STUDIES ON EFFECT OF SLICE THICKNESS AND TEMPERATURE ON ASCORBIC ACID RETENTION DURING DRYING AND STORAGE OF *KOTHIMBDA (Cucumis callosus)*

***GOJIYA, DEVANAND K. AND VYAS, D. M.**

DEPARTMENT OF PROCESSING AND FOOD ENGINEERING
COLLEGE OF AGRICULTURAL ENGINEERING AND TECHNOLOGY
JUNAGADH AGRICULTURE UNIVERSITY,
JUNAGADH, GUJARAT. 362001

****EMAIL:dkgojiya@gmail.com***

ABSTRACT

The Kothimbda slice was dried in Industrial tray dryer with three levels of drying temperature (50, 60 and 70 °C) with constant air velocity at 1.5 m/sec and in solar cabinet dryer also with three levels of thickness (3, 5and 7 mm). The temperature and slice thickness affected significantly the ascorbic acid content during drying of Kothimbda slice. During storage observations in terms of ascorbic acid were recorded at 15 days interval. The highest ascorbic acid content was found in the powder prepared from slices of 7 mm thickness and dried at 50 °C temperature, while the lowest ascorbic acid content was observed in the powder prepared from slices of 3 mm thickness and in the solar dried samples. It was observed that the ascorbic acid content of the stored Kothimbda fruit powder made from different slice thickness was decreasing with the increase in storage period when stored at room temperature. Similarly, the observations indicated that the loss in ascorbic acid during storage was lowest in the powder made from the solar dried samples followed by 70, 60 and 50 °C.

KEY WORDS: Ascorbic acid, Kothimbda, slice, temperature, thickness

INTRODUCTION

Cucumis callosus (Rottl.) Cogn *(Cucurbitaceae*) is very common throughout the India and commonly known as "*Kothimbda*" in Gujarat. *Kothimbda*, a drought tolerant cucurbitaceous vegetable found growing abundantly during rainy season in the arid and semi-arid regions of North-Western India, particularly in Gujarat and Rajasthan, and are usually cooked with various vegetable preparations. It is an ideal summer vegetable crop chiefly grown for its edible tender fruits, preferred as salad ingredient, pickles and as a cooked vegetable. The ripe fruits are eaten as such, while unripe fruits used as vegetable. Fruits are known to contain vitamin C (Singh and Joshi, 2010).

Kothimbda powder obtained after drying the fruits is used as souring agent in combination with other spices to make spice premix and mouth fresheners. Powder of *Kothimbda* with other spices is commonly used for various therapeutic purposes to cure stomach pain, nausea, vomiting and constipation. The dehydrated *Kothimbda* is coughicide, vermicide, cooling, diuretic and gastric stimulant. Amongst all nutrients, ascorbic acid (Vitamin C) is most important from the processing point of view (Goyal and sharma, 2009).

The post-harvest loss of *Kothimbda* varies from 30 to 40 per cent due to its perishable nature and glut during harvesting time, which also reduces the market value of the fruit. Hence, dehydration is the only

solution to overcome the problem of post-harvest losses as well as to provide high returns to the growers along with the availability of the fruit during off season. The farmers producing *Kothimbda* in our country are still using the traditional drying techniques for drying of *Kothimbda* and so far very little scientific research work has been undertaken on standardization of drying and dehydration technology especially for *Kothimbda.* Appropriate size of slices and drying temperatures are good for drying and improve the appearance, colour and quality of dehydrated product.

Generally, fruits and vegetables are heat sensitive and therefore, present a special problem when drying. Dehydration has to be carried out under carefully controlled conditions. Sun drying is being increasingly adopted in vegetable preservation due to high cost skill required in the artificial drying method. Though, conservation of nutrients is very important in view of the prevalent micronutrient deficiency problems. The action of applying heat to a material in order to dry it does not merely remove the moisture, but can also affect the nutritional qualities of the dried product (Onayemi, 1981). The rate of drying depends upon the rate of humidity and size or thickness of the pieces. The range of drying is determined by a range of factors such as external air, temperature, the size of the food pieces been dried and the depth to which the drying tray is packed. Since these factors vary, it is impossible to give an exact drying time for any particular food item. Considering all above aspects in mind, a study was undertaken to quantify the losses in those quality parameters during drying and establish appropriate drying temperature and time that will result in optimum retention of the nutritional parameters as well as ensuring storage stability.

MATERIALS AND METHODS

For this experimentation, the sound and uniformly matured fruits without any damage were selected and washed in tap water. The washed and shade dried *Kothimbda* fruits were sliced into 3 mm, 5 mm and 7 mm thickness by using stainless steel knife. To prevent bacterial and mold infection, knifes were frequently dipped into potassium permanganate solution (5%) for 2 minutes before reusing for slicing. The slices of *Kothimbda* slices were uniformly spread in single layer in tray for dehydration. The dried *Kothimbda* slices were grinded into the desired particles sizes by the Bajaj make grinder of 600W and 1800 rpm. The powder of dried *Kothimbda* slices obtained under different was sieved with the help of IS sieves, having openings of size (16 mesh) to obtain the uniform desired particle size of 16 mesh.

The packaging of *Kothimbda* powder of each treatment under study was done in glass bottles, polyethylene pouches of 300 µ thickness and in Aluminum coated P.P. bags. All the containers were stored for a period of 3 months at room temperature. Temperature and relative humidity during the storage period was varying between 7.4 to 36.5 ^{0}C and 13 to 95 % per cent, respectively. The observation in terms of ascorbic acid content was recorded at an interval of 15 days besides initially during storage. To estimate ascorbic acid content, the following procedure as reported by Sadasivam and Manikam (1991) was followed. The experiment was carried out in a Factorial Completely Randomized Design (F-CRD) with three factors and two replications for the study of effect of slice thickness, temperature and packaging materials on storage.

RESULTS AND DISSCUSION

Effects of different temperature and thickness levels on ascorbic acid during drying

The highest ascorbic acid content was found in the powder prepared from slices of 7 mm thickness (40.00 mg/100g) and dried at 50 °C temperature (42.03 mg/100g), while the lowest ascorbic acid content was observed in the powder

prepared from slices of 3 mm thickness (35.41 mg/100g) and in the solar dried samples (32.96 mg/110 g) (Table 1). As the ascorbic acid is highly sensitive towards the temperature and rapidly degrade in the presence of heat, the samples with more thickness and dried with lower temperature, retain maximum ascorbic acid. Similar results are reported by Ramallo and Mascheroni (2004) during drying of pineapple half slices, Marfil*et al.* (2008) in tomatoes and Pendre*et al.* (2012) in case of okra drying.

Effects of different temperature and slice thickness levels on ascorbic acid during storage

From the data presented in Table 2 as well as depicted in Figure 1, it was observed that the ascorbic acid content of the stored *Kothimbda* fruit powder made from different slice thickness was decreasing with the increase in storage period when stored at room temperature. In case of slice thickness, for 3, 5 and 7 mm samples, the ascorbic acid content was varying from 38.33 to 19.44, 37.91 to 21.11 and 41.66 to 21.39 mg/100g during 90 days of storage period at room temperature, respectively. From these observations, it wasalso cleared that the loss in ascorbic acid during storage was minimum in the powder made from 5 mm thick slices followed by 3 and 7 mm (Table 2).Similarly, for drying temperature at 50, 60 and 70 °C and Solar drying samples, the ascorbic acid content was varying from 43.33 to 22.03, 42.22 to 22.03, 36.66 to 20.18 and 35.00 to 18.33 mg/100g during 90 days of storage period at room temperature, respectively (Table 2, Figure 2). The observations indicated that the loss in ascorbic acid during storage was lowest in the powder made from the solar dried samples followed by 70, 60 and 50 °C (Table 2).

The statistical analyzed data revealed that the slice thickness was giving highly significant results for the ascorbic acid content in mg/100g during 30 days and 45days of storage at room temperature. The minimum loss was found in 5mm slice (v_2), indicating that for ascorbic acid retention in 5 mm slice was superior to v_3 (7 mm) and v_1 (3 mm). As far as drying temperature, the minimum ascorbic acid content was ranged from 18.33 to 22.03 mg/100g after 90days of storage, whereas the maximum ascorbic acid content varying from 35.00 to 43.33 mg/100g on the initial day of storage when stored at room temperature. The *Kothimbda* powder prepared from the samples dried at 50 °C (t_1) gave highest value of ascorbic acid followed by 60 °C (t_2), 70 °C (t_3) and solar dried (t_4). The drying temperature was observed highly significant for ascorbic acid content (mg/100g) for all the stages of three months of storage period. Interaction between slice thickness and temperature (v x t) was giving significant values for storage for 0, 15, 30, 45, 75 and 90 days of storage and it showed non-significant results for 60days of storage.

CONCLUSION

The highest ascorbic acid content was found in the powder prepared from slices of 7 mm thickness and dried at 50 °C temperature, while the lowest ascorbic acid content was observed in the powder prepared from slices of 3 mm thickness and in the solar dried samples. It was observed that the ascorbic acid content of the stored *Kothimbda* fruit powder made from different slice thickness was decreasing with the increase in storage period when stored at room temperature. Similarly, the observations indicated that the loss in ascorbic acid during storage was lowest in the powder made from the solar dried samples followed by 70, 60 and 50 °C.

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Table 1: Effect of drying temperature (t) and slice thickness (v) on ascorbic acid of *Kothimbda*fruit during drying.

Treatments	**Ascorbic Acid(mg/100g)**
A) Drying Temperatures (T)	
50°C (T_1)	42.03
60°C (T_2)	42.03
70°C (T_3)	34.81
Solar dried (T_4)	32.96
S. Em±	0.91
CD at 5 %	2.60
B) Slice thickness (V)	
3 mm (V_1)	35.41
5 mm (V_2)	38.47
7 mm (V_3)	40.00
S. Em±	0.79
CD at 5 %	2.26
C) Interaction T x V	
S. Em±	1.57
CD at 5 %	4.51
C.V.%	10.14

Table 2 Effect of different slice thicknesses, temperature and packaging materials on ascorbic acid content (mg/100g) of *Kothimbda*fruit powder during storage.

Treatments	Ascorbic Acid (mg/100g)						
	Storage Period in Days						
	Initial	15	30	45	60	75	90
Slice Thickness (V)							
V_1	38.33	32.50	29.30	25.97	24.72	22.78	19.44
V_2	37.91	34.58	28.33	29.02	26.53	24.03	21.11
V_3	41.66	35.14	32.64	29.72	25.55	23.19	21.39
S. Em. ±	0.54	0.66	0.86	0.75	0.71	0.60	0.65
CD (0.05)	2.255**	1.897*	2.478**	2.159**	NS	NS	NS
Temperature (T)							
T_1	43.33	38.14	34.44	30.92	27.59	25.74	22.03
T_2	42.22	37.59	32.96	31.11	27.59	24.07	22.03
T_3	36.66	31.29	29.07	25.74	23.89	22.03	20.18
T_4	35.00	29.26	26.85	25.18	23.33	21.48	18.33
S. Em. ±	0.62	0.76	1.00	0.87	0.82	0.69	0.75
CD (0.05)	1.78**	2.191**	2.862**	2.493**	2.362**	1.98**	2.159**
Interaction							
T x V							
S. Em. ±	1.07	1.32	1.73	1.50	1.43	1.20	1.30
CD (0.05)	3.09*	3.79*	4.957**	4.318**	NS	3.44**	3.73*

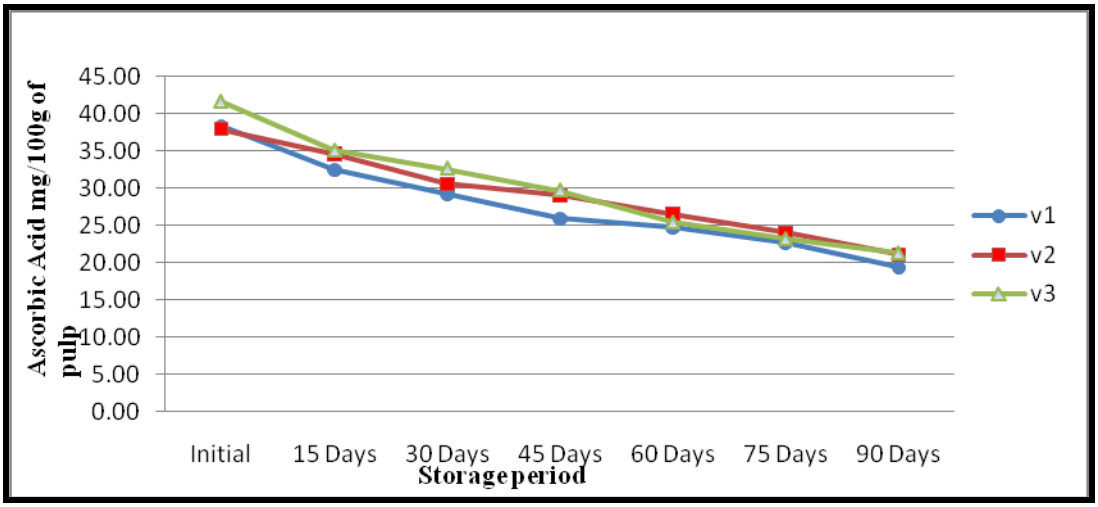

Figure 1: Effect of thickness levels on ascorbic acid content of *kothimbda*slice powder during storage.

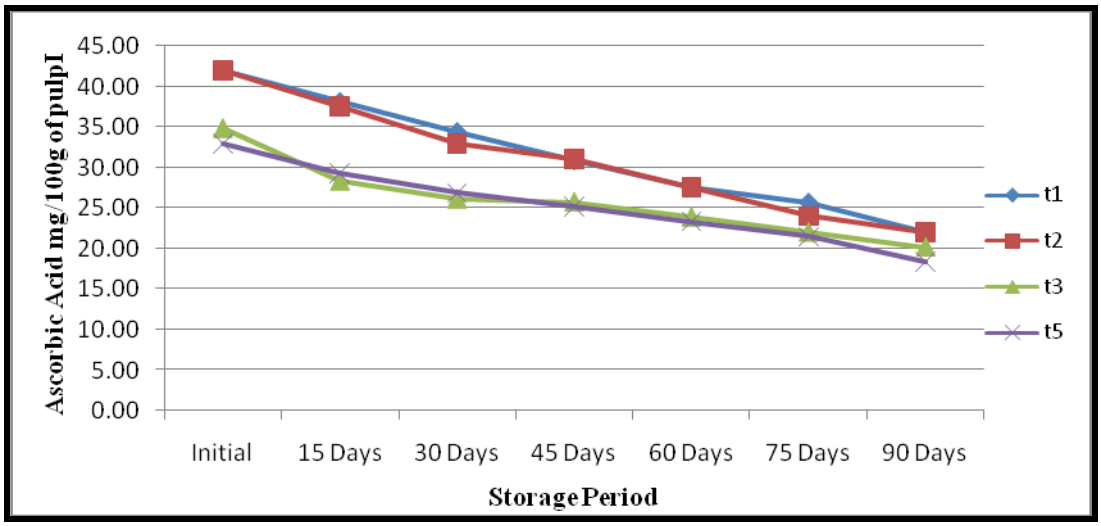

Figure 2: Effect of temperature levels on ascorbic acid content of *kothimbda* slice powder during storage.

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