International Journal of Processing and Post Harvest Technology

RESEARCH PAPER

Studies on dehydrated carrot cubes

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Research chronicle : Received : 01.02.2014; **Revised :** 11.05.2014; **Accepted :** 19.05.2014

SUMMARY :

An investigation was carried on the effect of pre-treatments on quality of dehydrated carrot cubes at Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The pre-treatment T_8 (Blanching in 55 ^{0}Brix sucrose solution and soaking in 1.0% KMS solution for 60 min) was found superior in maintaining maximum total carotenoid (850.13 µg/g), total sugar (15.13%), crude fibre (8.84%) and rehydration ratio (5.07). However, maximum moisture (13.27%), dehydration ratio (9.15) were registered in control. While, minimum (12.17%,8.06) in pre-treatment T_8 (Blanching in 55^0 Brix sucrose solution and soaking in 1.0% KMS solution for 60 min.) dried in cabinet drier with the advancement of storage period. During storage, the physico-chemical parameters like moisture, total sugar showed increasing trend while, rehydration ratio and total carotenoid content expressed the decreasing trend with the advancement of storage period. Crude fibre content remained constant with the advancement of storage period. Regarding sensory scores, the rehydrated carrot cubes prepared from the T_8 (Blanching in 55 ^{0}Brix sucrose solution and soaking in 1.0% KMS solution for 60 min) dried in cabinet drier secured the maximum score upto 80 days.

KEY WORDS : Carrot, Dehydration, Total carotenoids, Crude fibre, Total sugar

How to cite this paper : Bhoj, Shriram, Patil, Surendra R. and Sonkamble, Arvind M. (2014). Studies on dehydrated carrot cubes. *Internat. J. Proc. & Post Harvest Technol.*, **5** (1) : 67-70.

Amongst various methods of vegetables preservation, but dehydration is highly acceptable method for preservation and reduction in weight of raw material and their products. Dehydrated vegetables are good source of energy, minerals and vitamins. They provide moderate amount of protein to diet and are concentrated nutrients (Thomas and Calloway, 1961). Dried or dehydrated vegetables have advantages when compared with other methods of preservation. Dried products were less in weight, thus, reduces in the cost of transport; due to reduction in size, the product requires less space in storage. The cost of production of dried vegetable is very low, as compared to canned food and other products.

Carrot (*Dacus carota* L.) is one of the most important cool season root vegetable grown extensively in various countries particularly during winter season in tropical regions. It finds wide application in day to day use for making carrot juice, carrot powder, terminated carrot sweetmeats, soups, stews carrot flakes etc. Carrot is known for its nutrient content *viz.*, carotene and carotenoids, besides appreciable amounts of vitamins B_1, B_2, B_6 and B_{12} vitamins and minerals. Hence, carrots occupies an important place in root vegetables for their multifaceted application, which in turn, results in the development of various processing operations for making different products and/or to extend shelf-life. Fresh carrots cannot be stored for more than 3–4 days under ordinary conditions, but shelf-life can be extended to 7–8 months if stored in crates covered with perforated plastic film at 0 ^{0}C and 93–96 per cent relative humidity (Chadha, 2002). The other methods of extending shelf-life are fermenting, pickling, canning or cold storage freeze-drying, etc.

Considering the importance of dehydrated products, the experiment was carried out on the effect of pre-treatments on quality of dehydrated carrot cubes with objectives to find out suitable pretreatment and dehydration method for better quality dehydrated carrot cubes.

EXPERIMENTAL METHODS

Fresh, healthy, tender, ripe and uniform sized carrots were procured from Main Garden, Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. After sorting out, carrots were washed thoroughly using tap water. The experiment was laid out in Randomized Block Design and replicated thrice in PHT Laboratory, Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. Carrot cubes were prepared and treated with different treatments *viz.*,T_1 (Unblanched), T_2 (Blanching in 10% NaCl for 60 min.), T_3 (Blanching in 10 % NaCl and 0.2% KMS solution for 60 min), T_4 (Blanching in 10 % NaCl and soaking in 0.5 % KMS solution for 60 min), T_5 (Blanching in 10 % NaCl and soaking in 0.5 % KMS solution for 60 min), T_6 (Blanching in 55 ^{0}Brix sucrose solution for 60 min) and T_7 (Blanching in 55 ^{0}Brix sucrose solutionand soaking in 0.5 per cent KMS solution for 60 min). All the treated and untreated carrot cubes were spread in a single layer in tray drier and drying temperature was maintained at 60°C for initial 3 hrs and towards the end of drying, temperature was reduced to 50°C (Lidhoo and Khar, 2007).

The observations on physico-chemical and organoleptic parameters were recorded at 20 days interval upto 80 days of storage. The chemical analysis was done for moisture (%), total sugar, total carotenoids, crude fibre, dehydration ratio and rehydration ratio. Organoleptic evaluation of carrot product for colour, flavour, texture and over all acceptability was done by a panel of seven experienced judges by adopting hedonic scale during storage period. Dehydration ratio and rehydration ratio of dried carrot cubes were calculated by using the following formulae given by Ranganna (1979).The total sugar content in dehydrated sample was estimated by using the method described by Dubois method (1979). Crude fibre content in dehydrated sample was estimated by using the method described by Mazumdar and Mazumder (2003).

EXPERIMENTAL FINDINGS AND ANALYSIS

The experimental findings regarding dehydration and rehydration ratio are presented in Table 1 and analyzed below:

Dehydration and rehydration ratio:

Significantly lowest dehydration ratio was recorded when carrot cubes blanched in 55 ^{0}Brix sucrose solution and soaked in 1.0% KMS solution for 60 min (8.06) and highest in control. To one lot of the carrot, no blanching was done prior to osmosis as it has been reported to be detrimental to osmosis dehydration process due to loss of semi-permeability of cell membrane and reduction in moisture of carrots (Kalra *et al.*, 1990). Similar results of decreasing dehydration ratio in carrot slices were reported by Morale and Bourne (1992) and Takle and Singh (1986).

Since most of dehydrated vegetables are used after rehydration and rehydration ratio is important parameter for judging the quality of product. In the present investigation, rehydration ratio was significantly higher treatment blanched in 10 % NaCl and soaked in 0.5 % KMS solution for 60 min as compared to control.

Higher rehydration ratio indicates higher capacity of dried sample to reabsorb water. The reabsorption capacity related to the tissue integrity and structure, *i.e.* lower the disturbances in the tissue structure of the vegetables during drying period; higher will be the capacity of dried tissue to reabsorb moisture during rehydration. Similar results of increased rehydration ratio in the carrot slices blanched in brine solution were reported by Sharma *et al*. (2000) and Hiremath *et al.* (2009).

The experimental findings regarding moisture content, total carotenoids, total sugars and crude fibre presented in Table 2 and analyzed below:

Moisture content in dried carrot cubes was increased with advancement of storage upto 80 days. The increasing trend might be due to the gain of moisture by the dried cubes from the atmosphere. The gain of moisture was highest in control as compared to pre-treated slices with 10 % salt + 1.0 % KMS for 60 minutes. The progressive increase in moisture content was notified in all the samples dried by cabinet drying method. It might be possibly due to hygroscopic nature of the cubes, which absorbed the moisture during storage. Similar kinds of observations were also recorded by Singh *et al.* (2001) and Banga and Gujral (2002) for drying of carrot cubes.

Treatment control recorded minimum (736 µg/g) total carotenoid, while maximum (1192.87µg/g) with blanching in 55 ^{0}Brix sucrose solution and soaking in 1.0% KMS solution for 60 as min pre-treatment. Carotenoids are highly susceptible to auto oxidative degradation during processing and storage of foods, causing not only discoloration, but also off-odour especially in dehydrated vegetables on storage. The decrease in amounts of dry matter leads to increase in the concentrations of total carotenoids in blanched carrots. Similar kinds of observations were also recorded by Sharma *et al.* (2000) and Banga and Gujral (2002) for total carotenoid of carrot cubes.

The effect of different pre-treatments on total sugar (%) content of dried carrot cubes was recorded and found significant and increasing throughout the storage. These observations are in line with Singh *et al.* (2001) and Flink (1995) in dehydrated product of carrot.

The effect of different pre-treatments on crude fibre content of dried carrot cubes and was found significant and

Table 1: Effect of pre-treatments on rehydration ratio of carrot cubes at ambient storage

Treatments	Dehydration ratio	Rehydration ratio				
		Storage (days)				
		1st	20th	40th	60th	80th
T_1	9.15	5.89	5.71	5.55	4.97	4.48
T_2	8.70	6.15	5.87	5.61	5.19	4.76
T_3	8.52	6.27	6.01	5.88	5.46	5.27
T_4	8.11	6.45	6.09	5.98	5.57	5.35
T_5	8.17	6.63	6.24	6.06	5.67	5.12
T_6	8.34	6.16	5.95	5.72	5.17	4.72
T_7	8.22	6.25	6.01	5.80	5.41	4.93
T_8	8.06	6.45	6.15	5.98	5.50	5.07
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S.E.±	0.03	0.01	0.02	0.02	0.01	0.01
C.D. at 5%	0.09	0.04	0.06	0.06	0.04	0.04

Table 2: Effect of pre-treatments on moisture (%), total carotenoid (µg/g), total sugar (%) and crude fibre (%) of carrot cubes at ambient storage

Treatments	Moisture (%)		Total carotenoid (µg/g)		Total sugar (%)		Crude fibre (%)	
	Storage (days)							
	1st	80th	1st	80th	1st	80th	1st	80th
T_1	7.13	13.27	736.00	575.96	10.90	11.13	7.81	7.81
T_2	6.61	12.98	841.76	653.20	11.24	11.41	8.20	8.20
T_3	6.36	12.63	842.76	677.66	11.34	11.44	8.40	8.40
T_4	5.69	11.23	875.73	691.53	11.40	11.45	8.57	8.57
T_5	5.65	10.91	907.66	702.30	11.45	11.65	8.93	8.93
T_6	5.89	11.54	916.36	725.33	13.74	14.46	8.24	8.24
T_7	6.05	11.90	964.96	776.43	13.89	14.92	8.58	8.58
T_8	6.11	12.17	1192.87	850.13	14.04	15.13	8.84	8.84
'F' test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S.E.±	0.02	0.01	8.48	1.53	0.01	0.03	0.04	0.04
C.D. at 5%	0.06	0.03	25.44	4.61	0.04	0.09	0.12	0.12

constant throughout the storage.

The overall acceptability of the rehydrated carrot cubes depends upon colour, flavour and texture. The dehydrated cubes of carrot were rehydrated and kept for organoleptic evaluation. Significantly highest scores for taste and overall acceptability obtained in cubes blanched in 55 ^{0}Brix sucrose solution and soaked in 1.0% KMS solution indicated that, treatment had improved the taste, colour and hence, the acceptability of the product. The sucrose solution treated cubes also scored higher for taste, colour and overall acceptability.

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