest physiology and quality of loquat fruit. Freshly harvested loquat fruit was treated with different concentrations of calcium chloride (1%, 2% and 3%), stored at 4 °C, RH 85-90%, and evaluated regarding various quality parameters. Results showed significant ($p = 0.05$) retention of firmness and ascorbic acid content in samples dipped in 3% calcium chloride. Total soluble solids content was inversely correlated with acidity and throughout the 24-day storage period was significantly ($p = 0.05$) lower in samples treated with 3% $CaCl_2$ than the untreated samples. Results of the weight loss %, firmness and vitamin C assessments suggested that 3% $CaCl_2$ was helpful in extending shelf-life.

Studies have shown that the rate of senescence often depends on the calcium status of the tissue; increasing calcium levels alter various measures of senescence such as respiration, protein, chlorophyll content and membrane fluidity (**Poovaiah, 1986**). Calcium (Ca^{2+}) has been extensively reviewed as both an essential element and in regard to its potential role in maintaining postharvest quality of fruit and vegetable crops (**Kirkby and Pilbeam, 1984**). The presence of Ca^{2+} ions contributes to the linkages among pectic substances within the cell-wall (**Demarty et al., 1984**). It also reduces the rate of senescence and fruit ripening (**Ferguson, 1984**). One percentage solution of $CaCl_2$ delayed fruit ripening, improved resistance to fungal attack and maintained the structural integrity of cell walls of strawberry fruit during a 10 day storage period at 3°C (**Lara et al., 2004**). Softening was delayed and storage life was increased by 10–12 weeks in Kiwi fruits stored at 0°C by application of 1% $CaCl_2$, compared with untreated fruit **(Dimitrios and**

Pavlina, 2005). One percentage $CaCl_2$ dip reduced softening and browning rates of „Bartlett" pear slices (**Rosen and Kader 1989**). High calcium concentrations decreased calcium-associated flesh browning symptoms in fruits (**Hewajulige et al., 2003**) . **Luna et al., (2000**) Fresh-cut cantaloupe cylinders were dipped for 1 min in 2.5% solutions of either calcium chloride ($CaCl_2$) at 25°C or calcium lactate at 25 and 60°C. Firmness, microbiological (Total Plate Count, Yeast and Mold, and Microaerophilic Bacteria) and sensory characteristics, respiration (CO_2) and ethylene (C_2H_4) production were evaluated during 12 days storage at 5°C and 95% relative humidity. Both calcium salts maintained melon firmness throughout cold storage. $CaCl_2$, but not calcium lactate, imparted undesirable bitterness to the fruit pieces. No significant differences were observed in the physiological behavior of the treated fresh-cut compared to just-cut samples.

This work was carried out to study the effect of calcium spraying on turnip, carrot and Jerusalem artichoke during growth vegetation on shelf life post harvest and after pickling process. On the other hand to introduce the Jerusalem artichoke as new product in pickling world

Materials and methods

1- Materials

1.1 vegetables seeds

A- Carrots seeds (Royal anteni ,from seminis company ,(U.S.A)were obtained from local market in Al -Kasasin Ismilia

B-Turnip seeds (Balady) were obtained from local market in Kasasin Ismilia

C- Jerusalem artichoke seeds were obtained from Al-Kasasin research station

1.2 Chemicals

A-Micronate CaO 18% -Boron 2% from Al Qawafal Company –jordan were obtained from Al hady Company in new Salhia

B-Carbomax CaO30 % -Boron 1% from Ispmar Company Spain were obtained from Al hady company in New Salhia

C-Calcium chloride were obtained from Al Gamhoria Company of chemical material in Zagazig – Sharkia

2.Methods

A- Planting the seeds in Kassasin Research Station

A-**Each kinds of vegetables** were planted in three areas in January 2015

B-Spraying calcium

1-Micronatet (CaO 18%) were sprayed after one month from planting the seeds on one area from each vegetables by moter sprayer one dose which recommended (MAO) 1gram / liter and the spraying had been done once every week until harvesting the product .

2- Carbomax (30 % caO) were sprayed after one month from planting the seeds on one area from each vegetables by moter sprayer one dose which recommended (MAO) 1gram / liter and the spraying had been done once every week until harvesting the product

3-Control sample no spraying for one area from each vegetables

C- harvesting the products of vegetable s

The products of vegetables were harvested and were put in the table (1) to compare between the shelf life on sprayed vegetables which control samples of each vegetable

D-Pickling process

Every groups of vegetables were pickled in salt solution 10% salt NaCl after cutting into small pieces for testing the shelf life of vegetables after pickling process and Cacl2 were added 1 grm / 1kg for Another samples for comparison.

E-Method Analysis .

Total solids, PH value, moisture content and Ec(Electric conductivity) were determined according to A.O.A.C (1990).

F- Sensory evaluation

Color, texture, taste and acceptability were evaluated by panel testers. Average of scores were considered. The qualities were A cored on a scale ranging to Io. (Lermond 1970)

Results and Discussion

Data presented in Table (1) show the effect of sprayed calcium on vegetables during vegetation growth in the field on shelf life after harvesting. it could be noticed that spraying of micronate on turnip lead to an increasing of Shelf life from 6 days in control sample to 8 days and spraying of carbomax on turnip lead to an increasing of shelf life from 6 days in control sample to 9 days. Because the calcium is involved maintaining the textural quality and these results are in agreement with those reported by **(Gareia et al 1996)**. On the other hand, the spraying micronateon carrot lead to on increasing of shelf life 7 days in control sample to 9 days and spraying of carbamate on carrot lead on increasing of shelf life 7 days in control sample to 12 days and increasing of shelf life carbomax comparing by micronaterefer to the increasing of calcium concentration from in micronate to in carbomax.The spraying of micronent on Jerusalem artichoke lead on increasing of shelf life 10 days in control sample to 13 days and spraying of carbomax on Jerusalem artichoke lead to an increasing of shelf life from 10 days in control sample to 15 days and that refers to the same reason which mentioned before with both turnip and carrot.

Table (1) Effect of sprayed calcium on vegetables during vegetation growth on field on shelf life after harvesting

Vegetables shelf life / **Calcium source**	**Shelf of life of vegetables (days)**		
	turnip	carrot	Jerusalem artichoke
Control sample	6 days	7 days	10 days
Micronota (18% CaO)	8days	9days	13 days
Carbomax (30% CaO)	9 days	12 days	15 days

Data presented in Table (2): show that the effect of sprayed and added calcium on vegetable on shelf life after of pickling process it could be noticed that added calcium chloride by rate 1 gram / 1 kg turnip.. To brine solution lead to an increasing of shelf life of pickled from 63 days in control sample to 95days and lead lead to on increasing the shelf life of pickled carrot from 94 days in control sample to 122 days

Table(2) Effect of sprayed and add calcium on vegetables on shelf life after pickling process

Vegetables shelf life / **Calcium source**	Shelf of life of vegetables (days)		
	turnip	carrot	Jerusalem artichoke
Control sample	6 3days	94 days	340 days
Cacl2	95 days	122days	351 days
Micronota 18% CaO	97 days	125 days	355 days
Carbomax sprayed 30% CaO	123 days	160days	390 days

On the other hand, it lead to on increasing the shelf life of pickled Jerusalem Artichoke from 340 days in control sample to 351 days.These results are in agreement with those reported by **Chardonnet *et al* (2003)**

Micronate sprayed lead to an increasing of shelf life of pickled turnip from 63 days in control sample to 97days and lead to on increasing the shelf life of pickled carrot from 94 days in control sample to 125 days. On the other hand, on its lead to increasing the shelf life of prickled Jerusalem Artichoke from 340 days in control sample to 355days carbomax sprayed.

The long period of shelf life on carbomax than micronate in all pickled vegetables referes to the increasing of calcium concentration on carbomax .

Data presented in Table (3) show the effect of pickling process in some charchtaristices of vegetables in control sample.

Table (3) effect of pickling process on some charachtristics on vegetables in control sample

Measurements / product	EC (ppm)	PH	T.S%	Moisture%
Fresh turnip	312	6.7	13%	87%
Pickled turnip	3240	4.15	9%	91%
Fresh carrot	390	6.50	20%	80%
Pickled carrot	2040	4.50	18%	82%
Fresh Jerusalem artichoke	454	6.70	15%	85%
Pickled Jerusalem artichoke	263	3.96	12%	88%

From Table(3), was observed that the EC increased by picking samples pickling process lead to an increasing the EC of all pickled vegetables and that's refers to that salt sodium chloride in brine solution.

- Pickling process lead to decreasing the PH values of all pickled vegetables from neutralized medium in fresh to acidfied medium in pickled.

-but the pickling process did not affect on the color of all vegetables, On the other hand the pickling process lead to decreasing the Total solid (T.S) with increasing in moisture% with all prickled vegetables.

- Sensory assessment of Jerusalem artichoke, carrot and turnip revealed that the test treatment after calcium sprayed (CaO30%). Data of the organoleptic evaluation of pickled vegetable in the results presented in Table (4) in dictated that the color had high scores in all vegetables samples with calcium added or calcium sprayed.

Table 4 sensory evaluation of pickled vegetables

Treatments / Charachraristics	Turnip				carrot				Jerusalem artichoke				L.S.D
	Control sample	Add calcium	Micronota spray cao 18%	sprayed cao 30%	Control sample	Add calcium	Micronote spray Cao 18%	carbomaxsprayed Cao 30%	Control sample	Add calcium	Micronota spray Cao 18%	Carbomax sprayed Cao 30%	
color	7.3	7.8	8.1	8.3	8.1	7.9	8.4	9	7.9	8.3	8.5	9.1	1.52
taste	7.1	8.2	8.5	9.1	8.4	8.4	8.6	9.1	8.1	8.5	9	9.1	1.61
texture	7.2	8.3	9.1	9.4	8.6	8.9	8.8	9.2	8.6	8.8	9.1	9.3	1.67
Over All acceptability	7.5	8.4	8.8	9.2	8.2	8.3	8.6	9.1	8.3	8.7	9	9.2	1.83

-Taste and texture high score in all vegetables with calcium compared by control samples in all vegetables.

Cost benefit: calcium compounds are very cheap and very economically by comparing the obtained results.

On the other hand, sprayed microcnate or carbomax had high scores in over all acceptability in turnip carrot and Jerusalem Artichoke

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دراسات تكنولوجية على كل من الطرطوفة والجزر واللفت

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الملخص العربى

يهدف هذا البحث الى دراسة تأثير رش الكالسيوم على المجموع الخضرى أثناء فترة النمو على مده حفظ بعض الخضروات كاللفت والجزر والطرطوفة بعد الحصاد فى الصورة الطازجة وكذلك بعد عملية التخليل

وقد تم استخدام مركب ميكرونيت والذى يحتوى على ١٨% أكسيد كالسيوم وكذلك مركب كاربوماكس والذى يحتوى على ٣٠% أكسيد كالسيوم فى الرش بمعدل ١جم/ لترماء وذلك بعد زراعة تلك الخضروات بشهر بمعدل مرتكل أسبوع حتى الحصاد أيضا تم أستخدام كلوريد الكالسيوم بأضافتة لغينه لم يتم رشها للمقارنه فى عمليه التخليل

وقد أوضحت النتائج المتحصل عليها كالأتى فى الحالة الطازجة لعينات الخضروات المختبرة أن رش الميكرونيا أدى الى زيادة مدة كلا من حفظ اللفت والجزريومين وزيادة حفظ الطرطوفة الى بمعدل ٣ أيام وذلك فى الحاله الطازجة وذلك مقارنة بالعينات الكنترول والتى لم يتم رشها

ايضا رش الكاربوماكس أدى الى زيادة مده حفظ اللفت بمعدل ٣ يوم أما الجزر والطرطوفه بمعدل ٥ يوم فى الحالة الطازجة وذلك مقارنة بعينات الكنترول

أظهرت النتائج أيضا فى عينات الخضروات المختبرة بالتحليل أن الكالسيوم المضاف أو المرشوش أدى الى زيادة مدة الحفظ بدرجة كبيرة حيث أن كلوريد الكالسيوم المضاف أدى الى زيادة حفظ اللفت المخلل من ٦٣ الى ٩٥ وزيادة حفظ الجزر المخلل من الى ١٢٢ يوم وزيادة حفظ الطرطوفه المخللة من ٣٤٠ الى ٣٥١ يوم على التوالى مقارنة بالعينات فى الكنترول

أما عن رش الكالسيوم كاربوماكس أدى الى زيادة مده حفظ اللفت المخلل من ٦٣ الى ١٢٣ وادى الى زيادة حفظ الجزر المخلل من ٩٤ الى ١٦٠ يوم و زيادة حفظ الطرطوفة المخللة من ٣٤٠ يوم فى الكنترول الى ٣٩٠ يوم على التوالى وكذلك عند التقييم الحسى حصلت الخضروات المخللةالمرشوشه بالكالسيوم او المضاف اليها الكالسيوم على درجات اعلى من عينات فى الكنترول