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Study on effect of osmotic dehydration on marking nut fruit

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Abstract
Marking nut is one of the underutilized minor crop growing wildly in our country. This fruit has got great medicinal properties and health benefits. But its importance is not completely understood and the fruits go waste. Therefore, it is necessary to develop value added products and the osmotically dehydrated fruits have good potential. The inclusion of osmotic process in conventional dehydration has two major advantages of quality improvement and energy savings. There was a significant difference found in the samples prepared from different pretreatments of osmotic dehydration. Osmotic pretreatment T3 (Sucrose 60º Brix. + 18 hrs of immersion + Drying at 60 ºC) had a great influence on quality and organoleptic properties of the fruits with maximum solid gain (86.40%), carbohydrates (75.78%) and minimum scores for moisture (13.60%). Also the highest scores for organoleptic parameters like color (4), appearance (4), texture (3.75) and taste (3.75) were recorded in same sample.

Keywords: Osmotic dehydration, marking nut fruit

Introduction

Marking nut (*Semecarpus anacardium*) commonly known as phobi nut tree and varnish tree, is anunder exploited minor fruit native to India, found in the outer Himalayas to Coromandel Coast and wildly grown in North Eastern Transition Zone of Karnataka. It is a member of Anacardeaceae family and is closely related to the cashew. It is a deciduous tree. The flowers are greenish white, in panicles and appear with new leaves in May and June, easily recognized by large leaves and the red blaze exuding resin, which blackens on exposure. The nut is about 2.5 cm long, ovoid and smooth lustrous black (Semalty *et al.*, 2010) [22]. The fruit is composed of two parts, a reddish-orange accessory fruit and a black drupe that grows at the end. The accessory fruit is edible and sweet when ripe. It is also known as *ker beeja* in Kannada. It is well known for nutritional and medicinal values. Various parts of these plants are commonly used in the Ayurvedic system of medicine for the treatment of various ailments, mainly alimentary tract and certain dermatological conditions. Reports have shown noticeable impact on illnesses related to the heart, blood pressure, respiration, cancer and neurological disorders (Patel *et al*., 2009) [13].

Application of osmotic dehydration process in the production of safe, stable, nutritious, tasty and economical product is gaining more attention. This process involves placing solid food, whole or in pieces in sugar or salt aqueous solution of high osmotic pressure which removes 30–50% of the water from fresh ripe fruits such as mango, pineapple, sapota, papaya, guava and jackfruit (Lewicki and Lenart 1995) [10]. The quality of dried fruits is enhanced to a great extent due to increase in sugar content, reduction of sour taste and prevention of loss of natural flavor along with better retention of nutrients. The major advantage of inclusion of osmotic process in conventional dehydration are quality improvement (Pointing *et al*. 1966; Raoult-wack 1994) [14] and energy savings (Raoult-wack 1994 and Lewicki and Lenart 1995) [10]. Influence of osmotic agents on drying behavior and product quality has been reviewed by several workers (Lerici *et al*. 1985; Rastogi *et al*., 2002 and Tiwari 2005) [9, 8, 24]. Osmotic dehydration in fruits such as banana (Pokharkar *et al*. 1997; Thippanna and Tiwari 2015) [15, 23], papaya (Ahemed and Choudhary 1995) [1], mango (Nanjundaswami *et al*. 1978 and Madamba and Lopez 2002) [12, 11] and pineapple (Beristian *et al*. 1990 and Rahman and Lamb 1990) [3, 16] has been attempted. The present investigation was carried out to study the effect of osmotic dehydration to enhance postharvest life of marking nut fruit and to study the effect of osmotic dehydration on sensory quality of marking nut.

Materials and methods

The experiment was conducted in College of Horticulture, Bidar 2017-18. The fresh fruits were harvested and washed. The marking nut apples were separated from the fruits.

They were soaked in different solutions according to the set treatments and subjected to dehydration using tray drier. The proximate composition of the fruits was analyzed (Table 1).

Table 1: Nutrient composition of marking nut apple (%)

Moisture	53.52
Ash	1.56
Protein	3.51
Fiber	5.58
Fat	0.15
Carbohydrate	35.65

Treatments

The fruits were dipped in 40, 50 and 60° Brix sugar syrup containing 0.2% of citric acid and 0.1% each of potassium metabisulphite (KMS) in 1:2 fruit to syrup ratio and allowed to undergo osmosis for 18 hrs at room temperature (25–35 °C) for T1, T2 and T3 respectively. Slices were drained and rinsed with water to remove adhering syrup. For T4 and T5, the fruits were directly dried at 60 ºC and in sunlight respectively without and pretreatment.

T1- Sucrose 40º Brix + 18 hrs of immersion +Drying at 60 ºC
T2- Sucrose 50º Brix + 18 hrs of immersion + Drying at 60 ºC
T3- Sucrose 60º Brix + 18 hrs of immersion + Drying at 60 ºC
T4- Drying at 60 ºC
T5- Sun drying

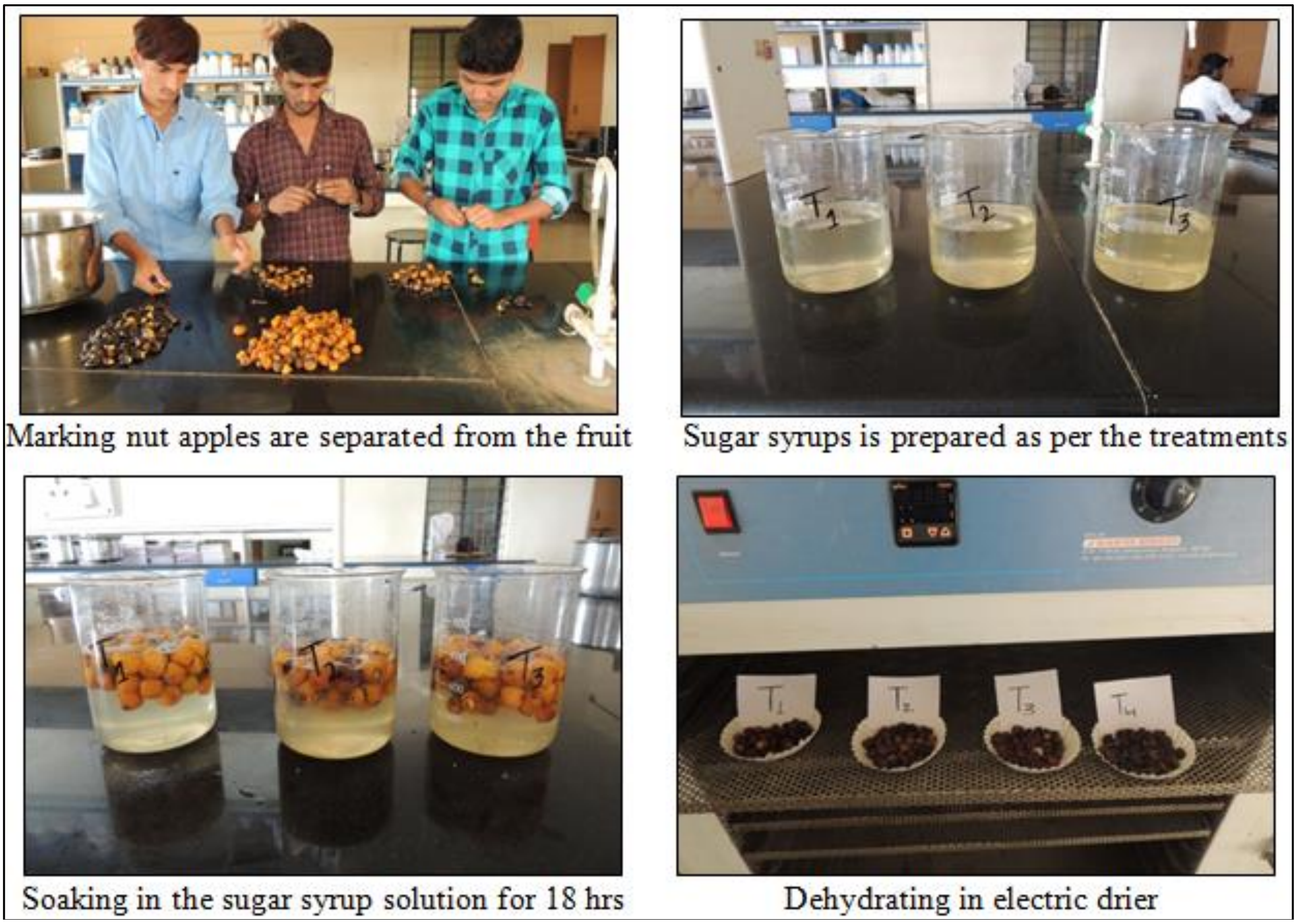

Fig 1: Different operations in osmotic dehydration treatment

Dehydration

Osmosed slices from different treatments were spread on stainless steel trays and were dehydrated in a cabinet drier at 60 °C on to a constant moisture level (except T5). The dried samples were packed in polythene covers.

Physico-chemical analysis

The dried samples were analysed for different attributes. Moisture content was determined by drying the samples to a constant weight in a hot air oven at 70±1 °C and using the following formula. The total solids were calculated by subtracting the moisture content from 100.

$$\text{Moisture content} = \frac{\text{Initial weight} - \text{Dried weight}}{\text{Dried weight}} \text{ X } 100$$

Dried weight

The biochemical analysis of parameters like carbohydrates, proteins, fats, fiber and ash was done using the AOAC standard procedures (Edition 2016).

Sensory analysis

The osmotically dehydrated samples were evaluated by sensory panel using hedonic scale having score ranging from very good (5) to very poor (1) for the attributes like color, appearance, texture and taste.

Statistical analysis

The experiment was carried out by using a Completely Randomized Design (CRD) with 5 treatments and 3 replications. The data for variations in different physico-chemical attributes were analyzed by using Analysis of variance (ANOVA) technique.

Fig 2: Treated marking nut samples

Results and Discussion

Physico-chemical parameters of osmotically dehydrated fruits.

The data pertaining to the moisture content and total solids in different treatments is presented in Table 2. The moisture content varied in different treatments with minimum (13.60%) in T3 (Sucrose 60º Brix. + 18 hrs of immersion + Drying at 60 ºC) followed by T2 (Sucrose 50º Brix. + 18 hrs of immersion + Drying at 60 ºC) to maximum (23.91%) in T4 (Drying at 60 ºC). The content of total solids reciprocated the result of moisture content as the maximum total solids content (86.4%) was observed in T3 (Sucrose 60º Brix. + 18 hrs of immersion + Drying at 60 ºC) followed by T2 (Sucrose 50º Brix. + 18 hrs of immersion + Drying at 60 ºC) whereas the minimum (76.09%) was found in T4 (Drying at 60 ºC). The fruits immersed in osmotic solutions gain the equilibrium in the solution by losing the moisture content and gaining the solids from the solution.

Osmotic treatment with sucrose syrup lowered the drip loss and moisture content of frozen pineapples (Khan, 2012). Yan *et al.* (2008) [8, 27] pointed that the specific volume, shrinkage and porosity of banana, pineapple and mango decreased as moisture content decreases during drying.

Studies made by several workers indicate that increasing the sugar syrup concentration favor water loss and also resulted in solid gain (Pointing *et al*. 1966; Hawkes and Flink 1978 and Torreggiani 1993) [14, 7, 25].

Table 2: Effect of osmotic dehydration on moisture content and total solids of marking apple

Treatments	Moisture Content (%)	Total solids (%)
T1-40% Sucrose	16.82	83.18
T2-50% Sucrose	14.20	85.80
T3-60% Sucrose	13.60	86.40
T4-Drying at 60°C	23.91	76.09
T5-Sun drying	18.79	81.21
C.D.@ 0.1%	0.81	0.81
S.E(m)±	0.25	0.25

The data pertaining to carbohydrates, proteins, fat, fiber and ash content in different treatments is presented in Table 3. The maximum value (75.78%) for carbohydrates was observed in T3 (Sucrose 60º Brix. + 18 hrs of immersion + Drying at 60 ºC) followed by T2 (Sucrose 50º Brix. + 18 hrs of immersion + Drying at 60 ºC) and the minimum (61.15%) was found in T4 (Drying at 60 ºC). The increased carbohydrate content reflected the sugar absorbed by the samples. These results indicate that syrup concentration had significant effect on the composition of Osmotically dehydrated samples. This increase in sugar content in fruits duringosmotic dehydration process has been reported (Torreggiani1993; Raoult-Wack *et al*. 1991 and Sankat *et al*. 1996) [25, 17, 20]. Giraldo *et al.* (2003) [6] stated that variables affecting osmotic dehydration kinetics also affect sugar content in the final products. The results of present study are in conformity with the observations made by several earlier workers (Sagar and Khurdiya 1999 and Sharma *et al*. 2004) [19, 21]. The protein, fat and ash content was maximum (5.35%, 1.28% and 4.18% respectively) in T5 (Sun drying) and minimum (3.50%, 0.88% and 2.72% respectively) in T1 (Sucrose 40º Brix. + 18 hrs of immersion + Drying at 60 ºC). The maximum fiber content (6.54%) was found in T2 (Sucrose 50º Brix. + 18 hrs of immersion + Drying at 60 ºC) and minimum (2.89%) was recorded in T3 (Sucrose 60º Brix. + 18 hrs of immersion + Drying at 60 ºC).The chemical composition (fat, protein, salt and carbohydrate), physical structure (fiber orientation, porosity and skin), may be effected by the kinetics of osmosis in food (Rahman and lamb 1990) [16].

Table 3: Effect of osmotic dehydration on physico-chemical parameters of marking apple

Treatments	Carbohydrates (%)	Protein (%)	Fat (%)	Fiber (%)	Ash(%)
T1-40% sucrose	70.44	3.50	0.88	5.63	2.72
T2-50% sucrose	71.85	3.61	0.93	6.54	2.87
T3-60% sucrose	75.78	3.83	1.01	2.89	2.87
T4-Drying at 60°C	61.15	4.35	0.95	6.33	3.31
T5-Sun drying	66.62	5.35	1.28	3.59	4.18
C.D.@ 0.1%	0.68	0.07	0.06	0.17	0.07
SE(m)±	0.21	0.02	0.02	0.05	0.02

Sensory qualities of osmotically dehydrated marking nut apples are affected by different osmotic pre-treatments.

Fig 3: Organoleptic evaluation of marking nut samples

Color

The data pertaining to color is presented in Table 4. The highest score (4) was obtained by T3 (Sucrose 60º Brix. + 18 hrs of immersion + Drying at 60 ºC) and the lowest (2.5) was obtained by T4 (Drying at 60 ºC). Torreggiani (1993) [25] reported that sugar uptake owing to the protective action of the sugars in syrup helps in the stability of product color during osmotic process and subsequent storage. Osmotic pretreatment and drying temperature had significant effect on chroma and hue angle values of dried peppers (Falade and Oyedele 2010) [5].

Appearance

The data regarding appearance of the samples is depicted in Table 4. The maximum score (4) was obtained by T3 (Sucrose 60º Brix. + 18 hrs of immersion + Drying at 60 ºC) and minimum (3) was for T4 (Drying at 60 ºC). Due to considerable solid gain by the slices, the loss in moisture was compensated and there was not much of deformity in the marking nut apples. These results are in conformity with the findings on organoleptic properties of osmotically dehydrated banana (Sankat *et al*. 1996) [20]. According to Varany-Anond *et al*. (2000) [26] the bestosmotic treatment for mango was 60°Brix sucrose at 50 °C for 4 hours.

Texture

The data pertaining to texture is presented in Table 4. The treatment T3 (Sucrose 60º Brix. + 18 hrs of immersion + Drying at 60 ºC) obtained highest score (3.75) and treatment T5 (Sun drying) secured lowest score (2.83) for texture. Improvement in texture of osmotically dehydrated samples might be due to positive role of sugars available in the fruit slices. Influence of osmotic agents on product quality have been reported by earlier workers in fruits such as papaya (Ahemed and Choudhary 1995) [1], mango (Sagar and Khurdiya 1999; Varany-Anond *et al*. 2000 and Madamba and Lopez 2002) [19, 26, 11].

Taste

The data related to taste is depicted in Table 4. The maximum score (3.75) was obtained byT3 (Sucrose 60º Brix. + 18 hrs of immersion + Drying at 60 ºC) and T5 (Sun drying). However the minimum score (2.5) was obtained by T1 (Sucrose 40º Brix. + 18 hrs of immersion + Drying at 60 ºC). Improvement in taste of osmotically treated slices fromthe above treatments was mainly due to better sugar acid ratio. It has been reported that variables affecting osmotic dehydration kinetics, as well as final ratio of water loss and sugar gainhas great influence on product characteristics and improved product from fruits can be obtained through osmotic dehydration (Torreggiani 1993; Raoult-Wack1994; Bongirwar 1997) [25, 4].

Table 4: Effect of osmotic treatment on organoleptic evaluation of marking apple

Treatments	Color (5)	Appearance (5)	Texture (5)	Taste (5)
T1-40% sucrose	3.50	3.75	3.50	2.50
T2-50% sucrose	3.50	3.42	3.50	3.00
T3-60% sucrose	4.00	4.00	3.75	3.75
T4-Drying at 60 °C	2.50	3.00	3.00	3.58
T5-Sun drying	3.08	3.25	2.83	3.75
C.D.@ 0.1%	0.52	0.43	0.63	0.52
SE(m)±	0.16	0.13	0.20	0.16

Conclusion

Based on the physico-chemical composition and sensory quality it was concluded that osmotic pretreatment of marking nut apples with 60°Brix sugar syrup with 18 hours of immersion and drying at 60 ºC was best treatment. However the sun dried samples retained higher amount of protein and fat content.

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