

## STUDY ON THE STORAGE OF EGYPTIAN SIWI DATE VARIETY (SEMI-DRY DATE)

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### Abstract

Studies on the storage of Egyptian Siwi date variety were conducted in order to lower the changes in chemical and sensory characteristics and to prevent the insect infestation. The following treatments were used to reach this target:

- preservation of dates by packing in sealed plastic containers, using polyethylene-polyamide bags for packing dates under vacuum and treating the dates by sulfur dioxide in the store.
- previous treatments were stored in tightly closed store for eleven months.

The results revealed that treating Siwi dates of Kharja and Dakhla Oasis by sulfur dioxide led to the best color (10.36 and 11.82 ICUMSA respectively for the date extract) and total color density were very low for the same treatment (0.324 and 0.367 OD respectively). The unacceptable color appeared in the dates packed in plastic containers. No insect infestation was found in any treatments.

### INTRODUCTION

The total production of Egyptian date fruit is 750000 tons (FAO, 1998). Semi-dry date represent about 20.4% of the total production and Siwi date variety is one of the important semi dry date in Egypt which represent about 16.9%.

The storage of Egyptian Siwi dates have many problems such as the darkening (browning) and insect infestation.

Some studies on storage of semi-dry dates were carried out on Iraqi dates (Benjamin *et al.*, 1976) who studied the effect of storage on Zahdi date fruit at different temperatures (-3, 0, 5°C and room temperature). The quality of stored dates at room temperature was very poor and unacceptable for human consumption. The suitable temperature for storage ranged from -3 to 5°C.

Some chemicals such as methyl bromide and hydrogen phosphide are used to prevent the insect infestation (Barreveld, 1994).

Sulfur dioxide is one of the chemicals which has been used for preventing the color changes and disinfestation. This compound is used to preserve the dried fruits such as dried apricot, raisins and figs (Ingles and Reynolds, 1958; Hulme, 1970; Foda *et al.*, 1972 and Nezam El-Din, 1978).

Since quantities of dates are consumed in the Islamic world during the fasting month of Ramadan. Since this month might come before the ripening of dates, dates may be stored for long periods 10-12 months.

This work aims at finding good and suitable methods for the storage of the Egyptian Siwi dates to obtain good quality fruits and free from insects.

## MATERIALS AND METHODS

### Materials :

Two samples of Egyptian Siwi date variety were obtained from New Valley Governorate. The first sample obtained from El-Kharja Oasis and the second sample obtained from El-Dakhla Oasis.

Some techniques were used for treating Siwi dates before storage, as follows:

1. Siwi dates were packed in plastic containers and tightly closed.
2. Siwi dates were packed in polyethylene – polyamide bags under vacuum.
3. Siwi dates were treated by sulfur dioxide in the store and the concentration of sulfur used to burn was 29 gm /m<sup>3</sup>.

Another concentration of sulfur dioxide was used (10 g/m<sup>3</sup>) but the results of this treatment was neglected because its quality after washing and drying was not accepted.

### The treatments of Siwi date fruit treatments were as follows :

1. Kharja Siwi dates stored in plastic containers.
2. Dakhla Siwi dates stored in plastic containers.
3. Kharja Siwi dates stored after washing and drying at 65°C.
4. Dakhla Siwi dates stored after washing and drying at 65°C.
5. Kharja Siwi dates stored after packing in poly ethylene - poly amide (PE-PA) bags un-

der vacuum.

6. Dakhla Siwi dates stored after packing in polyethylene – polyamide (PE-PA) bags under vacuum.
7. Kharja Siwi dates stored after washings, drying at 65°C and packed in PE-PA bags under vacuum.
8. Dakhla Siwi dates stored after washing, drying at 65°C and packed in PE-PA bags under vacuum.
9. Kharja Siwi dates stored after burning the sulfur in the store.
10. Dakhla Siwi dates stored after burning the sulfur in the store.
11. Stored treatments of sulfured Kharja Siwi date (9) were washed and dried at 65°C.
12. Stored treatments of sulfured Dakhla Siwi dates (10) were washed and dried at 65°C.

All previous treatments were stored in a tightly closed store at ambient temperature.

#### **Methods :**

Moisture content, total acidity and pH value were measured according to AOAC (1990).

Reducing and total sugars, Hydroxy methyl furfural and sulfur dioxide were determined as mentioned by Ranganna (1979).

Total phenols were determined by using Folin-Denis reagent as described by Swain and Hillis (1959).

#### **Color measurement :**

The color of non-enzymatic browning was extracted by 100 ml ethyl alcohol 60% then filtered. The color of filtrate measured at 420 nm. (Ranganna, 1979).

The color (ICUMSA unit) was measured by the method of meade (1970) as follows: date fruits were extracted by water then filtered. The ICUMSA units were measured from the following equation

$$(E_{420} - E_{720}) \div (\text{TSS of dates extract} \times \text{depth of solution in cuvette}).$$

**Total color density (TCD)** of Date fruit (1gm) was extracted by water (25 ml) then filtered and the color measured at 420 and 520 nm. The Summation of optical density at these two wave lengths indicate to the total color density. (Amerine and

Ough, 1980).

#### **Examination of insects :**

One hundred dates were selected randomly from each treatment and for examination of dates it was used a magnifying glass (90 mm Diameter) for counting any infestation which contained adults, eggs, larvae, pupae and feces.

#### **Organoleptic Evaluation**

Sensory evaluation of (color, taste and flavor) of dates were performed by panelists using scale from 1 to 10.

The collected data were subjected to analysis of variance (Completely Randomized Design) as mentioned by Snedcor and Cochran (1980).

### **RESULTS AND DISCUSSION**

The chemical composition of date fruit is very important especially for exportation because these components have the main role for keeping the quality of dates. To lower the chemical changes of dates during storage, it was carried some treatments (storage in plastic containers, storage , in polyethylene - polyamide (PE-PA) bags under vacuum and storage of sulfured treated dates in closed store).

The chemical analysis revealed that Kharja and Dakhla Siwi dates control (stored in carton box) had many changes during storage (Table 1) as follows.

Moistures content was decreased by storage from 18.00 and 21.00 to 10.4 and 11.00 % of Kharja and Dakhla dates respectively , pH values increased from 5.57 and 5.6 to 5.67 and 5.69 Kharja and Dakhla dates respectively. Total acidity (as citric acid) was decreased from 0.45 and 0.42 to 0.27 and 0.26% Kharja and Dakhla dates respectively, this decreased may be attributed to the reaction between organic acids and sugars forming sugar monoester (Ingles and Reynolds, 1959).

A decrease in total phenols, reducing and total sugar were observed (Table 1), these was related to the browning reaction between free amino acids and sugars (Anet and Reynolds, 1957 and Reynolds, 1965).

The non enzymatic browning lead to form Hydroxy methyl furfural (Table 2). The darkening of the stored dates (control) and its insect infestation which reached 100% after eleven months led to refuse these dates by the panelists.

The Browning reaction was observed from the hydroxy methyl furfural formation which increased from 0.6 and 0.65 to 1.88 and 1.97 mg/100g of Kharja and Dakhla dates respectively, also the non-enzymatic browning was measured by the published method of Ranganna (1979). The optical density at 420 nm illustrated that color change of browning reaction increased by storage from 0.167 and 0.178 too 0.900 and 0.970 OD of Kharja and Dakhla dates respectively.

The measurements of color units (ICUMSA) for Siwi date extracts (control) were increased by storage from 7.3 and 7.9 to 15.58 and 15.88 of Kharja and Dakhla dates respectively.

Also total color density increased from 0.3 and 0.33 before storage to 0.72 and 0.74 OD after storage of Kharja and Dakhla dates respectively.

#### **Date fruit treatments :**

From table 3 it was found that the moisture content decreased in all treatments by storage and the lowest concentration was found in treated dates by sulfur dioxide.

Total acidity in all date treatments were more than the stored dates which related to browning reaction (Nezam El-Din 1978).

The acidity of the sulfure dioxide treatments (9, 10 , 11 and 12) were lower than the other treatments (Table 3).

The pH value of Siwi date (control) was 5.57 and 5.58 which increased by storage to 5.62 and 5.64 of Kharja and Dakhla dates respectively but pH values of all treatments were lower than stored control (table 3).

A little decrease in pH value was observed in sulfured treated dates that may result from the effect of sulfur dioxide on the inhibition of non-enzymatic browning reaction (Anet and Reynolds , 1957).

Reducing sugars were decreased by storage in all treatments, this decreases may be related to the Maillard reaction between the amino acids and reducing sugars (Hulme, 1970).

#### **Color changes of stored date fruit :**

Hydroxy methyl furfural (HMF) is a compound produced during the browning reaction between sugars and amino acids (Reynolds, 1965). HMF was increased in all

treatment by storage and sulfured treatments contain less amount of HMF (Table 4) as a results from sulfur dioxide effects (Joslyn and Braverman, 1954).

By measuring the non enzymatic browning at 420 nm (Table 4) it was found that browning color was inhibited in sulfured dates, (Nezam El-Din, 1978). The browning color of packed dates in plastic containers was very high but the color of packed dates in PE-PA bags under vacuum was less than plastic containers and higher than sulfured treatments (Table 4).

The ICUMSA units were used for measuring the color of the clear date extract and these units were high for the dates stored in plastic container, lower in PE-PA bag under vacuum bag and the lowest in stored dates which treated in the store by sulfur dioxide.

Generally, the units of all treatments were less than the stored dates (control).

From table 2 it was observed that total color density (TCD) very high in stored dates (control) and TCD of the other stored treatments (Table 4) were lesser than control. Treated date by sulfur dioxide led to the lowest TCD.

From previous results it was clear that the best color (lowest color changes) was found in sulfured then packing dates in PE-PA bags under vacuum and at least the packing in plastic containers.

#### **Remaining sulfur dioxide of dates :**

The dates treated with sulfur dioxide were analysed after storage for eleven months. The remaining sulfur dioxide contents were lower than the legal recommended sulfur dioxide additives used to preserve dried fruits (2000 ppm) as shown in table 5.

#### **Insect infestation :**

It was observed that all stored date treatments were free from any insect infestation but the control dates were completely infested (100%) after storage.

#### **Organoleptic evaluation :**

The color, taste, flavor were measured in all treatments by panelists except the stored date (control) which was unaccepted and were completely infested by insects (100%).

From Table 6, it was found that the best color was obtained by treatment by sulfur dioxide (9, 10, 11 and 12). The scores of treatments 9 and 10 were more than 11 and 12 because the washing and drying of treatment 11 and 12 led to increase the color to be more brown than 9 and 10. The chemical analysis of browning and color (Table 4) supported the previous panel test which may be related to the effect of sulfur dioxide on the Maillard reaction (Nezam El-Din, 1978). The second accepted color by panelists was packing dates in PE-PA bags under vacuum and the last treatment was packing dates in plastic containers as shown in table 6.

Taste of treated dates by sulfur dioxide was good because sulfur dioxide led to inhibit the non-enzymatic browning reactions and prevent the formation of some unacceptable compounds such as HMF (Table 4).

The packed dates in PE-PA bags under vacuum treatment had low acceptability than sulfured treatment and the last ability of taste was found in packing dates in plastic containers.

From table 6 it was observed that sulfur dioxide played good role in the flavour of dates which inhibit the strecker degradation and prevent the formation of carbonyl compounds (Nezam El-Din, 1978).

The flavour of packing date in PE-PA under vacuum had less score than sulfured date, but packing dates in plastic containers had the lowest score for flavour by panelists.

So it is clear that the date treating by sulfur dioxide (29 gm sulfur/per cubic meter) led to good quality, then the packing in PE-PA bag under vacuum and last the packing in tightly closed plastic containers.



Table 1. Physicochemical characteristics of Siwi date (control)

	Fresh Dates		Stored Dates	
	Kharja dates	Dakhla dates	Kharja dates	Dakhla dates
Moisture content %	18.00	21.00	10.4	11.0
Total acidity %* (as citric acid)	0.45	0.42	0.27	0.26
PH value	5.57	5.60	5.69	5.69
Reducing sugar %*	63.1	61.3	58.7	54.4
Total sugars %*	72.6	72.1	67.1	65.2
Total phenols %*	0.66	0.71	1.75	1.74

\* dry weight basis

Table 2. Color and browning reaction compounds of Siwi dates.

	Fresh Dates		Stored Dates (Eleven Months)	
	Kharja dates	Dakhla dates	Kharja dates	Dakhla dates
Hydroxy methyl furfural Mg/100g*	0.60	0.65	1.88	1.97
Non-enzymatic browning color (OD at 240 nm)	0.167	0.178	0.900	0.970
Color units of date extract (ICUMSA units)	7.30	7.90	15.58	15.88
Total Color Density (TCD)	0.30	0.33	0.72	0.74

\* dry weight basis



Table 3. Physical and chemical characteristics of stored Siwi dates.

Sample No.	Moisture content %	Total acidity* %	PH. Value	Reducing sugars %	Total sugars** %	Total phenols %
1	9.90	0.40	5.45	61.0	69.8	2.01
2	10.10	0.52	5.36	60.3	68.1	2.06
3	10.50	0.56	5.27	58.0	67.0	1.67
4	10.81	0.54	5.25	57.0	65.0	1.86
5	9.00	0.56	5.23	62.0	70.0	1.81
6	8.80	0.56	5.23	61.2	68.1	1.97
7	11.20	0.55	5.33	59.0	67.2	1.62
8	11.40	0.50	5.39	58.2	65.5	1.81
9	7.10	0.39	5.46	64.0	74.3	2.00
10	7.40	0.34	5.56	62.8	72.8	1.83
11	7.50	0.38	5.57	58.0	68.0	1.72
12	7.30	0.37	5.50	56.3	66.0	1.60

\* Total acidity measured as citric acid    \*\* The percentage measured on dry weight basis

Table 4. The color and browning compounds of stored Siwi dates.

	HMF (gm/100g*)	Browning compounds (OD at 420 nm)	Color as ICUMSA units	Total color Denisty (TCD)
1	1.82	0.84	14.28	0.486
2	1.86	1.03	18.28	0.538
3	1.94	0.91	14.92	0.442
4	1.98	1.10	19.66	0.582
5	1.66	0.80	12.82	0.368
6	1.71	1.00	14.21	0.407
7	1.83	0.84	14.00	0.457
8	1.89	0.88	14.34	0.510
9	1.33	0.55	10.36	0.324
10	1.35	0.63	11.82	0.367
11	1.39	0.57	11.16	0.402
12	1.44	0.67	11.90	0.367

\* Hydroxy methyl furfural measured on dry weight basis.

Table 5. Remaining sulfur dioxide of stored treated dates.

Treatment No.	Date sources	Sulfur dioxide (ppm)
9	Kharja Siwi dates treated by SO <sub>2</sub>	512
10	Dakhla Siwi dates treated by SO <sub>2</sub>	512
11	Washed and dried Kharja Siwi dates after sulfured	480
12	Washed and dried Dakhla Siwi dates after sulfured	480

Table 6. Color, taste and flavor measurement by panelists.

	Color	Taste	Flavor
1	5.65	7.00	6.90
2	5.30	0.40	7.00
3	4.90	6.00	6.70
4	4.25	6.20	7.30
5	6.40	7.90	8.00
6	5.70	7.90	8.30
7	5.30	7.50	8.20
8	5.20	7.40	8.00
9	8.90	8.00	8.60
10	8.90	8.00	8.40
11	8.35	8.60	8.40
12	8.35	8.20	8.30

LSD

5%	0.600	1.429	0.632
1%	0.794	1.98	0.836

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## دراسة على تخزين البلح السيوى المصرى (تمور نصف جافة)

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أجريت هذه الدراسة على تخزين البلح السيوى المصرى بغرض تقليل التغيرات الكيميائية والحسية ومنع الإصابة الحشرية . وللوصول إلى هذا الهدف أجريت المعاملات التالية :- حفظ التمور فى أوعية بلاستيكية محكمة الغلق ، تعبئة التمور فى أكياس بولى اثيلين - بولى أميد تحت تفريغ وأخيراً معاملة ثمار البلح السيوى بثانى أكسيد الكبريت فى المخزن . ولقد تم تخزين المعاملات السابقة داخل المخازن بأحكام لمدة إحدى عشر شهراً . أظهرت النتائج أن معاملة البلح السيوى المنتج فى كلاً من الواحات الخارجة والداخلية بثانى أكسيد الكبريت أدى إلى افضل لون ( ١٠,٣٦ ، ١١,٨٢ وحدة لون على التوالي لمستخلص التمور ) وأيضاً كانت كثافة اللون الكلى منخفضة لنفس المعاملات السابقة عند مقارنتها بالمعاملات الأخرى إذ أنها كانت ٠,٣٢٤ ، ٠,٣٦٧ على التوالي ولقد ظهر اللون الغير مقبول واضحاً فى عينة ثمار البلح التى تم تعبئتها فى الأوعية البلاستيكية .

أما من حيث الإصابة الحشرية فلم تظهر فى أى معاملة من المعاملات السابقة .