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DRYING EFFECT ON SOME PHYSICOCHEMICAL PROPERTIES OF IRANIAN DATE

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CSBE101129 – Presented at Section VI: Postharvest Technology, Food and Process Engineering Conference**ABSTRACT** The main objective of this study was to produce pure date powder. Two varieties of Iranian low moisture dates called Zahedi and Abbas-abad were selected as studying samples. Drying experiments, included oven drying at different temperatures (65, 75 and 85 ^{o}C) and at a constant time (72 hr) were carried out. Moisture content and some main physicochemical properties of the selected dates and dried samples such as sugars, protein, fat and color were analyzed. Furthermore the influence of drying temperature (65, 75 and 85 ^{o}C) on the date palm fruits was investigated. The results show that drying process decreases the lipid and protein contents. Sucrose contents of two selected dates are very limited whereas fructose and glucose are dominant. The results show that fructose and glucose amounts in each date have been decreased after drying whereas sucrose amounts of two dates increased. For Abbas-abad date, *L, a, b* and yellowness values are increased by drying with significant differences. For Zahedi date, color assessment results are different from Abbas-abad date for *a* and yellowness parameters; values of *a* and yellowness are decreased by drying.

Keywords: Date, drying, physicochemical properties.

INTRODUCTION The date fruit (phoenix dactylifera) is non climacteric fleshly fruit and is one of most important plants of arid, desert area of Middle East, Southern Asia and Africa over 5000 years especially in many Persian Gulf countries. Iran is one of the most important date producer countries and date is grown in southern area such as Kerman, Shiraz and Khuzestan provinces (southern Iran). Date has always played an important role in economic and social lives in the country. Egypt, Iran, Saudi Arabia and United Arabia Emirates, respectively, are the date producing in world. They produced 1326133, 1000000, 982542 and 755000 tonnes date, respectively, in 2007.

Date solid mostly consist of fructose and glucose, sucrose and a small quantity of dietary fibre. Dates sugars are most important quality index of them and were studied for some dates by researchers. Also date color is an important sensory quality attribute because it is usually one of the first properties that consumer observes and minimizing the color losses, during processing and storage is of primary concern to the processor. Color varies among varieties and different stages of maturities of dates. The initial green color converts to yellow, golden or reddish brown. The color of the date paste changes during processing too.

Date palm is becoming an important commercial crop in the producing countries with significant increase in yield by adopting advanced biotechnological approach. However, date processing industries have not expanded at the same rate. Most of the premium quality dates are either consumed fresh or in ripened form. Recently the demand for table dates has decreased; while, there has been renewed interest in the date as a component of new food formulations/preparations. Process industries produce various date products like date-paste, date-syrup, date-dip, date-honey, date-jam, date-vinegar, etc (Ahmed and Ramaswamy, 2006).

It seems that powder production from low moisture and quality dates is as an applicable and cost-effective method to use these products. The date powders can be used in confectionary, bakery and ice creams. One of the challenges of production fruit powders is to reduce stickiness during drying and safe handling and storage of the powder. The stickiness in fruit powders is mainly due to the presence of low molecular weight sugars, such as fructose, glucose, sucrose and some organic acids in the fruit. The date is also comprised of these sugars. These sugars and organic acids are very hygroscopic in their amorphous state and have low glass transition temperature (Sablani et al., 2008).

James (1971) used tricalcium phosphate, calcium silicate and calcium oxide at different percentages to produce powder from guava and pineapple juices using vacuum drying.

Date powder production has been rarely considered by researchers. Sablani et al (2008) developed a mixing technique to produce free flowing powder granules from date. Their method involved preparation of the paste from raw date, mixing with maltodextrin powder followed by an oven drying at 70^{o}C. In order to produce stable granules, they used various proportions of date paste and maltodextrin (DE 6).

No researcher has studied drying and drying different temperatures effects on physicochemical properties of date.

The main objective of this study was to produce pure date powder of two Iranian low moisture and quality dates and evaluate different drying temperatures effects on some physicochemical properties of them.

MATERIAL AND METHODS

Samples Two varieties of date fleshes, namely Abbas-abad and Zahedi harvested at full ripeness were purchased from a market and stored in safe conditions. Initial moisture content of samples was determined using vacuum drying method at 70 ^{o}C, 25 mm Hg and for 48 hr (AOAC). The initial moisture content of Abbas-abad and Zahedi variety was obtained 15.19 and 6.71% (w.b) respectively.

Drying experiment Drying conditions was prepared at an oven. Prior to drying, the dates seeds were removed and samples were spread on oven dryer shelves in as a single thin layer. Oven had six shelves and in each experiment, three of them filled by Abbas-abad and others were filled by Zahedi dates. Drying conditions were selected for different temperature at three levels of 65, 75, and 85 ^{o}C. For each experiment, drying time was selected as 72 hr.

Production of date powder After drying, the dry products were grounded in a hammer mill to produce date powder. The powder was immediately collected in plastic pouches to avoid moisture pick-up from the air. Laboratory test sieves were used to collect date powder with particle size below 1.0 mm. these powders then stored for further analysis. The moisture content of the produced powders was determined using vacuum oven at 70 ^{o}C for 24 hr (AOAC).

Lipid extraction and measurements Extraction of lipid was carried out with SER 148 solvent extractor equipped with six Soxhlet post (Besbes et al., 2004). The operational conditions were:

- Immersion time: 30 min with thimble immersed in boiling solvent.
- Washing time: 60 min of reflux washing.

After removing solvent, the lipid content was measured.

Protein content measuring Total protein was determined by Kjeldahl method. Protein was calculated using the general factor (6.25) (El. Shurafa et al., 1982). Data were expressed as percent of dry weight.

Sugars Analysis of sugars was carried out by an HPLC system (AOAC) equipped with a refractive index detector and system was attached to data processing unit. A 20 µl sample was injected onto a cartridge column (4 µm, 100×8 mm). The mobile phase acetonitrile: water=83:17 (v/v) was used at a flow rate 1.5 ml/min to achieve optimum resolution peaks of fructose, glucose and sucrose in the presence of other component in dates. The column and detector temperature was maintained at 35 ^{o}C.

Color assessment After Hunter *L*, *a* and *b* parameters were determined for fresh dates and produced dates powders. The values of the samples were obtained using a color difference meter (Spectraflash 600- data color model). The *L* values are used as an indicator of brightness, *a* to indicate chromaticity on *a* green (-) to red (+) axis (the higher *a* value, the closer it is to deep green); and *b* to indicate chromaticity on a blue (-) to yellow (+) axis (the higher *b* value, the closer it is to deep yellow). Three replicates were used for each treatment. To evaluate the color of fresh dates, they were minced in a laboratory mincer to produce a smooth paste. The samples (powders and pastes) were spread over a white paper and the tip of the measuring head was pointed on the samples for measurement. Three measurements were recorded for each sample.

Statically analysis To analyze the results, SAS-Duncan's procedure with a 0.05 level of significant was used.

RESULTS AND DISCUSSION

Lipid and protein Total solid, lipid and protein of fresh dates and dates powders are shown in table 1. As expected, by increase drying temperature (with constant drying time), total solid of the drying matters were increased. Lipid and protein contents of the selected dates are low as shown in table 1. The results show that drying process decreases the lipid and protein contents; the higher the temperature, the more decreasing the pointed parameters. The differences between treatments for lipid levels in Zahedi variety are not significant.

Table 1 Average of Total solid, lipid and protein contents of the fresh and dried dates.

Date	Factor (g/100g)	Fresh date	Date powder (65 °C)	Date powder (75 °C)	Date powder (85 °C)
Abbas-abad	Total solids	84.81	93.84	95.1	99.66
	Lipid	1.04^{A1}	1.02^{B}	1.01^{B}	0.98^{C}
	Protein	2.98^{A}	2.14^{B}	2.06^{B}	2.02^{B}
Zahedi	Total solids	93.29	98.17	98.72	99.84
	Lipid	0.96^{A}	0.96^{A}	0.95^{A}	0.94^{A}
	Protein	2.66^{A}	2.32^{A}	2.16^{C}	2.08^{C}

1 for each row means with no common letter are significantly different (P< 0.05)

Sugars contents Average of sugars contents of fresh and dried samples are shown in table 2. Sucrose contents of two selected dates are very limited whereas fructose and glucose are dominant. The results show that fructose and glucose amounts in each date have been decreased after drying whereas sucrose amounts of two dates increased. The highest, intermediate and lowest values of fructose and glucose for Abbas-abad date belong to fresh date, date powders dried at 65 and 75 °C and date powder dried at 85°C, respectively. Sucrose value of Abbas-abad date is decreased by drying; the higher the drying temperature, the more decreasing the Sucrose value. The decrease of fructose in Zahedi date by drying treatments is not significant whereas differences between glucose values are significant for all treatments; the higher the drying temperature, the more decreasing the glucose value. Highest and lowest values of glucose of Zahedi date belong to fresh and date powder dried at 85 °C. Sucrose values of Zahedi date increase by drying and have significant difference for all treatments.

Table 2 Average of sugars contents of the fresh and dried dates.

Date	Factor (g/100g)	Fresh date	Date powder (65 °C)	Date powder (75 °C)	Date powder (85 °C)
Abbas-abad	Fructose	40.96^{A1}	38.06^{B}	37.8^{B}	32.04^{C}
	Glucose	42.55^{A}	37.22^{B}	36.95^{B}	30.63^{C}
	Sucrose	1.81^{C}	1.75^{C}	2.13^{B}	4.07^{A}
Zahedi	Fructose	31.3^{A}	32.55^{A}	31.6^{A}	30.01^{A}
	Glucose	42.77^{A}	31.27^{B}	29.15^{C}	29^{D}
	Sucrose	2.24^{D}	12.1^{C}	14.18^{B}	14.91^{A}

1 for each row means with no common letter are significantly different (P< 0.05)

Color Table 3 shows results of laboratory analysis of hunter *L, a, b* and yellowness values of fresh and dried dates under different drying temperatures. For Abbas-abad date, *L, a, b* and yellowness values are increased by drying with significant differences. The highest values of *L, a* and *b* belong to date powder dried at 65, 85 and 75 °C temperatures, respectively. The lowest values of *L, a, b* and yellowness belong to fresh date. The yellowness value of Abbas-abad date is increased by drying; the higher the drying temperature, the more increasing the yellowness value. For Zahedi date, color assessment results are different from Abbas-abad date for *a* and yellowness parameters. As Table 3 shows, for Zahedi date, values of *a* and yellowness are decreased by drying. *L*

and *b* values are increased by drying. The highest values of *L* and *b* belong to date powder dried at 65 and 85 ^{o}C, respectively and highest values of *a* and yellowness belong to fresh zahedi date.

Table 3 Average of hunter *L*, *a*, and *b* values of the dates paste and dates powders.

Date	Factor	Fresh date	Date powder (65 ^{o}C)	Date powder (75 ^{o}C)	Date powder (85 ^{o}C)
Abbas-abad	L	38.53^{C1}	50.98^{A}	49.33^{A}	42.87^{B}
	a	8.11^{C}	10.2^{B}	14.1^{A}	15.09^{A}
	b	19.24^{C}	25.66^{A}	31.64^{A}	29.74^{B}
	Yellowness	74.21^{D}	78.88^{C}	96.68^{B}	103.05^{A}
Zahedi	L	40.72^{D}	72.9^{A}	68.03^{B}	58.09^{C}
	a	12.78^{A}	7.09^{D}	8.64^{B}	10.87^{B}
	b	24.35^{B}	24.95^{B}	25.42^{B}	27.8^{A}
	Yellowness	92.75^{A}	56.94^{D}	63.26^{C}	77.31^{B}

1 for each row means with no common letter are significantly different ($P< 0.05$)

CONCLUSION Date powder production of low quality dates that are not suitable for fresh consuming can be a useful and commercial method to use these products in food production. The used process to powder production in this study is very feasible and cost-effective to be applied. In order to decrease drying temperature and drying time, further work is required. Convective drying can be used in future studies.

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