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**REDUCING THE RUTAB PERCENTAGE OF ZAGHLOUL DATES  
DURING STORAGE TO PROLONG THE MARKETING SEASON.  
BY**

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**ABSTRACT**

In 2002 & 2003 seasons, Zaghoul date fruits were picked at maturity stage and subjected to seven treatments; dipping in (Ca Cl<sub>2</sub>) and (Na Cl) at 2&4% for three minutes, respectively using 2 and 4 grams Desiccant Silica Gel as a humidity absorbant packed in small sachets and placed in trays of 100gm fruits, and the untreated fruits (control). Trays for all treatments were divided into three groups, the first group, was uncovered, the second, trays were covered by a low density polyethylene membrane of 15 microns, and the third group, was covered by a high density polyethylene membrane of 30 microns, and then stored for 30 days at 0°C and 85 – 90% relative humidity. Zaghoul date fruits treated by 4% Ca Cl<sub>2</sub> followed by 4% Na Cl and fruits were placed in trays containing sachets of Silica gel (4gm/100fruits) then packaged in 15m.m. polyethylene gave the best results of increasing the storage ability, lessening the percentage of Rutab dates beside decreasing the fermented ones during cold storage and or marketing.

The best and most significant result was obtained with fruits packaged in 15m.m. polyethylene compared with 30m.m. and the unpacked trays.

This method of packing reduced the percentage of Rutab fruits as well as the fermented ones, and the loss of weight, while helped in maintaining the red glossy color with a firmer texture.

**INTRODUCTION**

Date palm fruits are considered one of the most popular and nutritious fruits. They are a rich source of energy, proteins, minerals, fibers, and vitamins. (Ibrahim and Haggag 1993 and Al-Shahib and Marshall, 2003). According to their variations in moisture content they have several types of maturation. The softer ones containing higher moisture, are mainly consumed early at the Khalal stage or at the following stage of maturity (Rutab stage) according to the cultivars. In general, fruits consumed at Khalal stage, have less amount of tannins, and therefore, less astringent taste.

During Rutab stage, the soluble form of tannins convert in insoluble one (Maier and Metzler, 1965). The high content of soluble and insoluble form of tannins may protect the fruits, because such oxidized phenols are more active as

anti-fungal agents than the non-oxidized materials. Susceptibility to physiological darkening, mould damage and mite infestation is determined by postharvest handling practices and, in particular, by the moisture content of the fruits (Snowdon, 1990).

At the Rutab stage, the fruit is highly perishable, because of its softness, which affects its marketability and hastens its spoilage.

Postharvest application of Calcium salts maintain quality and extend shelf-life of many fruits throughout its effect on maintaining their cell wall structure and firmness, reducing respiration rates, ethylene production, protein breakdown and decay process (Bangerth *et al.*, 1972; Poovaiah, 1988; Hussein *et al.*, 1993 and El-Dengawy, 2004).

Nowadays, biological control of plant pathogens is worldwide practiced (Sabry, 1998).

The present work was to study the effect of postharvest treatments such as Calcium, Sodium chloride, Disiccant Silica Gel (as a humidity absorbant), Wrapping the packages with polyethylene on maintaining Rutab date quality without fermentation and reducing fruit softening during storage and prolonging the marketing period.

## MATERIALS AND METHODS

This investigation has been carried out during the seasons of 2003 – 2004. Zaghloul date fruits were harvested from an orchard in Giza Governorate. Seven treatments of selected mature fruits were of complete red color with a firmer texture. Each treatment was replicated for three times.

The treatments applied were as follows:

1. Control (untreated fruits).
2. Fruits dipped in Calcium Chloride 2% for three minutes.
3. Fruits dipped in Calcium Chloride 4% for three minutes.
4. Fruits dipped in Sodium Chloride 2% for three minutes.
5. Fruits dipped in Sodium Chloride 4% for three minutes.
6. Disiccant silica gel of 2 gm/100gm as a humidity absorbant in small sachets were placed in trays (untreated fruits).
7. Disiccant silica gel sachets of 4 gm/100gm as a humidity absorbant were placed in trays (untreated fruits).

Sound fruits were packaged at one layer in foam trays, having an average weight of 100grams per each in the two seasons. Trays for all treatments were divided into three groups, the first group, was uncovered, the second, trays were covered by a low density polyethylene membrane of 15 microns, and the third group, was covered by a high density polyethylene membrane of 30 microns. All trays were stored at 0°C with relative humidity 85 – 90 % for thirty days.

All the tested treatments were carried out to evaluate fruit quality every ten days intervals during cold storage. Fruits were rejected when the percentage of Rutab stage, shrunk and rotted ones exceeded 40 %.

**Physical properties**

**Percentage of weight loss:** Fruits were periodically weighed and the percentage of weight loss was calculated.

**Rutab stage:** Were calculated when reaching the ripe stage or at full browning.

**Pulp texture:** Was recorded by a lifra texture analyzer instrument, using a penetrating cylinder of (1 mm) of diameter, to a constant distance (5 mm) inside the fruit and by a constant speed, (2 mm/sec), and the results were expressed per gram.

**Peel color Measurement:** Was determined by using a Hunter colorimeter type (DP-9000) for the estimation of a\* (green – red) and b\* (blue – yellow) values.

**Shelf life after cold storage:** At the end of the storage period, three replicates from each treatment were left at ambient temperature to simulate the marketing environments in Egypt, for a period of three days. Changes in the physical and chemical characteristics of the fruits were recorded. i. e. loss of weight %, appearance, Rutab stage % and T.S.S. %.

**Chemical properties:**

**Total Soluble Solids %:** A refractometer was used to determine the percentage of total soluble solids in fruit juice (A.O.A.O., 1990).

**Titrateable Acidity %:** Titrateable acidity was determined in terms of anhydrous malic acid percentage after titrating against (0.1 N. sodium hydroxide) using phenolphthalein as indicator (A.O.A.O., 1990).

**Tannins (gm/100 gm fresh weight):** Tannins content was determined according to the method described by (Winton and Winton, 1958).

**Statistical Analysis:** the statistical analysis of the obtained data was carried out according to (Snedecor and Cochran, 1990).

**RESULTS AND DISCUSSION**

**Physical properties**

**Weight loss %:**

Data in Table (1) clearly show that there were significant differences between all treatments and untreated fruits either packed or not in affecting the percentage of loss in fruit weight during the cold storage. From the above mentioned results, it could be concluded that fruits treated with (Ca Cl<sub>2</sub> at 4 %) followed by (Na Cl at 4 %) and using Silica Gel at (4 gram/100gm) reduced the loss in fruit weight through reducing the moisture loss. These results were in line with those obtained by (Attia *et al*, 1997), who found that sealing Zaghoul fruits stored at 0°C reduced weight loss significantly compared with control fruits.

**Rutab stage %:**

It is clear from Table (2) that there was significant difference between all treatments and untreated fruits either packed or not in affecting the percentage of Rutab stage during storage period.

Table (1): Effect of postharvest treatments on weight loss % of Zaghoul date fruits stored at (0°C) during seasons 2003 – 2004.

1 <sup>st</sup> season																						
Storage in days	Control	CaCl <sub>2</sub>		NaCl		Silica gel in grams		Modified Atmosphere packages														M
		2%	4%	2%	4%	2	4	P.E. (15µ)								P.E. (30µ)						
								Con.	CaCl <sub>2</sub>		NaCl		Silica gel in grams		Con	CaCl <sub>2</sub>		NaCl		Silica gel in grams		
									2%	4%	2%	4%	2	4		2%	4%	2%	4%	2	4	
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	2.65	1.17	1.15	1.26	1.20	1.29	1.23	1.68	0.11	0.04	0.13	0.16	0.20	0.23	1.79	0.15	0.08	0.16	1.05	0.83	1.12	0.84
20	3.76	1.45	1.35	1.48	1.37	1.52	1.39	2.69	0.54	0.37	0.57	0.47	0.63	0.52	2.81	0.63	0.40	0.65	0.43	0.68	0.48	1.15
30	4.34	1.97	1.76	2.02	1.78	2.10	1.79	3.62	0.84	0.60	0.87	0.66	0.91	0.70	3.90	0.86	0.66	0.88	0.71	0.89	0.79	1.55
M	2.69	1.15	1.07	1.19	1.09	1.23	1.10	2.00	0.37	0.25	0.39	0.32	0.44	0.36	2.13	0.41	0.29	0.42	0.55	0.60	0.60	0.89
2 <sup>nd</sup> season																						
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	2.61	1.33	0.53	1.68	0.88	0.70	0.82	1.35	0.13	0.03	0.16	0.04	0.31	0.12	2.91	0.23	0.10	0.27	0.16	0.33	0.15	0.71
20	4.06	1.80	0.70	1.84	0.77	0.87	0.71	3.89	0.26	0.25	0.36	0.31	0.38	0.34	4.86	0.31	0.28	0.39	0.38	0.39	0.39	1.12
30	5.24	2.72	1.10	2.76	1.33	1.18	1.36	4.89	0.70	0.59	0.74	0.61	0.76	0.63	5.66	0.74	0.58	0.80	0.71	0.78	0.68	1.65
M	2.98	1.46	0.58	1.57	0.74	0.69	0.72	2.53	0.27	0.22	0.31	0.24	0.36	0.27	3.36	0.32	0.24	0.36	0.31	0.38	0.30	0.87
Average	2.83	1.31	0.82	1.38	0.92	0.96	0.91	2.26	0.32	0.24	0.35	0.28	0.40	0.32	2.74	0.36	0.26	0.39	0.43	0.49	0.45	0.88

L.S.D at 5% level

1<sup>st</sup> Season2<sup>nd</sup> Season

A

0.03337

0.03356

B

0.07647

0.07689

AxB

0.1529

0.1538

**Table (2): Effect of postharvest treatments on Rutab stage % of Zaghoul date fruits stored at (0°C) during seasons 2003 – 2004.**

1 <sup>st</sup> season																							
Storage in days	Control	CaCl <sub>2</sub>		NaCl		Silica gel in grams		Modified Atmosphere packages												M			
		2%	4%	2%	4%	2	4	P.E. (15µ)						P.E. (30µ)									
								Con.	CaCl <sub>2</sub>		NaCl		Silica gel in grams		Con.	CaCl <sub>2</sub>		NaCl			Silica gel Per grams		
									2%	4%	2%	4%	2	4		2%	4%	2	4				
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	16.67	11.11	5.55	11.11	8.33	5.55	8.33	8.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.11	0.00	0.00	0.00	0.00	0.00	0.00	4.10
20	28.75	22.95	18.10	21.25	19.17	19.52	18.10	18.10	8.33	5.55	8.33	5.55	5.55	5.55	20.58	13.89	11.11	15.00	16.67	11.11	8.33	14.36	
30	41.58	33.33	29.31	33.07	28.71	34.60	30.15	39.09	27.69	21.31	28.75	26.09	28.92	26.80	40.28	28.67	25.24	29.63	27.59	29.87	27.70	30.40	
M	21.75	16.85	13.24	16.36	14.05	14.92	14.14	16.38	9.01	6.72	9.27	7.91	8.62	8.09	17.99	10.64	9.09	11.16	11.07	10.25	9.01	12.21	
2 <sup>nd</sup> season																							
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	16.67	11.11	8.33	13.89	11.11	8.33	11.11	5.55	0.00	0.00	0.00	0.00	0.00	0.00	8.33	2.78	0.00	5.44	2.78	0.00	2.78	5.15	
20	27.81	16.67	13.89	20.68	18.10	18.10	18.10	22.50	5.55	2.78	11.11	8.33	5.55	2.78	26.24	8.33	5.55	13.89	11.11	8.33	5.55	12.90	
30	44.46	27.61	26.58	33.33	28.01	25.39	24.40	37.42	20.95	16.67	23.07	21.74	23.49	23.07	38.44	22.34	20.95	26.31	26.73	22.92	22.01	26.47	
M	22.23	13.85	12.20	16.97	14.30	12.96	13.40	16.37	6.63	4.86	8.55	7.52	7.26	6.46	18.25	8.36	6.63	11.41	10.15	7.81	7.59	11.13	
Average	21.99	15.35	12.72	16.67	14.18	13.94	13.77	16.37	7.82	5.79	8.91	7.71	7.94	7.28	18.12	9.50	7.86	11.28	10.61	9.03	8.30	11.67	

L.S.D at 5% level

1<sup>st</sup> Season  
2<sup>nd</sup> Season

A  
0.7681  
0.9625

B  
1.760  
2.205

AxB  
3.520  
4.411

During both seasons, results clearly showed that there was no percentage of Rutab fruits for a period of ten days in storage at (0°C) for all fruits packed in polyethelene (15 or 30 micron). Packed fruits treated with (Ca Cl<sub>2</sub> at 4 %) followed by (Na Cl at 4 %) and Silica Gel at (4 gram/100gm) showed a decrease in Rutab stage percentage than other treatment and untreated fruits. On the other hand untreated fruits and unpackaged showed the highest values in Rutab stage percentage followed by untreated fruits and packaged in polyethylene 15 micron and 30 micron. During storage period in both seasons, respectively (41.58 – 39.09 – 40.28) & (44.46 – 37.42 – 38.44). With regard to polyethylene effect, the data clearly indicated that wrapping the fruits with polyethylene reduced Rutab stage percentage.

This may be due to the effect of using polyethylene wrappers which create a modified atmosphere surrounding the fruits. Consequently, wrapped fruits in polyethylene film reduced Rutab stage percentage by transpiration and slowed down fruit respiration.

Similar results were obtained by (Attia *et al*, 1997), who pointed out that using polyethylene had lowered the fruit Rutab incidence when compared with untreated ones.

#### **Pulp texture (5 mm):**

Results presented in Table (3) show a significant difference between all treated and untreated fruits either packed or not in affecting fruit texture during cold storage. Fruit treated with (Ca Cl<sub>2</sub> at 4 %) and (Na Cl at 4 %) followed by Silica Gel at (4 gram/100gm) on fruits packaged in polyethylene (15 micron). Showed the highest fruit texture until 3 days cold storage in the second season (154.4 – 147.2 and 144.8) respectively. The untreated and unpacked fruits showed the highest decrease in fruit texture than untreated and fruits packed in polyethylene (15 and 30 micron) in both season respectively (180.2 – 190.30 – 175.3) & (130.4 – 134.3 – 135.8) during cold storage.

In fact, fruit texture had an important role affecting the keeping quality and storability of Zaghoul date fruit.

The present data and related discussion are in correspondence with those reported by (Higazy *et al*, 2002) on Zaghoul date fruits.

#### **Fruit color:**

Numerical values of fruit color in Zaghoul date fruits after cold storage at (0°C) was presented in Tables (4 & 5).

Data showed that fruits treated with (Ca Cl<sub>2</sub> 4% followed by Na Cl 4% and Silica Gel 2 gm/100gm) for three minutes and packaged in (15 micron polyethylene) resulted in the most colored fruits with higher red signs (a\*value) in both seasons, (24.68 – 24.29 – 24.45) & (26.32 – 26.12 – 26.10) and color darkening (b\*value) which was associated with Rutab stage progress as it was observed in all treatments.

Table (3): Effect of postharvest treatments on Texture (5 mm) of Zaghoul dates fruit stored at (0°C) during seasons 2003 – 2004.

1 <sup>st</sup> season																						
Storage in days	Control	CaCl <sub>2</sub>				NaCl				Silica gel in grams		Modified Atmosphere packages										M
		2%	4%	2%	4%	2	4	P.E. (15μ)					P.E. (30μ)									
								Con.	CaCl <sub>2</sub>		NaCl		Silica gel in grams		Con	CaCl <sub>2</sub>		NaCl		Silica gel in grams		
									2%	4%	2%	4%	2	4		2%	4%	2%	4%	2	4	
0	220.0	220.0	220.0	220.0	220.0	220.0	220.0	220.0	220.0	220.0	220.0	220.0	220.0	220.0	220.0	220.0	220.0	220.0	220.0	220.0	220.0	220.0
10	200.5	212.2	214.8	207.0	209.5	216.2	218.2	207.0	216.9	218.1	217.6	217.4	217.1	218.3	200.4	210.3	213.2	207.9	211.7	210.0	211.4	212.2
20	193.5	200.3	208.7	203.1	208.1	205.3	216.1	196.7	214.8	216.8	216.1	214.7	215.4	216.8	183.3	191.4	191.9	190.5	191.3	196.1	198.0	203.3
30	180.2	193.7	196.1	190.0	192.9	202.7	212.1	190.3	212.4	204.7	213.4	199.3	213.9	213.7	175.3	188.0	189.2	180.4	180.4	186.0	187.3	195.3
M	198.6	206.5	209.9	205.0	207.6	211.1	216.6	203.5	216.0	214.9	216.8	212.9	216.6	217.2	194.7	202.4	203.6	199.7	200.8	203.0	204.2	207.7
2 <sup>nd</sup> season																						
0	192.0	192.0	192.0	192.0	192.0	192.0	192.0	192.0	192.0	192.0	192.0	192.0	192.0	192.0	192.0	192.0	192.0	192.0	192.0	192.0	192.0	192.0
10	169.6	174.4	176.2	171.4	173.2	170.1	172.3	171.1	180.3	183.5	174.0	175.5	172.2	174.0	171.3	172.8	174.8	168.7	171.4	167.4	170.3	173.1
20	155.6	160.2	162.3	149.1	152.4	146.8	150.4	157.4	164.4	167.1	154.4	156.8	153.0	154.9	158.6	156.7	159.8	146.8	149.8	144.6	147.9	154.7
30	130.4	149.0	151.3	139.6	142.7	137.6	141.1	134.3	150.7	154.4	144.8	147.2	143.0	144.8	135.8	143.8	148.2	137.8	140.5	136.3	139.0	142.5
M	161.9	168.9	170.5	163.0	165.1	161.6	163.9	163.7	171.9	174.3	166.3	167.9	165.0	166.4	164.4	166.3	168.7	161.3	163.4	160.1	162.3	165.6
Average	180.2	187.7	190.2	184.0	186.4	186.3	190.3	183.6	193.9	194.6	191.5	190.4	190.8	191.8	179.6	184.4	186.1	180.5	182.1	181.6	183.2	186.6

L.S.D at 5% level

1<sup>st</sup> Season

2<sup>nd</sup> Season

A

0.8807

1.164

B

2.018

2.667

AxB

4.036

5.335

Table (4): Effect of postharvest treatments on Color (a\*value) of Zaghout date fruits stored at (0°C) during seasons 2003 – 2004.

1 <sup>st</sup> season																								
Treat- ments	Control	CaCl <sub>2</sub>		NaCl		Silica gel in grams		Modified Atmosphere packages																M
		2%	4%	2%	4%	2	4	P.E. (15µ)								P.E. (30µ)								
								Con.	CaCl <sub>2</sub>		NaCl		Silica gel in grams		Con	CaCl <sub>2</sub>		NaCl		Silica gel in grams				
									2%	4%	2%	4%	2	4		2%	4%	2%	4%	2	4			
Storage in days	2%	4%	2%	4%	2	4	Con.	2%	4%	2%	4%	2	4	Con	2%	4%	2%	4%	2	4				
0	26.47	26.47	26.47	26.47	26.47	26.47	26.47	26.47	26.47	26.47	26.47	26.47	26.47	26.47	26.47	26.47	26.47	26.47	26.47	26.47	26.47	26.47		
10	24.86	25.32	25.36	25.29	25.16	25.13	25.09	25.04	25.34	25.67	25.28	25.44	25.16	25.17	24.72	25.28	25.31	25.25	25.29	25.23	25.25	25.22		
20	24.13	24.65	24.79	24.59	24.48	24.37	24.27	24.63	24.99	25.04	24.92	24.97	24.89	24.91	24.44	24.84	24.98	24.74	24.94	24.68	24.87	24.72		
30	23.32	24.16	24.30	24.08	24.01	23.98	23.95	24.04	24.59	24.68	24.50	24.29	24.45	24.35	23.73	24.46	24.61	24.32	24.57	24.30	24.51	24.25		
M	24.70	25.15	25.23	25.11	25.03	24.99	24.95	25.05	25.35	25.47	25.29	25.29	25.24	25.23	24.84	25.26	25.34	25.19	25.32	25.17	25.28	25.16		
2 <sup>nd</sup> season																								
0	27.74	27.74	27.74	27.74	27.74	27.74	27.74	27.74	27.74	27.74	27.74	27.74	27.74	27.74	27.74	27.74	27.74	27.74	27.74	27.74	27.74	27.74		
10	26.39	26.79	26.91	26.72	26.81	26.70	26.77	26.91	27.32	27.37	27.25	27.21	27.86	27.14	26.59	26.99	27.27	27.14	27.24	27.12	27.21	27.03		
20	26.24	26.17	26.33	26.02	26.18	25.88	26.00	26.40	26.89	27.02	26.81	26.78	26.76	26.71	26.35	26.59	26.92	26.74	26.91	26.65	26.82	26.53		
30	25.25	25.62	25.85	25.50	25.61	25.38	25.52	25.55	26.14	26.32	26.12	26.04	26.10	25.99	25.35	25.85	26.04	25.95	26.01	25.84	25.90	25.81		
M	26.40	26.58	26.71	26.49	26.59	26.42	26.51	26.65	27.02	27.11	26.98	26.94	27.12	26.89	26.51	26.79	26.99	26.89	26.98	26.84	26.92	26.78		
Average	25.55	25.87	25.97	25.80	25.81	25.71	25.73	25.85	26.18	26.29	26.14	26.12	26.18	26.06	25.67	26.03	26.17	26.04	26.15	26.00	26.10	25.97		

L.S.D at 5% level

1<sup>st</sup> Season2<sup>nd</sup> Season

A

0.1593

0.1569

B

0.3649

0.3596

AxB

0.7299

0.7191

**Table (5): Effect of postharvest treatments on Color (b\*value) of Zaghoul date fruits stored at (0°C) during seasons 2003 – 2004.**

1 <sup>st</sup> season																							
Treat-ments	Storage in days	Control	CaCl <sub>2</sub>		NaCl		Silica gel in grams		Modified Atmosphere packages												M		
			2%	4%	2%	4%	2	4	P.E. (15µ)						P.E. (30µ)								
									Con.	CaCl <sub>2</sub>		NaCl		Silica gel in grams		Con.	CaCl <sub>2</sub>		NaCl			Silica gel in grams	
										2%	4%	2%	4%	2	4		2%	4%	2%	4%		2	4
0	12.07	12.07	12.07	12.07	12.07	12.07	12.07	12.07	12.07	12.07	12.07	12.07	12.07	12.07	12.07	12.07	12.07	12.07	12.07	12.07	12.07	12.07	12.07
10	10.70	11.39	11.56	11.24	11.48	11.23	11.33	11.32	11.62	11.73	11.55	11.61	11.57	11.61	10.56	11.43	11.58	11.34	11.50	11.30	11.37	11.38	11.38
20	10.42	11.11	11.36	11.01	11.31	10.91	11.06	10.92	11.36	11.47	11.24	11.29	11.12	11.16	10.34	11.18	11.30	11.07	11.17	10.98	11.04	11.09	11.09
30	9.14	10.54	10.71	10.41	10.55	10.28	10.44	10.37	10.92	11.03	10.82	10.90	10.74	10.77	9.04	10.80	10.93	10.71	10.79	10.61	10.63	10.53	10.53
M	10.58	11.28	11.42	11.18	11.35	11.12	11.23	11.17	11.49	11.57	11.42	11.47	11.37	11.40	10.50	11.37	11.47	11.30	11.38	11.24	11.28	11.27	11.27
2 <sup>nd</sup> season																							
0	12.51	12.51	12.51	12.51	12.51	12.51	12.51	12.51	12.51	12.51	12.51	12.51	12.51	12.51	12.51	12.51	12.51	12.51	12.51	12.51	12.51	12.51	12.51
10	11.11	11.78	11.83	11.81	11.74	11.77	11.68	11.86	12.02	12.07	11.93	11.97	11.88	11.88	11.78	11.89	11.98	11.93	11.96	11.89	11.90	11.84	11.84
20	10.52	10.98	11.05	11.05	10.93	10.90	10.90	10.83	11.79	11.85	11.77	11.71	11.66	11.58	10.94	11.66	11.72	11.73	11.67	11.68	11.64	11.36	11.36
30	9.73	12.64	10.75	10.71	10.64	9.33	10.58	10.07	10.72	10.81	10.66	10.67	10.56	10.58	9.84	10.21	10.31	10.32	10.42	10.27	10.20	10.48	10.48
M	10.97	11.98	11.53	11.52	11.45	11.13	11.42	11.32	11.76	11.81	11.72	11.71	11.65	11.64	11.27	11.57	11.63	11.62	11.64	11.59	11.56	11.55	11.55
Average	10.77	11.63	11.48	11.35	11.40	11.12	11.32	11.24	11.63	11.69	11.57	11.59	11.51	11.52	10.88	11.47	11.55	11.46	11.51	11.41	11.42	11.41	11.41

L.S.D at 5% level

1<sup>st</sup> Season

2<sup>nd</sup> Season

A

0.06390

0.1026

B

0.1464

0.2350

AxB

0.2928

0.4700

Control fruits (unpacked) attained the highest decrease rate in both seasons (12.07 to 9.14) & (12.51 to 9.73) in the two seasons, respectively.

#### **Chemical properties:**

##### **T.S.S. %:**

Data in Table (6) showed that T.S.S. % increased towards the end of the storage period in all treatments.

Fruits packed in polyethylene 15 or 30 micron and treated with Ca Cl<sub>2</sub> 4% or Na Cl 4% and the addition of Silica Gel 4 gm/100gm showed the highest values in T.S.S.% than other treatments and unpacked. On the other hand, untreated fruits (packed or unpacked) showed the lowest values in T.S.S.% in both seasons.

These results confirmed the previous results obtained by El-Morshedy *et al.*, (1992) and Attia *et al.*, (1997). Who found that total soluble solids of Zaghoul date fruits increased during storage at 0°C.

##### **Acidity%:**

Acidity percentage decreased steadily during the storage periods Table (7).

Fruits treated with Ca Cl<sub>2</sub> 4% or Na Cl 4% followed by using Silica Gel 4 gm/100gm, and placed in trays showed the lowest values in Acidity% than fruits of other treatments and the control.

Packed fruits showed best results than unpacked ones having the lowest acidity in Zaghoul fruits during cold storage.

These results agreed with those obtained by El-Morshedy *et al.* (1992) and Attia *et al.* (1997) who reported that fruit juice acidity of Zaghoul dates gradually decreased with increasing the storage period.

##### **Tannins%:**

Data in Table (8) showed that total tannins content in packed fruits showed a lowest value than unpacked ones.

Fruits treated with Ca Cl<sub>2</sub> 4% or with Na Cl 4% for three minutes followed by using Silica Gel 4 gm/100gm and packed in 15 or 30 micron polyethylene, showed the lowest values in tannin contents than other treatments during cold storage. Untreated fruits showed the highest values in tannin contents (packed or unpacked) during storage at 0°C in both seasons.

#### **Fruits behavior during shelf life period after cold storage:**

Fruit behavior parameters during simulating marketing period (shelf life) for three days at ambient temperature after removal from cold storage are shown in Table (9).

**Table (6): Effect of postharvest treatments on T.S.S % of Zaghoul date fruits stored at (0°C) during seasons 2003 – 2004.**

1 <sup>st</sup> season																							
Storage in days	Control	CaCl <sub>2</sub>		NaCl		Silica gel in grams		Modified Atmosphere packages														M	
		2%	4%	2%	4%	2	4	P.E. (15μ)							P.E. (30μ)								
								Con.	CaCl <sub>2</sub>		NaCl		Silica gel in grams		Con	CaCl <sub>2</sub>		NaCl		Silica gel in grams			
									2%	4%	2%	4%	2	4		2%	4%	2%	4%	2	4		
0	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8
10	18.0	18.1	18.3	18.1	18.3	18.1	17.9	18.1	18.3	18.4	18.1	18.4	18.2	18.4	17.9	18.1	18.1	18.0	18.2	18.3	18.3	18.2	18.2
20	18.2	18.3	18.5	18.4	18.6	18.3	18.0	18.3	18.5	18.7	18.3	18.7	18.4	18.6	18.3	18.2	18.3	18.3	18.4	18.6	18.6	18.4	18.4
30	18.4	18.5	18.6	18.6	18.7	18.5	18.5	18.5	18.6	19.8	18.5	19.2	18.7	18.9	18.4	18.5	18.6	18.6	18.6	18.7	18.8	18.7	18.7
M	18.1	18.2	18.3	18.2	18.4	18.2	18.1	18.2	18.3	18.7	18.2	18.5	18.3	18.4	18.1	18.2	18.2	18.2	18.3	18.4	18.4	18.3	18.3
2 <sup>nd</sup> season																							
0	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2
10	17.4	17.4	17.4	17.4	17.4	17.4	17.5	17.4	17.4	17.4	17.5	17.4	17.4	17.5	17.3	17.5	17.4	17.5	17.4	17.4	17.4	17.4	17.4
20	17.6	17.6	17.6	17.6	17.5	17.7	17.7	17.6	17.6	17.7	17.7	17.6	17.6	17.8	17.5	17.6	17.6	17.7	17.7	17.7	17.7	17.7	17.6
30	17.7	17.9	17.9	17.8	17.9	17.9	17.9	17.8	18.0	18.8	18.0	18.7	17.9	18.0	17.6	17.7	17.9	17.9	17.8	17.9	17.9	17.9	17.9
M	17.5	17.5	17.5	17.5	17.5	17.5	17.6	17.5	17.6	17.8	17.6	17.7	17.5	17.6	17.4	17.5	17.5	17.6	17.5	17.6	17.6	17.5	17.5
Average	17.8	17.9	17.9	17.9	17.9	17.9	17.8	17.8	17.9	18.2	17.9	18.1	17.9	18.0	17.7	17.8	17.9	17.9	17.9	18.0	18.0	17.9	17.9

L.S.D at 5% level

1<sup>st</sup> Season  
2<sup>nd</sup> Season

A  
0.03689  
0.03337

B  
0.08454  
0.07647

AxB  
0.1691  
0.1529

Table (7): Effect of postharvest treatments on Total acidity % of Zaghoul date fruits stored at (0°C) during seasons 2003 – 2004.

1 <sup>st</sup> season																						
Treatments	Control	CaCl <sub>2</sub>		NaCl		Silica gel in grams		Modified Atmosphere packages														M
		2%	4%	2%	4%	2	4	Con.	P.E. (15µ)						P.E. (30µ)							
									CaCl <sub>2</sub>		NaCl		Silica gel in grams		Con	CaCl <sub>2</sub>		NaCl		Silica gel in grams		
									2%	4%	2%	4%	2	4		2%	4%	2	4			
0	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210	0.210
10	0.192	0.161	0.162	0.163	0.162	0.166	0.165	0.187	0.156	0.155	0.154	0.154	0.157	0.154	0.191	0.166	0.164	0.160	0.159	0.159	0.159	0.164
20	0.163	0.143	0.141	0.138	0.139	0.140	0.140	0.131	0.128	0.131	0.126	0.124	0.126	0.125	0.155	0.142	0.136	0.142	0.132	0.133	0.131	0.136
30	0.122	0.110	0.106	0.097	0.108	0.108	0.107	0.111	0.112	0.094	0.106	0.095	0.114	0.111	0.116	0.106	0.104	0.105	0.105	0.098	0.098	0.106
M	0.172	0.156	0.155	0.152	0.155	0.156	0.156	0.160	0.152	0.147	0.149	0.146	0.152	0.150	0.168	0.156	0.154	0.154	0.152	0.150	0.149	0.154
2 <sup>nd</sup> season																						
0	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196
10	0.183	0.177	0.173	0.178	0.174	0.178	0.172	0.163	0.147	0.132	0.144	0.133	0.157	0.154	0.186	0.173	0.168	0.175	0.175	0.141	0.141	0.163
20	0.158	0.142	0.130	0.138	0.129	0.134	0.132	0.146	0.125	0.103	0.122	0.105	0.126	0.124	0.163	0.133	0.133	0.133	0.137	0.136	0.137	0.133
30	0.144	0.114	0.107	0.115	0.112	0.117	0.116	0.135	0.095	0.086	0.091	0.088	0.112	0.114	0.150	0.118	0.109	0.106	0.105	0.099	0.107	0.111
M	0.170	0.157	0.152	0.157	0.153	0.156	0.154	0.160	0.141	0.129	0.138	0.131	0.148	0.147	0.174	0.155	0.151	0.152	0.153	0.143	0.145	0.151
Average	0.171	0.157	0.153	0.154	0.154	0.156	0.155	0.160	0.146	0.138	0.144	0.138	0.150	0.149	0.171	0.156	0.152	0.153	0.152	0.147	0.147	0.152

L.S.D at 5% level

1<sup>st</sup> Season2<sup>nd</sup> Season

A

0.003518

0.003689

B

0.008060

0.008454

AxB

0.01612

0.01691



Table (9): Fruit quality of Zaghfoul dates fruits after removal from the end of cold storage to ambient temperature (20 – 23 °C) for three days.

1 <sup>st</sup> season																						
Treat-ments	Control	CaCl <sub>2</sub>		NaCl		Silica gel in grams		Modified Atmosphere packages														M
		2%	4%	2%	4%	2	4	P.E. (15µ)								P.E. (30µ)						
								Con.	CaCl <sub>2</sub>		NaCl		Silica gel in grams		Con.	CaCl <sub>2</sub>		NaCl		Silica gel in grams		
									2%	4%	2%	4%	2	4		2%	4%	2%	4%	2	4	
T.S.S%	18.0	18.3	18.2	18.2	18.1	18.1	18.1	18.6	18.7	20.0	18.8	19.4	18.8	19.0	18.2	18.3	18.4	18.3	18.3	18.5	18.6	18.5
Rutab st.%	59.32	43.79	40.48	47.08	44.97	46.07	43.74	43.45	32.06	30.70	32.63	31.68	32.21	31.01	49.65	33.28	33.63	36.01	35.67	35.04	35.37	38.94
Appearance	1.3	1.7	2.0	1.7	2.0	2.0	1.7	2.0	3.0	3.3	2.7	2.3	2.7	2.3	1.7	2.3	2.3	2.0	2.3	2.3	2.7	2.21
Loss of weight%	7.04	3.76	2.11	3.92	2.97	2.79	2.62	4.16	1.82	1.66	1.95	1.97	2.03	2.09	6.65	1.97	1.83	2.29	2.09	2.34	2.19	2.87
2 <sup>nd</sup> season																						
T.S.S%	17.5	17.8	17.8	17.6	17.7	17.7	17.8	17.9	18.1	19.0	18.1	18.8	18.0	18.2	17.6	17.7	17.9	17.7	17.7	17.7	17.8	17.91
Rutab st.%	56.08	44.26	41.05	46.30	44.34	45.26	44.83	41.49	30.98	30.25	31.49	30.73	30.56	30.87	49.29	32.39	31.95	34.23	34.37	34.12	34.93	38.09
Appearance	1.3	1.7	2.0	1.7	2.0	2.3	2.0	2.0	3.0	3.7	2.7	2.3	2.7	2.3	1.7	2.3	2.3	2.0	2.3	2.3	2.3	2.24
Loss of weight%	7.21	3.78	2.28	3.62	2.66	2.59	2.50	5.75	1.85	1.73	1.95	1.85	1.98	1.91	6.66	1.93	1.84	2.08	1.95	2.08	2.06	2.87

L.S.D at 5% level

T.S.S%

Rutab st.%

Appearance

Loss of weight%

1<sup>st</sup> season

0.2761

1.355

0.9622

0.2952

2<sup>nd</sup> season

0.2905

1.452

0.9749

0.4839

Concerning total soluble solids, fruits treated with dipping in Ca Cl<sub>2</sub> at 2% for 3 minutes and packed in polyethylene 15 micron showed the highest values compared to other treatments and untreated fruits in both seasons.

Regarding the Rutab incidence, fruits dipped in Ca Cl<sub>2</sub> at 4% for three minutes followed by fruits treated with Ca Cl<sub>2</sub> at 2% for three minutes and fruits placed in trays containing sheets of Silica Gel 4 gm/100gm and packed in polyethylene 15 micron, showed the lowest values compared with other treatments and untreated fruits in both seasons. Percentage weight loss in fruits dipped in Ca Cl<sub>2</sub> at 4% and packed in polyethylene 15 micron showed the lowest values compared with other treatments and untreated fruits in both seasons.

The best fruits appearance was found when dipping the dates in Ca Cl<sub>2</sub> at 4% followed by those dipped in Na Cl at 4% then fruits placed in trays with sheets of Silica Gel 2 gm/100gm and packed in polyethylene 15 micron compared with other treatments and untreated fruits.

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تأثير بعض معاملات ما بعد الحصاد على جودة ثمار البلح الزغلول  
وتقليل نسبة الترطيب أثناء التخزين البارد

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أجريت الدراسة خلال عامي ٢٠٠٢ - ٢٠٠٣ على صنف البلح الزغلول بهدف الحفاظ على جودة الثمار بدون ترطيب والمحافظة على ما يربط منها بدون تخمر أثناء التخزين البارد أو عند العرض بالأسواق.

قطفت الثمار في مرحلة إكمال النمو وتم غمرها في محلول كلوريد كالسيوم ٢ & ٤ % لمدة ثلاث دقائق أيضا ووضع مادة سليكا جيل (مادة ماصة للرطوبة) ٢ جم & ٤ جم في أطباق فوم تحتوي على ١٠٠ جم ثمار وقسمت جميع المعاملات إلى ثلاثة مجاميع، الأولى بدون تغليف والثانية تغليف بالبولي إيثيلين ١٥ ميكرون والثالثة تغليف بالبولي إيثيلين ٣٠ ميكرون ثم خزنت الثمار على صفر<sup>٥</sup> ورطوبة نسبية ٨٥ - ٩٠ % لمدة ثلاثون يوما.

ووجد أن ثمار البلح المعاملة بكلوريد الكالسيوم ٤% وكلوريد الصوديوم ٤% واستخدام مادة سليكا جيل ٤ جم/١٠٠ جم ثمار مع التغليف ببولي إيثيلين ١٥ ميكرون تفوقت عن باقي المعاملات المغلفة ببولي إيثيلين ٣٠ ميكرون والثمار الغير مغلفة أثناء التخزين البارد حيث أدت إلى تقليل النسبة المئوية للفق في الوزن وتقليل نسبة الترطيب والحفاظ على قوام الثمار وزيادة درجة اللون ونسبة المواد الصلبة الذائبة وتقليل نسبة الحموضة والتانينات وبالتالي زيادة القدرة التخزينية والتسويقية.