

Effect of using Rotary Evaporator on Date Dibs Quality

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Abstract: Date Palm is one of the oldest and major fruit crop in Saudi Arabia Kingdom. There has been, however, a surplus of Saudi low quality dates are not benefited in the industry sector. Local date dibs is produced in some Saudi regions by traditional approach (boiling that results in dark color and high turbidity. This study was carried out to improve the quality of date dibs using a rotary evaporator device. Two local varieties of dates used in this study, namely Sufri (dark) and Silage, which have low quality and common in Saudi society. The date juice of these dates was extracted, clarified by active charcoal and then concentrated by rotary evaporator. The obtained results were compared with date juice concentrated by boiling method in water bath at 100°C (as a traditional method) and with commercial date dibs. Results showed that, there was no significant difference between darkness of Sufri and Silage dibs concentrated by rotary evaporator and boiling method. However, Silage dibs concentrated by a rotary evaporator has higher redness ($a^* = 1.33$) and lower yellowness (1.83) compared to Sufri dibs. While, commercial dibs had the highest yellowness ($b^* = 2.45$) and lowest redness ($a^* = 0.24$). Active charcoal decreased the darkness of Sufri dibs concentrated by rotary evaporator ($L^* = 22.87$), while Silage dibs and local dibs were increased ($L^* = 21.29$ and $L^* = 21.38$, respectively). A concentration of Dibs by rotary evaporator method was appropriate, because the dibs had attractive color; especially with using active charcoal to clarify date juice. In order to evaluate the effect of clarification and concentration between boiling method and rotary evaporator with commercial dibs, physico-chemical characteristics were determined in Sufri and Silage dibs. Results indicated that, commercial dibs had lower moisture content and higher reading in viscosity, TSS, TS, glucose, fructose, pectin and ash. At the same time, there were slight differences in physico-chemical characteristics of Sufri or Silage dibs concentrated by boiling method and rotary evaporator. The dibs of Sufri and Silage concentrated by rotary evaporator and stored at 5 and 25°C for 6 months period characterized by helpful sensory evaluation (color, taste, flavor and general acceptance), *but* it was affected during storing at 45°C.

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1. Introduction

Date palm fruits (*Phoenix dactylifera*) have nutritional and economic importance in many countries. Saudi Arabia Kingdom production of dates increased largely to reach 1078300 tons in 2010 (FAOSTAT, 2012). This production progress is unfortunately accompanied by a substantial increase of losses. The high quality dates are consumed fresh, dried or preserved. Date palm fruits of Sufri and Silage varieties are widely cultivated and represent one of moderate quality and there is a surplus in local markets. Al-Jasser (1990) recommended using the two date varieties as a raw material for food industries.

The surplus date fruits of inferior grades, which not accepted for the packaging industry, are sold at low prices. These fruits differ in their composition but still it is considered as a good source of sugars, minerals and other substances (Ramadan, 1995). Therefore, it is recommended to utilize these type of fruits to produce high quality products such as date syrup.

Date dibs (syrup) is one of dates derivatives that can produced with economic cost. Date syrup, locally named dibs, is a natural product that not requires any additives in the production process. Date dibs characterized with its higher calories, vitamins and minerals; and it could be used at industrial scale as a sweetener in bakeries, syrup, juice products, jams, marmalades, concentrated beverages, chocolates, ice cream, confectioneries, honey, products (Al-Farsi, 2003; Sidhu *et al.*, 2003 and Entezari *et al.*, 2004).

Date dibs produced by traditional method in some Saudi regions, the obtained dibs characterized with its darker color and high turbidity; and consumed locally after dilution (Ali *et al.*, 1995). Benjamin *et al.* (1982) found that, the yield of dibs could be maximized to reach 96% if seedless date palm crushed and cooked at 85°C for 50 min, but the quality of dibs was affected. Abd-Elfatah (1994) found that, using instrument of direct heating under atmospheric pressure to concentrate date palm juice gave low quality product due to sugar caramelization.

Also, Date dibs could produce at a semi or full industries scale at three stages. The process consisting of extraction, clarification and concentration of the date juice (El-Shaarawy *et al.*, 1986; AL- Jasser, 1990; Al-Farsi, 2003 and FAO, 2004). In date's syrup industry, flesh date fruits is mixed with water and heated at oven 70°C for one hour or more in the extraction process; resulting in destroying some of its nutritive and health-promoting components, and causing the darkness of the final product's color (Al-Hooti *et al.*, 2002 and Entezari *et al.*, 2004).

This study aimed to utilize the surplus date fruits of inferior grades, i.e. Sufri and Silage varieties as a good source of date dibs; and to improve its quality through using evaporation technology under vacuum and rotation (rotary evaporator) to concentrate date juice.

2. Materials and Methods

Sufri and Silage varieties of date palm fruits were obtained from Date Palm Packaging Comp., Al-Hassa, East of Saudi Arabia Kingdom. Date palm fruits were packed in polyethylene package and carton box; and kept in a deep freezer at -18°C.

Active Charcoal was procured from Alan Pharma-UK C1601 GRG (BP) Specifications.

Sufri and Silage fruits of date palm were soaked, washed in water and then air dried. The seeds were isolated from date palm fruits using mechanical separator of date palm seeds in Omar Asaad Company for date palm, El-Madina El-Menawara city, and then subjected to prepare date dibs as shown in Figure (1). The obtained date dibs were packaged in polyethylene pack and stored separately in three groups at 5, 25 and 45°C for 6 months.

Moisture content, pH, ash, and total soluble solids were determined in Sufri and Silage date dibs according to [AOAC \(1995\)](#). Pectin was determined as stated by [Carre and Haynes \(1922\)](#). Fructose, glucose and sucrose were determined using HPLC (Model 10AD, Japan) at the following conditions: detector was Refractive Index (RID-6A), column was 30 cm 15 (6 mm x cm) Shimpack LC-NH2, mobile phase was acetonitrile : H₂O (75:25) and its flow rate was at 2ml/min. ([AOAC, 1995](#)).

Viscosity was determined using Viscometer (model Lvdv11, Brookfield, Stoughton, USA). Date dibs color samples was determined according to [Hunter \(1975\)](#) using Hunter color machine (Minolta Chroma Meter CR-300-Japan). Hunter color parameters (L*, a* & b*) were measured in the reflection mode. The instrument was standardized each time with white tile of Hunter Lab Color Standard (LX No. 16379).

Sensory evaluation was carried out using Scoring Test ([Larmond 1980](#)) that carried out during

dibs storage. Dibs samples were randomly introduced to the same trained panelist to evaluate color, taste, flavor and general acceptance of stored dibs samples, where the excellent, very good, good-accepted and unaccepted scores were 9, 7, 4 and 1, respectively.

Statistical analysis were carried out using analysis of variance (ANOVA), Duncan's New Multiple Range Test to identify least significance differences between the mean value at $P \leq 0.05$ ([McClave and Benson, 1991](#)).

3. Results and Discussion

Rotary evaporator was used to concentrate date juice; and the obtained date dibs compared with dibs of juice that concentrated using water bath. Table (1) showed that there was no significant difference in total soluble solids (TSS) of rotary evaporator or water bath methods, where they reached to 70.45 and 70.26%, respectively. Using higher temperature in water bath than rotary evaporator associated with increasing in the yield of dibs reached to 35.87 %, while it was 30.70% in dibs that concentrated with rotary evaporator. But using vacuum in rotary evaporator method was accompanied by an increase in the rate of concentration, where 100 g date juice required for the concentration 32.5 min, while date dibs of water bath method required more time reached to 45 min. Also, rotary evaporator concentration method increased the percentage of evaporated water from date juice compared to water bath method. This result could due to the influence of rotary evaporator on moving all parts of the date juice at one time and the effect of suction on reducing heat temperature of boiling water.

Extracted date palm juice could be associated with some fruits pigments. Date juice pigments could be changed depending on the condition of juice concentration. To improve the color quality of local dibs two cheaper and low quality fruits of date palm varieties (Silage & Sufri) were selected and their juices were concentrated using boiling in water bath or rotary evaporator. Table (2) showed that there were no significant difference in darkness (L*) of Sufri or Silage dibs that concentrated with boiling in water bath or rotary evaporator. Also, boiling in water bath or rotary evaporator are not significantly affected on yellowness (b*) of Sufri or Silage dibs, while local dibs had lower redness (a*) and higher yellowness compared to dibs of the two varieties that concentrated using boiling in water bath or rotary evaporator.

In order to improve the color quality of local date dibs, date juice was treated with charcoal to remove a section of the turbidity-causing substances; and then concentrated using boiling in water bath or rotary

evaporator. Table (3) showed that there was no significant difference in the darkness (L^*) of silage dibs that concentrated with rotary evaporator, boiling in water bath or local date dibs. Also, Silage dibs that concentrated with rotary evaporator characterized with its higher redness (a^*) and lower yellowness (b^*) compared to Sufri dibs or local dibs. It was

found also that, local dibs had lower redness (b^*) and highest yellowness (L^*) than other prepared dibs. This result agreed with those found by Rhim *et al.* (1989) and Maskan (2004), they stated that heating during juice concentration destroyed some pigment, i.e. anthocyanin and some phenolic compounds led to higher darkness and lower redness.

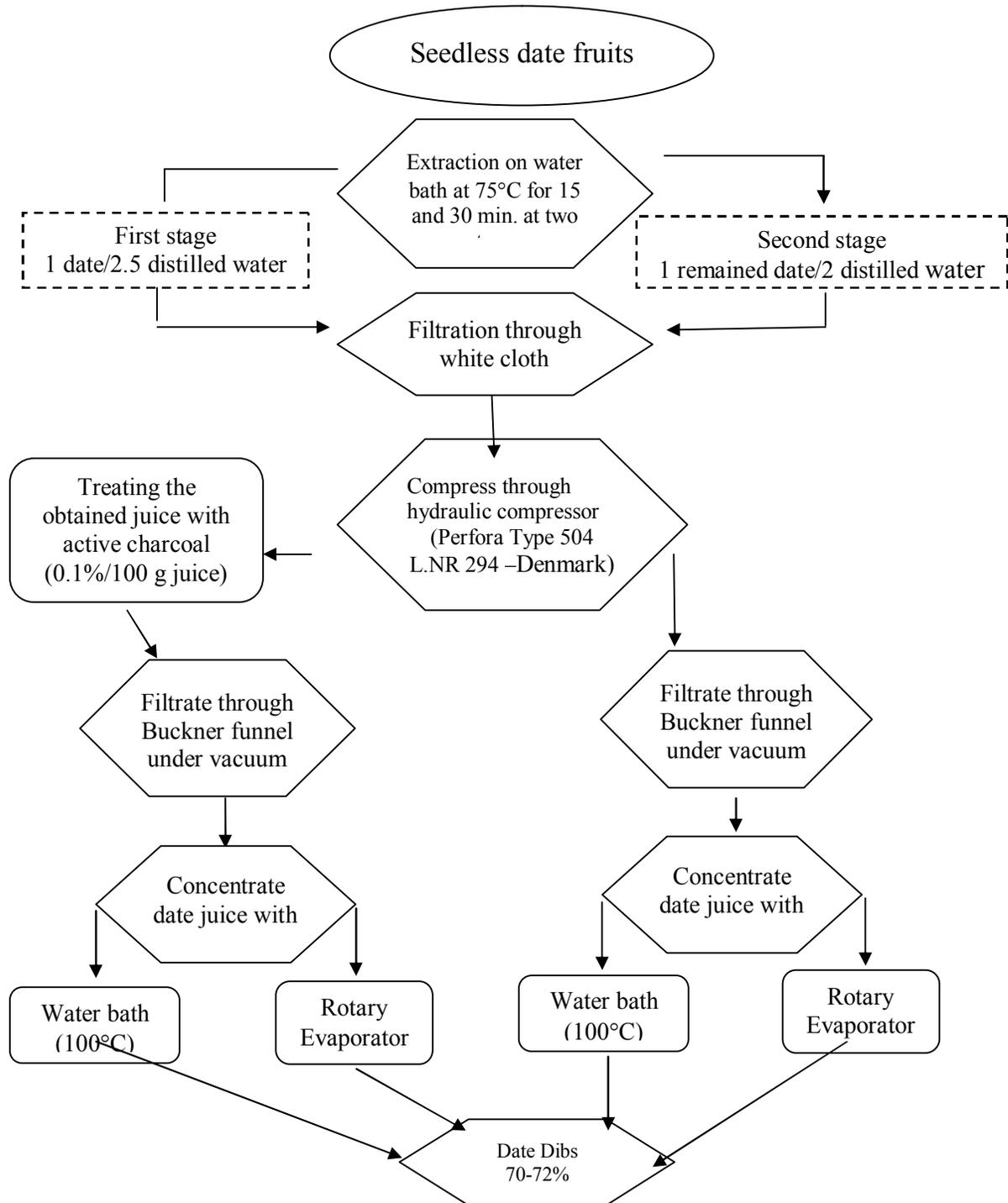


Figure (1): Flow chart of preparing date dibs on laboratory scale.

Table (1): Effect of boiling in water bath and rotary evaporator on concentration rate and yield of Sufri date dibs.

Date dips properties	Rotary Evaporator	Boiling in water bath	LSD at $P \geq 0.01$
Yield (%)	30.70 ^B ± 0.20	35.87 ^A ± 0.10	1.084
TSS (%)	70.45 ± 0.15	70.26 ± 0.10	N.S.
Water evaporated (%)	69.30 ^A ± 0.20	64.13 ^B ± 0.10	1.084
Concentration rate (100 g/min.)	32.5 ^B ± 0.50	45 ^A ± 0.76	1.028

- Value is the average of three replicates ± standard deviation.
- Dibs Yield (%) = % of dibs resulting from 25% TSS date juice.
- Averages in each row that have different letters mean there are significant differences between them.
- N.S. = Not significant

Table (2): Effect of rotary evaporator concentration or boiling in water bath methods on color quality of date dibs.

Date Dibs	Color Parameter		
	L*	a*	b*
Sufri variety concentrated with			
Rotary Evaporator	21.21	0.13 ^c	2.00 ^b
Boiling in water bath	21.41	0.67 ^b	2.00 ^b
Silage variety concentrated with			
Rotary Evaporator	21.22	1.33 ^a	1.83 ^b
Boiling in water bath	21.41	0.88 ^b	1.98 ^b
Local Dibs	21.38	0.24 ^c	2.45 ^a

L* = white (100) to black (-80). a* = red (100) to green (-80). b* = yellow (70) to blue (-80). Averages in each row that have different letters mean there are significant differences between them.

Table (3): Effect of rotary evaporator concentration or boiling in water bath methods on color quality of date dibs treated with charcoal.

Date Dibs	Color Parameter		
	L*	a*	b*
Sufri variety concentrated with			
Rotary Evaporator	22.87	0.32 ^b	1.89 ^b
Boiling in water bath	21.94	0.16 ^d	1.89 ^b
Silage variety concentrated with			
Rotary Evaporator	21.29	0.43 ^a	1.41 ^c
Boiling in water bath	21.48	0.17 ^d	1.74 ^b
Commercial dibs	21.38	0.24 ^c	2.45 ^a

L* = white (100) to black (-80). a* = red (100) to green (-80). b* = yellow (70) to blue (-80). Averages in each row that have different letters mean there are significant differences between them.

Table (4): Effect of concentration method on physicochemical characteristics of Silage dibs.

Physicochemical Characteristics	Method		Commercial Dibs
	Rotary Evaporator	Boiling in Water Bath	
Moisture (%)	25.88 ^a ± 0.26	26.70 ^a ± 0.20	16.36 ^b ± 0.29
Viscosity (cP)	67.86 ^c ± 2.40	99.33 ^b ± 7.17	150.33 ^a ± 7.63
TSS (%)	70.36 ^c ± 0.05	72.00 ^b ± 0.01	80.36 ^a ± 0.23
Total Solids (%)	74.11 ^b ± 0.26	73.29 ± 0.20 ^c	83.64 ^a ± 0.29
pH	4.63 ^b ± 0.01	4.72 ^a ± 0.01	4.65 ^b ± 0.02
Pectin (%)	0.86 ^a ± 0.02	0.58 ^b ± 0.01	0.88 ^a ± 0.02
Sucrose (%)	Traces	Traces	N.D
Glucose (%)	32.12 ^b ± 0.80	32.22 ^b ± 0.49	35.33 ^a ± 0.50
Fructose (%)	36.50 ^c ± 0.37	38.33 ^b ± 0.69	43.02 ^a ± 0.38
Ash (%)	1.47 ^b ± 0.05	1.45 ^b ± 0.03	1.88 ^a ± 0.01

- Value is the average of three replicates ± standard deviation.
- Averages in each row that have different letters mean there are significant differences between them.
- ND = Not detected.

The effect of concentration date juice (varieties Sufri & Silage) using boiling in water bath or rotary evaporator on the physicochemical properties of date dibs were also evaluated as shown in Tables (4 & 5). The obtained results indicated that commercial date dibs contains the lowest moisture content (16.36%) for using a higher temperature during concentration, while concentration Silage dibs (Table 4) with boiling in water bath or rotary evaporator increased moisture content to 26.70 and 25.88 %, respectively, and they take the same trend in dibs of Sufri variety where they were (Table 5) 24.85 and 24.76 %, respectively.

Viscosity is one of the important quality factors in date dibs manufacture. Juices viscosity is due to the colloidal properties of fruit, e.g. pectin, protein, and gum in addition to the viscosity of the sugars (Al-Hekhad, 2002). Tables (4 & 5) indicated that pectin ranged between 0.58 - 1.24% in date dibs of the two varieties. Significant higher viscosity of date dibs was found in commercial dibs (150.33 cP) compared to Silage dibs (Table 4) of boiling in water bath (99.33 cP) and rotary evaporator (67.86 cP). Also, Sufri dibs (Table 5) that concentrated with boiling in water bath or rotary evaporator decreased to 70.76 and 75.43 cP, respectively. Total soluble solids (TSS) increased in local dibs compared to boiling in water bath or rotary

evaporator, where they reached in Silage dibs (Table 4) to 72.00 and 70.36 %, and in Sufri dibs (Table 5) to 70.16 and 70.00%, respectively. The obtained result could be explained by the inverse relationship between viscosity and moisture content, i.e. the more decreased moisture content in the sample is the more concentration to TSS, resulting in an increase in the value of the viscosity of date dibs. The results of all date dibs treatments were within acceptable limits of

TSS as recommended by Saudi Standards, Metrology and Quality Organization (2005), which states that the proportion of TSS in the date dibs not less than 70%. Tables (4 & 5) showed also that, local dibs and date dibs of Silage or Sufri varieties characterized with their higher percentage of glucose and fructose. Also, pectin in dibs of the two varieties ranged between 0.58 - 1.24%.

Table (5): Effect of concentration method on physicochemical characteristics of Sufri dibs.

Physicochemical Characteristics	Method		Commercial Dibs
	Rotary Evaporator	Boiling in Water Bath	
Moisture (%)	24.76 ^a ± 1.01	24.85 ^a ± 0.48	16.36 ^b ± 0.29
Viscosity (cP)	75.43 ^b ± 1.70	70.76 ^c ± 1.70	150.33 ^a ± 7.63
TSS (%)	70.00 ^b ± 0.11	70.16 ^b ± 0.05	80.36 ^a ± 0.23
Total Solids (%)	75.24 ^b ± 1.01	75.14 ^b ± 0.48	83.64 ^a ± 0.29
pH	5.33 ^a ± 0.01	5.11 ^b ± 0.01	4.65 ^c ± 0.01
Pectin (%)	1.24 ^a ± 0.08	0.83 ^b ± 0.04	0.88 ^b ± 0.01
Sucrose (%)	Traces	Traces	ND
Glucose (%)	32.18 ^b ± 0.66	32.45 ^b ± 0.19	35.32 ^a ± 0.38
Fructose (%)	35.96 ^b ± 0.55	35.73 ^b ± 0.46	43.03 ^a ± 0.50
Ash (%)	1.92 ^a ± 0.02	1.92 ^a ± 0.02	1.88 ^b ± 0.01

- Value is the average of three replicates ± standard deviation.
- Averages in each row that have different letters mean there are significant differences between them.
- ND = Not detected.

Furthermore, the effect of clarifying date juice of Sufri and Silage varieties with active charcoal on physicochemical characteristics of dibs that concentrated with boiling in water bath or rotary evaporator were evaluated and presented in Tables (6 & 7). Table (6) indicated that moisture content of Silage dibs that treated with active charcoal and concentrated with boiling in water bath or rotary evaporator were increased to 23.50 and 24.61%, respectively compared to local dibs (16.36%). Also, the same trend were observed in moisture content of the same treatments in Sufri dibs (Table 7) where they reached to 25.00 and 23.33%, respectively. This result agreed with Al-Hekhadly (2002) who stated that moisture content of date dibs ranged between 15-28%. This result of all date dibs treatments were

within acceptable limits of moisture content as recommended by Saudi Standards, Metrology and Quality Organization (2005), which states that the proportion of moisture content in the date dibs not more than 27%.

It could be noticed from Table (6) that, lower moisture content of local dibs was accompanied by an increase in TSS (80.36%), TS (83.64%) and viscosity (150.33 cP). The same trend were observed in Silage dibs that treated with active charcoal and concentrated with boiling in water bath or rotary evaporator methods, where TSS, TS and viscosity were (72.00 & 70.13%), (76.49 & 75.38 %) and (61.76 & 49.90 cP), respectively; and in Sufri dibs (Table 7) they were (71.20 & 72.03 %), (76.66 & 74.99 %) and (74.40 & 142.53 cP), respectively.

Table (6): Effect of concentration method on physicochemical characteristics of date dibs of Silage variety that treated with active charcoal.

Physicochemical Characteristics	Method		Commercial Dibs
	Rotary Evaporator	Water Bath	
Moisture (%)	24.61 ^a ± 0.36	23.50 ^b ± 0.82	16.36 ^c ± 0.29
Viscosity (cP)	49.90 ^a ± 0.45	61.76 ^c ± 0.80	150.33 ^a ± 7.63
TSS (%)	70.13 ^c ± 0.05	72.00 ^b ± 0.02	80.36 ^a ± 0.23
Total Solids (%)	75.38 ^c ± 0.36	76.49 ^b ± 0.82	83.64 ^a ± 0.29
pH	5.50 ^a ± 0.01	5.15 ^b ± 0.01	4.65 ^c ± 0.01
Pectin (%)	0.85 ^a ± 0.02	0.51 ^b ± 0.03	0.88 ^a ± 0.01
Sucrose (%)	Traces	Traces	N.D
Glucose (%)	31.50 ^b ± 0.49	31.97 ^b ± 0.46	35.84 ^a ± 0.50
Fructose (%)	36.78 ^c ± 0.30	38.54 ^b ± 0.45	43.64 ^a ± 0.38
Ash (%)	1.67 ^b ± 0.04	1.63 ^b ± 0.01	1.88 ^a ± 0.01

- Value is the average of three replicates ± standard deviation.
- Averages in each row that have different letters mean there are significant differences between them.
- ND = Not detected.

Also, it could be noticed from Tables (4 & 6) that, pectin of Silage dibs affected slightly with active charcoal during clarifying and concentration date dibs with boiling in water bath (decreased from 0.58 to 0.51%) or in rotary evaporator (decreased from 0.86 to 0.85%). This result agreed with those obtained from Sufri dibs as shown in Tables (5 & 7). Tables (4-7) indicated that, pectin of Silage dibs or Sufri dibs was affected with concentrated method, where concentrating dibs with boiling in water bath method decreased pectin compared to those concentrated with rotary evaporator. This result could be due to the method of evaporation where vacuum evaporation and lower heat temperature in rotary evaporator could lead to lower losses of pectin. It was found that, Silage and Sufri dibs of rotary evaporator method contain pectin higher than dibs of boiling on water bath.

Table (7) showed that, viscosity of local and Sufri dibs that treated with active charcoal reached to 142.53 and 150.33 cP, respectively. The higher viscosity ratio could be attributed to the higher percentage of moisture and TSS; and to the lower moisture content of dibs samples.

Regarding pH, Table (7) showed that the treatment of Sufri juice with active charcoal and

concentration with boiling in water bath or rotary evaporator have a slightly significant differences on pH, where values were 5.29 and 5.13, respectively. This result was close with the same products of Sufri dibs that were not treated with activated charcoal (Table 5), where the values were 5.11 and 5.33, respectively.

Glucose and fructose of Silage or Sufri dibs that treated with charcoal not much affected with concentration with boiling in water bath or rotary evaporator, (Tables 6 & 7); and also not affected with clarifying Silage or Sufri juice with charcoal (Tables 4-7). Whereas, glucose and fructose content in Silage dibs for all treated sample ranged between (31.50 – 32.22%) and (36.50 – 38.54%), respectively; and they ranged also in Sufri dibs for all treated samples between (32.18 – 32.45) and (35.73 – 37.28), respectively. Therefore, active charcoal is restricted only on influencing colored substances of date dibs and did not have little impact on the percentage of monosaccharides. Also, ash content not much affected by date dibs variety, clarifying with active charcoal or concentration method, where all samples ranged between 1.45 – 1.91.94%.

Table (7): Effect of concentration method on physicochemical characteristics of date dibs of Sufri variety that treated with active charcoal.

Physicochemical Characteristics	Method		Commercial Dibs
	Rotary Evaporator	Water Bath	
Moisture (%)	23.33 ^b ± 0.08	25.00 ^a ± 0.32	16.36 ^c ± 0.29
Viscosity (cP)	142.53 ^a ± 1.64	74.40 ^b ± 3.55	150.33 ^a ± 7.63
TSS (%)	72.03 ^b ± 0.05	71.20 ^c ± 0.01	80.36 ^a ± 0.23
Total Solids (TS%)	74.99 ^c ± 0.32	76.66 ^b ± 0.08	83.64 ^a ± 0.29
pH	5.13 ^b ± 0.00	5.29 ^a ± 0.00	4.65 ^c ± 0.01
Pectin (%)	1.30 ^a ± 0.17	0.84 ^b ± 0.04	0.88 ^b ± 0.01
Sucrose (%)	Traces	Traces	N.D
Glucose (%)	32.29 ^b ± 0.14	32.30 ^b ± 0.30	35.33 ^a ± 0.50
Fructose (%)	37.28 ^b ± 0.35	36.97 ^b ± 1.01	43.02 ^a ± 0.38
Ash (%)	1.94 ^a ± 0.03	1.82 ^c ± 0.02	1.88 ^b ± 0.01

- Value is the average of three replicates ± standard deviation.
- Averages in each row that have different letters mean there are significant differences between them.
- ND = Not detected.

Sensory evaluation of Sufri and Silage dibs that treated with active charcoal and concentrated with boiling in rotary evaporator were evaluated during storage at 5, 25 and 45°C for 6 months and compared with local dibs product. Columns of Table (8) showed that, the color, taste, flavor and general acceptance of Sufri, Silage and local dibs are not affected significantly during storage at 5°C for 6 months. Also, sensory parameter of Sufri and Silage dibs were not affected during storage at 25°C for 6 months, while the color and general acceptance of local dibs decreased with the beginning of the second month till the end of

storage period. Also, increasing storage temperature to 45°C had a deteriorative effect on sensory quality of Sufri, Silage and local dibs with the beginning of the second month till the end of the storage period.

On the other hand, rows of Table (8) showed the effect of storage temperature on sensory quality of Sufri, Silage and local dibs for each storage period. Results indicated that, the best color was found in Sufri dibs up to two month (8.0) of storage at 5 °C; then decreased slightly by increasing storage temperature to 25°C to reach 7.13; and the highest deterioration was found during storage at 45°C where it reached to 3.33.

Also, at the same storage period, taste, flavor and general acceptance of Sufri dibs were not affected significantly during storage at 5 and 25 °C; and affected with increase storage temperature to 45°C. It was observed also that, sensory characteristics of Sufri dibs affected during storage for 4 and 6 months at the same aforementioned manner of storage for 2 months.

Rows of Table (8) showed also that, sensory characteristics of Silage dibs were matched with the previously mentioned Sufri dibs when stored for the same period of time and temperature. Whereas, color property of local dibs not affected significantly during storage for 2 months at 5°C, but it deteriorated slightly at 25°C; and deterioration maximized when stored at 45°C. These results can be explained by the change in the dibs color during storage at different temperatures, arise as a result of some breaking color pigments, resulting in a decrease in the degree of color, and this is in agreement with Rhim *et al.* (1989) and Maskan

(2004). Also, taste and flavor of commercial dibs are not affected significantly during storage for 2 months at 5 or 25°C, but it was affected during storage at 45 °C. While, general acceptance of commercial dibs was decreased significantly during storage for 2 month at 25 or 45°C. The changes that occurred in the taste and color could be due to change in pH, as stated with Al-Hekhadhy (2000). The changes in the sensory properties agreed with Kamil *et al.* (2000) who stated that, the change in the sensory properties of black honey beet could be due to penetration of air into the package and to high temperature storage, which cause changes in color, taste and flavor of honey.

From the above results it could be concluded that dibs stored at 45°C resulting in weak sensory characteristics in terms of color, taste, flavor and general acceptance. Therefore, this temperature degree is not an appropriate condition to store dibs.

Table (8): Effect of Storage periods at 5, 25 and 45°C on sensory properties of dibs that concentrated with boiling in rotary evaporator (Sufri and Silage) compared to commercial dibs.

Date Dibs Variety Storage periods (months)	Storage Temperature												
	5°C				25°C				45°C				
	Col or	Tas te	Fla vor	eral acc ept anc	Col or	Tas te	Fla vor	eral acc ept anc	Col or	Tas te	Fla vor	eral acc ept anc	
Sufri	0	6.73 ^a ±1.90	6.53 ^a ±2.09	6.13 ^a ±1.80	6.13 ^a ±2.09	6.73 ^a ±1.90	6.53 ^a ±2.09	6.13 ^a ±1.80	6.13 ^a ±2.09	6.73 ^a ±1.90	6.53 ^a ±2.09	6.13 ^a ±1.80	6.13 ^a ±2.09
	2	8.00 ^a ±0.65	7.40 ^a ±1.63	7.20 ^a ±1.52	7.40 ^a ±1.12	7.13 ^a ±1.50	6.06 ^a ±2.57	6.06 ^{ab} ±2.12	6.33 ^a ±2.02	3.33 ^b ±2.38	3.66 ^b ±2.25	4.66 ^{ab} ±2.46	3.93 ^b ±2.28
	4	7.40 ^{ab} ±1.40	7.00 ^a ±1.85	6.73 ^a ±1.83	7.00 ^a ±1.69	6.53 ^a ±1.30	6.60 ^a ±1.72	6.60 ^a ±1.68	6.80 ^a ±1.42	2.60 ^b ±2.13	2.86 ^b ±2.26	3.46 ^b ±2.66	2.73 ^b ±2.05
	6	7.73 ^{ab} ±1.75	7.33 ^a ±1.29	6.86 ^a ±1.64	7.40 ^a ±1.72	6.66 ^a ±1.04	6.80 ^a ±1.42	6.80 ^a ±1.78	6.13 ^a ±1.76	2.20 ^b ±1.32	3.40 ^b ±2.09	4.80 ^{ab} ±2.39	3.33 ^b ±1.91
Silage	0	6.93 ^a ±1.33	6.66 ^{ba} ±1.87	6.66 ^{ab} ±1.87	6.86 ^{ab} ±1.59	6.93 ^a ±1.33	6.66 ^a ±1.87	6.66 ^a ±1.87	6.86 ^a ±1.59	6.93 ^a ±1.33	6.66 ^a ±1.87	6.66 ^a ±1.87	6.86 ^a ±1.59
	2	7.00 ^a ±1.51	5.80 ^b ±2.00	5.73 ^b ±1.98	6.13 ^b ±1.80	6.73 ^a ±1.27	6.40 ^a ±1.84	6.20 ^a ±1.37	6.13 ^a ±1.35	3.66 ^b ±2.09	3.53 ^b ±2.38	4.13 ^{bc} ±1.84	3.53 ^b ±1.99
	4	7.46 ^a ±1.06	7.60 ^a ±1.50	6 ^{ab} ±1.64	7.26 ^a ±1.27	6.40 ^a ±1.72	7.00 ^a ±1.73	6.26 ^a ±1.57	6.66 ^a ±1.49	2.60 ^b ±1.95	2.80 ^b ±1.82	3.60 ^b ±2.19	2.73 ^b ±1.75
	6	7.66 ^a ±1.23	7.60 ^a ±1.18	7.20 ^a ±1.08	7.73 ^a ±0.79	6.26 ^b ±1.27	6.60 ^a ±1.63	6.80 ^a ±1.47	6.86 ^a ±1.12	2.80 ^b ±1.26	3.66 ^b ±2.16	5.33 ^{ba} ±1.67	3.53 ^b ±1.45
Commercial	0	8.33 ^a ±0.97	7.36 ^a ±2.48	7.46 ^a ±1.64	7.53 ^a ±2.23	8.33 ^a ±0.97	7.36 ^a ±2.48	7.46 ^a ±1.64	7.53 ^a ±2.23	8.33 ^a ±0.97	7.36 ^a ±2.48	7.46 ^a ±1.64	7.53 ^a ±2.23
	2	8.33 ^a ±0.72	6.06 ^a ±2.60	7.00 ^a ±1.77	6.86 ^a ±1.68	7.93 ^a ±0.96	4.46 ^b ±2.53	6.46 ^{ab} ±1.64	5.46 ^b ±1.92	4.86 ^b ±2.06	5.40 ^a ±2.44	5.13 ^b ±2.26	5.40 ^b ±1.84
	4	8.40 ^a ±0.73	6.00 ^a ±2.64	7.00 ^a ±2.03	6.80 ^a ±2.24	8.03 ^a ±0.89	5.66 ^{ab} ±2.63	6.46 ^{ab} ±1.76	5.86 ^b ±2.32	1.86 ^c ±1.45	2.46 ^c ±2.09	3.33 ^c ±1.98	2.20 ^c ±1.65
	6	8.26 ^a ±0.79	6.20 ^a ±1.56	6.73 ^a ±1.22	6.73 ^a ±1.66	6.80 ^b ±1.89	5.73 ^{ab} ±2.25	6.00 ^a ±1.30	6.06 ^{ab} ±1.98	2.40 ^c ±2.22	2.86 ^c ±1.35	4.60 ^{cb} ±1.84	3.26 ^c ±1.94

- The value is the average of three replicate samples ± standard deviation.

- Averages in each column that have different letters mean there are significant differences between them at $p \geq 0.05$.

- Averages in each row that have different letters mean there are significant differences between them at $p \geq 0.05$.

Conclusion

It may be concluded that, clarifying date juice with 0.1% active charcoal then using rotary evaporator to concentrate date juice under vacuum and rotation

can be utilized in preparation high quality date dibs with attractive properties, i.e. color, taste, flavour, general acceptance and physicochemical properties during storage at 5 or 25°C for 6 months.

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