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Effect of Pre-treatments on Physical and Sensory Qualities of Dehydrated Carrot Slices

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Abstract

Carrot is a popular cool season crop grown throughout India. It is used as raw as well as cooked form. The preservation methods such as dehydration, canning, and pickling can be successfully adopted to preserve carrot for off-season. Dehydrated carrot in the form of grating can be used in the preparation of halwa, discs made in to chips. Carrot is rich source of vitamin A and is a seasonal crop. To make available in the off season and to exploit the nutritive value of carrot it is necessary to convert into various value added products. Among the different methods of preservation, dehydration is one of the best and cheapest method of preservation. In this regard, a study was conducted to prepare dehydrated carrot slices. The experiment was conducted in completely randomized block design with seven treatments and three replications. The various physical parameters like recovery, time taken for drying, rehydration ratio, dehydration ratio, reconstitution ratio and organoleptic evaluation were carried out. Among the different treatments carrot slices dehydrated without any pretreatment taken minimum time for dehydration (15.10 hrs) whereas carrot slices dehydrated with blanching for 2 minutes + steeping in 40° Brix syrup + 6% salt for 2 hours had taken maximum time for dehydration (18.45 hrs). The highest recovery and lowest dehydration ratio were noticed in carrot slices dehydrated with blanching for 2 minutes + steeping in 40° Brix syrup + 6% salt for 2 hours. The rehydration ratio was found higher (5.04) in the slices steeped 0.75 percent KMS for 2 hours whereas the lowest rehydration ratio (2.59) was found in carrot slices blanched for 2 minutes + steeped in 40° brix syrup + 6% salt for 2 hours. The highest reconstitution ratio (0.57) was found in slices blanched for 2 minutes + steeped in 40° brix syrup+ 6% salt for 2 hours. Higher scores for colour and appearance (4.55), taste (4.43) were recorded in the slices blanched for 2 minutes + steeped in 40° brix syrup + 6% salt for 2 hours (T_6) whereas highest score for texture (4.46) and overall acceptability (4.55) were recorded in the slices blanched for 2 minutes + steeped in 30^0 brix syrup + 6% salt for 2 hours which was on par with T_6. It indicated that sugar and salt treatment blends improved the organoleptic qualities (colour, taste and overall acceptability) of the product.

Keywords: Carrot; Dehydration; Organoleptic evaluation; Syrup; Brine; KMS

Introduction

Carrot is a popular cool season crop grown throughout India. It is used as raw as well as cooked form. It is made in to pickles and sweet meat. Gajar halwa is delicious dish. The preservation methods such as dehydration, canning, and pickling can be successfully adopted to preserve carrot for off-season. Dehydrated carrot in the form of grating can be used in the preparation of halwa, discs made in to chips.

Dehydration is one of the important methods of value addition of vegetables to make them available during the off-season. Dehydrated products have even export demand. Out of rupees 31552 crores India's export earnings from processed fruits and vegetables in 2013-14, dried and preserved vegetables share of rupees 742.74 crores. Vegetables, which have export potential in dehydrated form, are onion, garlic, carrot, bitter gourd, okra, cauliflower, peas etc. Apart from export, there is great demand for dehydrated products in domestic market in big cities.

There is great demand for dehydrated form of carrot, but the information regarding simple technologies for drying/dehydration of these vegetables that can be adopted for small farmers at field level is lacking. Even though various pre-treatment are tried for different vegetables, there is need to evaluate the efficacy of different pre-treatment to get a dehydrated product. Therefore present study was undertaken to develop simple pretreatments for dehydration of carrot.

Material and Methods

An experiment was undertaken at department of Post-Harvest Technology, K R C College of Horticulture, Arabhavi during the year 2013-14 in completely randomized design with seven treatments and three replications. Carrots were procured from local market. Healthy, mature and uniform carrots were selected and washed in tap water. Selected carrots were cut in to five mm thick slices manually with stainless steel knife. The slices were subjected to different treatments. Blanching was done by using boiling water and slices were steeped in boiling water for specific period of time as mentioned in treatment details. The steeping solutions of brine (2 and 6%), KMS (0.75%) and syrup (20, 30 & 40°B) were prepared in water as per the treatments and carrot slices were steeped in the solution for specific period as mentioned in treatment.

All the treated and untreated carrot slices were spread in a single layer on trays and temperature was maintained at 60^0C for initial two hours and later decreased to 55°C. Drying was continued still a constant weight of dried slices was obtained and the time taken was noted down as drying time. Dehydrated slices were weighed, cooled to room temperature and packed in 200 gauge polythene bags and stored in cool and dry place.

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Treatment details

T_1: Steeping in 0.75% KMS for 2 hours.

T_2: Steeping in 2% brine + 0.1% KMS for 2 hours.

T_3: Blanching for 2 minutes + steeping in 2% brine + 0.1% KMS for 2 hours.

T_4: Blanching for 2 minutes + steeping in 20^0 brix syrup + 6% salt for 2 hours

T_5: Blanching for 2 minutes + steeping in 30^0 brix syrup + 6% salt for 2 hours

T_6: Blanching for 2 minutes + steeping in 40^0 brix syrup + 6% salt for 2 hours

T_7: Control

The percentage recovery of dehydrated slices and dehydration ratio was calculated by following formula.

$$\text{Per cent recovery} = \frac{\text{Wt of dehydrated sample}}{\text{Wt of fresh sample}} \times 100$$

$$\text{Rehydration ratio} = \frac{\text{Wt of fresh sample}}{\text{Wt of dehydrated sample}}$$

The known quantity of dehydrated carrot slices were steeped in water for two hours, excess water was drained out and weighed. The rehydration ratio and reconstitutability was calculated by following formula.

$$\text{Rehydration ratio} = \frac{\text{Wt of rehydrated sample}}{\text{Wt of dehydrated sample}}$$

$$\text{Reconstitutability ratio} = \frac{\text{Rehydration ratio}}{\text{Dehydration ratio}}$$

Hedonic scale	Colour and appearance	Texture	Taste	Overall acceptability
Highly susceptible	5	5	5	5
Acceptable	4	4	4	4
Fairly acceptable	3	3	3	3
Poorly acceptable	2	2	2	2
Not acceptable	1	1	1	1

Table 1: Details of scorecard. (Data on physico-chemical properties and organoleptic characters).

Orgnoleptic evaluation was done by a semi-trained panel of 10 judges. Carrot slices were analysed for colour and appearance, taste, texture and overall acceptability. The details of scorecard are given in Table1.

The data on physico-chemical properties and organoleptic characters recorded were subjected to statistical analysis and interpretation of data was carried out in accordance with Panse and Sukathme [1].

Results and Discussion

In the present investigation, recovery of dehydrated carrot as well as dehydration ratio showed significant variation due to treatments. The highest recovery (22.00%) and the lowest dehydration ratio (4.50) were noticed in slices blanched for two minutes and steeped in 40^0B syrup + six% salt for two hours (Table 2). These results are in confirmation with Gupta et al. [2] in cabbage, Manjula et al. [3] in carrot and Viresh [4] in bitter gourd. However, the recovery of dehydrated slices was found lower in treatment where slices were blanched for 2 minutes and steeped in 2% brine + 0.1% KMS solution for two hours (6.00%). Wherever the recovery was found higher, dehydration ratio was lower, which indicates the inverse relation between the percent recovery and its dehydration ratio. The highest recovery of slices may be attributed to osmosis process between the slices and steeping solution containing salt and sugar.

The rehydration ratio of dehydrated carrot slices was found highest in slices steeped in 0.75 percent KMS for two hours (5.04). The results are in confirmation with Bawa and Saini [5] in cauliflower and Manjula et al. [3] in carrot.

Ratio of rehydration to dehydration is used as an index of reconstitutability. This also differed significantly with respect to pre-treatments. The highest reconstitutability ratio was obtained in slices blanched for two minutes and then steeped in 40^0B syrup + six% salt for two hours (0.57) which was on par with slices blanched for 2 minutes and then steeped in 30^0B syrup + six% salt for two hours (0.55). However, the lower reconstitutability ratio was found in slices blanched in water for two minutes and then steeped in 2% brine + 0.1% KMS (0.22). Higher rehydration ratio and lower dehydration ratio indicate higher reconstitutability ratio, which is a measure of recovery. Similar results were also reported by Sardar and Chakraverty [6] and Manjula et al. [3] in carrot.

Treatments	Time taken for drying (hrs)	Recovery (%)	Dehydration ratio	Rehydration ratio	Reconstitution ratio
T_1 - Steeping 0.75 % KMS for 2 hours	15.30	8.00	11.90	5.04	0.42
T_2 - Steeping in 2% Brine + 0.1% KMS for 2 hours	16.45	10.00	9.87	4.16	0.42
T_3 - Blanching for 2 minutes+ Steeping in 2% Brine+ 0.1% KMS for 2 hours	17.00	6.00	15.63	3.56	0.22
T_4 - Blanching for 2 minutes + steeping in 20° brix syrup + 6% salt for 2 hours	17.30	21.00	4.80	2.70	0.56
T_5 - Blanching for 2 minutes + steeping in 30° brix syrup + 6% salt for 2 hours	18.15	21.00	4.79	2.65	0.55
T_6 - Blanching for 2 minutes + steeping in 40°brix syrup + 6% salt for 2 hours	18.45	22.00	4.50	2.59	0.57
T_7 - Control	15.10	9.00	11.36	4.83	0.425
S.Em ±	0.20	0.76	0.28	0.14	0.03
C.D. at 1%	0.84	3.21	1.22	0.60	0.12

Table 2: Time taken for drying, recovery per cent, dehydration ratio, rehydration ratio and reconstitution ratio of dehydrated carrot slices.

Treatments	Colour and appearance	Texture	Taste	Overall acceptability
T_1 - Steeping 0.75 % KMS for 2 hours	4.50	4.03	3.83	4.01
T_2 - Steeping in 2% Brine + 0.1% KMS for 2 hours	4.00	3.83	3.75	3.86
T_3 - Blanching for 2 minutes+ Steeping in 2% Brine+ 0.1% KMS for 2 hours	3.23	3.16	3.16	3.26
T_4 - Blanching for 2 minutes + steeping in 20° brix syrup + 6% salt for 2 hours	4.10	4.00	3.76	4.01
T_5 - Blanching for 2 minutes + steeping in 30° brix syrup + 6% salt for 2 hours	4.18	4.46	4.38	4.55
T_6 - Blanching for 2 minutes + steeping in 40°brix syrup + 6% salt for 2 hours	4.55	4.26	4.43	4.46
T_7 – Control	3.70	3.40	3.23	3.38
S.Em ±	0.03	0.03	0.03	0.03
C.D. at 1%	0.27	0.24	0.24	0.24

Table 3: Organoleptic evaluation (Score out of 5.00) of dehydrated carrot slices.

The quality of a product will be better if it is dried in shortest drying period. In this investigation, slices steeped in 0.75 per cent KMS for 2 hours took less number of hours for drying (15.30 hours) followed by slices steeped in 2% brine + 0.1% KMS for 2 hours (16.45 hours). However, the time required for drying was comparatively higher in syrup and brine treated samples.

The acceptability of a product depends on the consumer preference. Organoleptic evaluation is an important tool to know the consumer acceptability. Hence, in the present investigation, the organoleptic scores for colour and appearance, texture, taste and overall acceptability were assessed for selection of best treatments (Table 3). The highest scores for colour and appearance were obtained in treatment T_6 (4.55) which was on par with T_1 (4.50) whereas lowest score was observed in T_3 (3.23). The highest score for texture was observed in T_5 (4.46) which was on par with T_6 (4.26) whereas lowest score was observed in T_3 (3.16). There is significant difference between the treatments with respect to taste. The highest score for taste was observed in T_6 (4.43) which was on par with T_5 (4.38). The highest score for overall acceptability was observed in T_5 (4.55) which was on par with T_6 (4.46) whereas lowest score was observed in T_3 (3.26).

Conclusion

Among the 7 pre-treatments, the highest recovery, lowest dehydration and highest reconstitution were observed in slices blanched for 2 minutes and the steeped in 40° brix syrup + 6% salt for 2 hours (T_6). Similarly highest organoleptic scores for colour and appearance, texture, taste and overall acceptability was observed in slices blanched for 2 minutes and the steeped in 40° brix syrup + 6% salt for 2 hours (T_6) followed by slices blanched for 2 minutes and the steeped in 30° brix syrup + 6% salt for 2 hours (T_5). By considering all the parameters carrot slices blanched for 2 minutes and steeped in 40° brix syrup +6% salt for 2 hours was found to be the better for dehydration of carrot. This may be due to appropriate blend of sugar and salt improved the organolpetic parameters.

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