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Preparation and Quality Evaluation of Dehydrated Carrot and Onion Slices

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Abstract

Studies were conducted to determine the effect of different drying temperatures on the carrot and onion slices that were blanched with hot water and potassium meta bisulphite (KMS) then dipped in 0.25% for 20 min. Pre-treated to drying carrot and onion slices were dehydrated in cabinet tray dryer at four different temperatures *viz.* 50°C, 60°C, 70°C and 80°C. Dehydrated products were then packed in LDPE and stored at ambient temperatures. The products were analysed for physico-chemical, microbial and sensory attributes at regular interval of 0 days, 15 days and 30 days during one-month storage period, the results were compared with the control sample. It was observed that moisture content and rehydration ratio increased during storage period but moisture content showed decreasing trend with increasing temperatures. There was decrease in β-carotene, Vitamin A content and organoleptic properties. However, no significant effect on ash content was observed during storage. The treated samples showed better nutritive value than the control sample. Finished product had no mould count which means the product remained microbiologically sterile during entire storage period. It was observed that the products dehydrated at 50°C and 60°C were best among all the samples.

Keywords: KMS; Blanching; Tray drying; Dehydration ratio; Rehydration ratio; Low density polyethylene

Introduction

Vegetables constitute an important item of human diet. They are plant or parts of plant that are used as food. Vegetables are important in improving the acceptability of the meal, because of innumerable shades of colour, flavour and texture they contribute. The minimum daily requirement of vegetable is about 284 g per head i.e., 20 percent of the total food requirement of an adult, it is more in case of vegetarians. India is one of the horticulturally rich countries of world taking second position next to china with regard to vegetable production. About 46.97 million tonnes of fresh fruits and 110.67 million tonnes of vegetables are grown in nearly 9 million hectares. Only 70 percent of horticultural crops are effectively utilized and 30 percent of these account for post-harvest losses.

Drying is one of the most relevant and challenging processes of food industry, since a great number of food products are subjected to at least one drying step during its production. Dehydration or drying of foods is described as any process that involves thermal removal of volatile substances to obtain a dry solid [1]. The main purposes of drying crops are to increase its shelf life, to better its quality, to simplify the handling, storage and transport of the products and also to prepare the product to subsequent processes. *Moringa Oleifera* is native to some parts of Africa and Asia and it is the sole genus in the flowering plant family *Moringaceae*. *Moringa* is full of nutrients and vitamins and is good for both human and animal consumption. It is also a useful source of medicines. Drying of Agricultural crops is done in most farms by sun-drying. This results into contamination by insects and dust. Therefore, there is need to introduce the use of mechanical dryers provided that the nutritional characteristics would be retained better than using sun-drying method [2].

Being seasonal, as well as perishable due to high moisture content, carrots and onion are available in plenty only at a particular period of the years. During the peak season, due to abundant supply of carrots and onion the selling price becomes too low, leading to heavy losses to the growers. To preserve the carrots over a period of long time for use during off-seasons, dehydration is one of the most important methods, because it lowers the cost of packaging, storage and transportation by reducing both the weight and volume of the final product [3].

Carrot (*Daucus carota*) is an important vegetable, which has high nutritional value and utility. Carrot belongs to the family Umbelli ferae, genus *Daucus*, species *Carota*, and is one of the important root crops cultivated throughout the world for its fleshy edible roots 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 B1, B2, B6 and B12 vitamins and minerals. Hence, carrots occupy 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°C and 93-96 per cent relative humidity [4].

Onion belongs to the lily family amaryllidaceae, genus allium, species a. cepa, such as garlic and leeks. Dehydrated onion can be presented in powder, chunks, granules or slices. Its applications consider manufacturing of condiments, dehydrated or added to rehydrated meals. Dehydrated onion is used as condiment and flavouring agent in manufacturing of tomato ketchups, sauces, salad, pickles, chutneys, meat sausages, masala bread and buns, breakfast foods, etc. Dehydrated garlic is used for aids in digestion and for absorption of food having antiemetic and antiseptic properties and in some medicinal formulations. Allium crops are the most indispensable

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vegetable crops used as condiments in most Ethiopian cuisine. Among them, onion rightly called "queen of kitchen", belongs to the family *Alliaceae* and considered as one of the most important vegetable and spice crops produced in large scale in Ethiopia and cultivated during the dry and rainy seasons [5].

Methodology

Collection of carrot and onion samples

Properly matured carrots were selected for the purpose. Carrots and onions should not have blemish on surface or any mechanical damage. Damaged carrots and onions may lead to contamination. Unripe carrots and onions might affect the moisture loss in process so they were not used.

Slices: Carrot and onion slices for blanching and further process. Main purpose of slices was to give carrots and onions a uniform shape and size throughout experiment.

Pre-treatment

Blanching: Principle for blanching is to inactivate the enzyme present in food commodity. Time and temperature combination for carrots and onions is 95°C for 2-3 minutes. Carrots and onions was tied in muslin cloth and dipped in 95°C for 2-3 minutes. After blanching they was cooled to room temperature. Free surface moisture was removed by sieving. In blanching of carrots and onions, leaching was found along with enzyme inactivation. So, slight weight loss obtained.

Potassium meta bisulphite (KMS): Carrot and onion was dipped in 0.25% KMS by weight for 20 mins. KMS was used as a preservative and thus increases the shelf life of slices.

Cabinet tray drying: Tray drying was done to dehydrate carrot and onion slices for different dehydration temperatures was taken as 50°C, 60°C, 70°C and 80°C.

Collection of dried carrots and onions: Dried carrots and onions was collected and thus packaged in LDPE.

Physico-chemical analysis

Moisture content (%): Moisture was determined according to the hot air oven method described by AOAC [6].

$$Moisture\,content = \frac{W_1 - W_2}{W_1 - W} \times 100$$

Where,

W=weight of empty petri plate, g

W_1=weight of petri plate + slice before drying, g

W_2=weight of petri plate + slice after drying, g

Total ash content (%): The ash was estimated according to the method described by Ranganna [7].

$$Ash\,content\,(100) = \frac{W_2 - W_1}{W} \times 100$$

Where,

W=weight of sample, g

W_1=weight of crucible, g

W_2=weight of crucible + Ash, g

Dehydration ratio: Dehydration ratio was calculated by taking the weights of sample before drying and the weight of sample after drying [8].

$$Dehydration\,ratio = \frac{W_2}{W_1} \times 100$$

Where,

W_2=Weight of sample after drying

W_1=Weight of sample before drying

Rehydration ratio: Dehydrated slices were evaluated for rehydration ratio to find the reconstitution of dried sample using the following formula [7].

$$Rehydration\,ratio = \frac{W_2}{W_1} \times 100$$

Where,

W_2=Weight of rehydrated sample, g

W_1=Weight of the dehydrated sample, g

Beta carotene content and vitamin A (µg/100 g): Reagents: Acetone, anhydrous sodium sulphate, petroleum ether. 5 g of fresh sample was taken and crushed in 10-15 ml acetone, adding few crystals of anhydrous sodium sulphate, with the help of pestle and mortar. The supernatant was decanted into the beaker. The process was reported twice and transferred the combined supernatant to a separatory funnel, adding 10-15 ml petroleum ether and mix thoroughly. Two layers was separated and the lower layer was discarded and upper layer was collected in a 100 ml with petroleum ether and optical density was recorded using petroleum ether as blank [9].

Calculation:

$$\beta - carotene(\mu / g) = \frac{O.D \times 13.9 \times 104 \times 100}{Wt.of\ Sample \times 560 \times 1000}$$

Vitamin A content: The vitamin A was estimated according to the method described by Suman and Kumari [10].

$$Vita\min A(I.U) = \frac{\beta\text{-}carotene(\mu g)}{100}$$

Microbiological analysis

Dehydrated carrots and onions have too low moisture content to support even the growth of moulds. If, however these products become moistened above the minimum of microbial growth, growth was flow. A little moistening was permit only the growth of moulds. Moulds are thus most common and most important cause of spoilage.

Results and Discussion

The result obtained from the present investigation as well as relevant discussion have summarized under following:

Effect of temperature on moisture content (%) of dehydrated carrot slices during storage period

The product was prepared by processing it by different temperatures followed by storage at ambient temperature. Moisture content was calculated on the 0th day. The effect of storage condition on the moisture content was evaluated after every 15 days during a period of one month. The results showed that moisture content decreased with the increase in temperature as there is more evaporation of the moisture

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at higher temperature. Also, the moisture content increased during the storage period, the reason may be due to the ingress of moisture through the packaging material. The results obtained are shown in Table 1, the highest moisture content for carrot was 5.21% present in sample dehydrated at 50°C and lowest i.e., 4.98% was recorded in the sample dehydrated at 80°C [11].

Effect of temperature on moisture content (%) of dehydrated onion slices during storage period

The product was prepared by processing it by different temperatures followed by storage at ambient temperature. Moisture content was calculated on the zeroth day. The effect of storage condition on the moisture content was evaluated after every 15 days during a period of one month. The results showed that moisture content decreased with the increase in temperature as there is more evaporation of the moisture at higher temperature. Also, the moisture content increased during the storage period, the reason may be due to the ingress of moisture through the packaging material. The results obtained are shown in Table 2, the highest moisture content for onion slices was 7.87% present in sample dehydrated at 50°C and lowest i.e., 7.73% was recorded in the sample dehydrated at 80°C.

Effect of temperature on ash content (%) of dehydrated carrot slices during storage period

The ash content was obtained by incineration of the sample at 550°C in muffle furnace, at this high temperature all the organic component in the samples burn out and inorganic component is left. The results obtained are given in Table 3, the results showed that there was difference in ash content of sample treated at different temperatures. During storage, the ash content decreased slightly, this may be due to the increase in moisture content with the increase in storage period. The highest ash content in carrot was present in the sample dehydrated at 50°C i.e., 0.47% and lowest ash content 0.44% was found in the sample dehydrated at 80°C [12].

Moisture Content (%) of Carrot								
Tempera-ture	Control Sample				Treated Sample			
	0 day	15 days	30 days	Mean	0 Day	15 Days	30 Days	Mean
50ºC	4..85	5.06	5.27	**5.06**	5.21	5.4	5.62	**5.41**
60ºC	4.77	4.98	5.21	**4.98**	5.13	5.35	5.54	**5.34**
70ºC	4.71	4.91	5.16	**4.92**	5.07	5.26	5.48	**5.27**
80ºC	4.65	4.85	5.09	**4.86**	4.98	5.17	5.39	**5.18**
Mean	**4.74**	**4.95**	**5.18**		**5.09**	**5.29**	**5.50**	
Result	S	S	S		S	S	S	
S. Ed. (±)	0.025	0.058	0.037		0.009	0.018	0.006	
C.D.at 5%	0.052	0.123	0.078		0.019	0.038	0.012	

Table 1: Effect of temperature on moisture content of dehydrated carrot slices during storage period.

Moisture Content (%) of Onion								
Tempera-ture	Control Sample				Treated Sample			
	0 day	15 days	30 days	Mean	0 Day	15 Days	30 Days	Mean
50°C	7.23	7.44	7.67	**7.44**	7.87	8.07	8.28	**8.07**
60°C	7.18	7.38	7.61	**7.39**	7.83	8.02	8.24	**8.03**
70°C	7.13	7.36	7.59	**7.36**	7.78	7.96	8.19	**7.97**
80°C	7.08	7.31	7.55	**7.31**	7.73	7.91	8.15	**7.93**
Mean	**7.15**	**7.37**	**7.60**		**7.80**	**7.99**	**8.21**	
Result	S	S	S		S	S	S	
S. Ed. (±)	0.035	0.024	0.006		0.042	0.007	0.037	
C.D.at 5%	0.075	0.050	0.013		0.090	0.014	0.038	

Table 2: Effect of temperature on moisture content of dehydrated onion slices during storage period.

Ash Content (%) of Carrot								
Tempera-ture	Control Sample				Treated Sample			
	0 Day	15 Days	30 Days	Mean	0 Day	15 Days	30 Days	Mean
50°C	0.28	0.27	0.26	**0.27**	0.47	0.46	0.45	**0.46**
60°C	0.27	0.26	0.25	**0.26**	0.46	0.45	0.44	**0.45**
70°C	0.26	0.25	0.24	**0.25**	0.45	0.44	0.43	**0.44**
80°C	0.25	0.24	0.23	**0.24**	0.44	0.43	0.42	**0.43**
Mean	**0.26**	**0.25**	**0.24**		**0.45**	**0.44**	**0.43**	
Result	S	S	S		S	S	S	
S. Ed. (±)	0.007	0.007	0.005		0.008	0.008	0.004	
C.D. at 5%	0.016	0.014	0.010		0.016	0.017	0.008	

Table 3: Effect of temperature on ash content of dehydrated carrot slices during storage period.

Ash Content (%) of Onion								
Treatments	Control Sample				Treated Sample			
	0 Day	15 Days	30 Days	Mean	0 Day	15 Days	30 Days	Mean
50°C	0.24	0.23	0.22	**0.23**	0.43	0.42	0.41	**0.42**
60°C	0.23	0.22	0.21	**0.22**	0.42	0.42	0.41	**0.41**
70°C	0.22	0.21	0.20	**0.21**	0.41	0.40	0.39	**0.40**
80°C	0.21	0.20	0.19	**0.20**	0.40	0.39	0.38	**0.39**
Mean	**0.25**	**0.21**	**0.20**		**0.41**	**0.40**	**0.39**	
Result	S	S	S		S	S	S	
S. Ed. (±)	0.006	0.005	0.005		0.007	0.008	0.004	
C.D. at 5%	0.013	0.011	0.010		0.015	0.017	0.008	

Table 4: Effect of temperature on ash content of dehydrated onion slices during storage period.

Effect of temperature on ash content (%) of dehydrated onion slices during storage period

The ash content was obtained by incineration of the sample at 550°C in muffle furnace, at this high temperature all the organic component in the samples burn out and inorganic component is left. The results obtained are given in Table 4, the results showed that there was difference in ash content of sample treated at different temperatures. During storage, the ash content decreased slightly, this may be due to the increase in moisture content with the increase in storage period. The highest ash content in onion was present in the sample dehydrated at 50°C i.e., 0.43% and lowest ash content 0.40% was found in the sample dehydrated at 80°C.

Effect of drying temperature on weight loss of fresh carrot and onion slices

The weight loss in the sample upon drying is due to loss in moisture content. As moisture forms an important component of fresh vegetables, so upon drying moisture content is reduce thereby reducing the weight. The weight loss was calculated from initial weight of the blanched carrot slices and samples which were dried at 50°C, 60°C, 70°C and 80°C (Table 5). The weight loss was calculated for 0 min up to 5 hours for every one hour. Similarly, the weight loss was calculated from initial weight of the blanched onion slices during drying at 50°C, 60°C, 70°C and 80°C, 0 mins up to 5 hours in every one-hour weight of sample [13].

Effect of drying temperature on dehydration ratio of carrot slices

The dehydration ratio calculated from initial weight of carrot during cabinet type tray drying at 50°C, 60°C, 70°C and 80°C (blanching and KMS) is shown in Table 6, The results showed that dehydration ratio decreased with the increase in temperature as there occurs more evaporation of the moisture at higher temperature [13].

Effect of drying temperature on dehydration ratio of onion slices

The dehydration ratio calculated from initial weight of onion during cabinet type tray drying at 50°C, 60°C, 70°C and 80°C (blanching and KMS) is shown in Table 7. The results showed that dehydration ratio decreased with the increase in temperature as there occurs more evaporation of the moisture at higher temperature.

Weight Loss								
	Carrot(g)				Onion(g)			
Time(min)	at 50°C	at 60°C	at 70°C	at 80°C	at 50°C	at 60°C	at 70°C	at 80°C
0	100	100	100	100	100	100	100	100
60	40.5	38.46	36.31	34.28	38.45	36.46	33.85	31.32
120	24.4	23.68	21.50	20.45	22.45	21.05	19.15	18.32
180	19.85	19.79	19.75	19.71	17.65	17.54	17.42	17.31
240	14.93	14.81	14.76	14.49	12.23	12.18	12.15	12.13
300	14.69	14.67	14.48	14.32	11.75	11.69	11.62	11.58
	Result	S. Ed. (±)	C.D. at 5%		Result	S. Ed. (±)	C.D. at 5%	
Due to temp	NS	0.816	1.730		NS	0.927	1.966	
Due to Time	S	0.666	1.412		S	0.757	1.605	

Table 5: Effect of drying temperature on weight loss of fresh carrot and onion slices.

Dehydration Ratio of Carrot			
Temperature	Weight of the sample before drying (g) B	Weight of the sample after drying (g) A	Dehydration ratio(B/A)
Control Sample 50°C	950	103	0.108
Treated Sample 50°C	900	105	0.116
Control Sample 60°C	1200	116	0.096
Treated Sample 60°C	1100	115	0.104
Control Sample 70°C	900	81	0.090
Treated Sample 70°C	1000	98	0.098
Control Sample 80°C	850	68	0.080
Treated Sample 80°C	800	71	0.088

Table 6: Effect of drying temperature on dehydration ratio of carrot slices.

Dehydration Ratio of Onion			
Temperature	Weight of the sample before drying (g) B	Weight of the sample after drying (g) A	Dehydration ratio (B/A)
Control Sample 50°C	1050	104	0.099
Treated Sample 50°C	1100	115	0.104
Control Sample 60°C	1100	105	0.095
Treated Sample 60°C	1200	118	0.098
Control Sample 70°C	1150	100	0.086
Treated Sample 70°C	1200	107	0.089
Control Sample 80°C	900	72	0.080
Treated Sample 80°C	1000	84	0.084

Table 7: Effect of drying temperature on dehydration ratio of onion slices.

Rehydration Ratio of Carrot						
	Control Sample			Treated Sample		
Temperature	After 30 min	After 60 min	Mean	After 30 min	After 60 min	Mean
50°C	5.95	5.98	**5.96**	6.23	6.27	**6.25**
60°C	6.01	6.05	**6.03**	6.29	6.33	**6.31**
70°C	6.07	6.11	**6.09**	6.35	6.39	**6.37**
80°C	6.12	6.16	**6.14**	6.42	6.46	**6.44**
Mean	**6.03**	**6.07**		**6.32**	**6.36**	
Result	S	S		S	S	
S. Ed. (±)	0.041	0.008		0.011	0.014	
C.D. at 5%	0.086	0.018		0.023	0.031	

Table 8: Effect of drying temperature on rehydration ratio of carrot slices.

Rehydration Ratio of Onion						
	Control Sample			Treated Sample		
Temperature	After 30 min	After 60 min	Mean	After 30 min	After 60 min	Mean
50°C	6.34	6.37	**6.35**	6.62	6.65	**6.63**
60°C	6.39	6.42	**6.40**	6.67	6.68	**6.67**
70°C	6.45	6.49	**6.47**	6.71	6.73	**6.72**
80°C	6.49	6.52	**6.50**	6.76	6.78	**6.77**
Mean	**6.41**	**6.45**		**6.69**	**6.71**	
Result	S	S		S	S	
S. Ed. (±)	0.025	0.009		0.031	0.014	
C.D. at 5%	0.054	0.19		0.066	0.031	

Table 9: Effect of drying temperature on rehydration ratio of onion slices.

Effect of drying temperature on rehydration ratio of carrot slices

The rehydration was carried out by immersing dried carrot slices in boiling water, maintained at four temperatures i.e., 50°C, 60°C, 70°C, and 80°C. Approximately 5 g of sample was added to 200 ml of water, agitated and then allowed to rehydrate for 30 and 60 min time intervals and the contents were then filtered through filter paper. The weight of sample and the rehydration ratio is shown in Table 8. After the 30 min, the rehydration ratios of dehydrated carrots were found to be 6.23, 6.29, 6.35 and 6.42 respectively. After the 60 min, the rehydration ratio was found to be slight increased i.e., 6.27, 6.33, 6.39, and 6.46 respectively. The increase in the rehydration ratio was due to the absorption of water by the dried carrot slices. The rehydration ratio was seen less on 70°C and 80°C because of the high temperature due to which surface water was dried quickly and bound water was not dried properly [14,15].

Effect of drying temperature on rehydration ratio of onion slices

The rehydration was carried out by immersing dried onion slices in boiling water, maintained at four temperatures i.e., 50°C, 60°C, 70°C, and 80°C. Approximately 5 g of sample was added to 200 ml of water, agitated and then allowed to rehydrate for 30 and 60 min time intervals and the contents were then filtered through filter paper. The weight of sample and the rehydration ratio is shown in Table 9. After the 30 min, the rehydration ratios of dehydrated onion were found to be 6.62, 6.67, 6.71 and 6.76 respectively. After the 60 min, the rehydration ratio was found to be slight increased i.e., 6.65, 6.68, 6.73, and 6.78 respectively. The increase in the rehydration ratio was due to the absorption of water by the dried onion slices. The rehydration ratio was seen less on 70°C and 80°C because of the high temperature due to which surface water was dried quickly and bound water was not dried properly

Effect of temperature on carotenoid content of dehydrated carrot slices during storage period (μg/100 g)

The effect of different temperature time combination in β-carotene

Carotenoid Content						
	Treated Sample			Control sample		
Temperature	0 Day	15 Days	30 Days	0 Day	15 Days	30 Days
50°C	55075.7	55073.6	55072.5	50075.5	50074.6	50073.5
60°C	50061.7	50060.6	50058.6	45073.4	45072.6	45071.6
70°C	45061.7	45060.6	45059.6	40074.5	40073.6	40072.6
80°C	40087.3	40085.2	40084.1	35072.6	35071.2	35070.1
Mean	**47571.60**	**47570.10**	**47568.70**	**42574**	**42573**	**42571.95**
Result	S	S	S	S	S	S
S. Ed. (±)	5.321	6.033	6.369	4.260	3.558	3.894
C.D. at 5%	11.280	12.790	13.502	9.032	7.543	8.255

Table 10: Effect of temperature on carotenoid content of dehydrated carrot slices during storage period (µg/100 g).

Vitamin A Content						
	Treated Sample			Control Sample		
Temperature	0 Day	15 Days	30 Days	0 Day	15 Days	30 Days
50°C	550.757	550.736	550.725	500.755	500.746	500.735
60°C	500.617	500.606	500.586	450.734	450.726	450.716
70°C	450.617	450.606	450.596	400.745	400.736	400.726
80°C	400.873	400.852	400.841	350.726	350.712	350.701
Mean	**475.716**	**475.70**	**475.687**	**425.74**	**425.73**	**425.71**
Result	S	S	S	S	S	S
S. Ed. (±)	5.310	6.119	5.296	4.103	4.619	2.833
C.D. at 5%	11.258	12.973	11.227	8.698	9.792	6.007

Table 11: Effect of different temperatures on Vitamin A content of dehydrated carrot slices during storage period (µg/100 g).

Physico-Chemical Properties	Carrot	Onion
Moisture Content	85.5%	88.6%
Ash Content	0.30%	0.26%
β-Carotene Content	75075.2 µg/100 g	-
Vitamin A Content	750.752 µg/100 g	-

Table 12: Physico-chemical properties of fresh carrot and onion 100 g.

content on 50°C, 60°C, 70°C, 80°C at 15days interval during storage is shown in (Table 10). At 0th day, β-carotene content of carrots dehydrated at 50°C, 60°C, 70°C, 80°C was found to be 55075.7, 50061.7, 45061.7 and 40087.3µg respectively. After 15 days of storage, β-carotene value was found to be 55073.6, 50060.6, 45060.6 and 40085.2 µg respectively. On critical evaluation of the result during storage it was found that β-carotene content decreased with increase in storage and temperature. Finally, after 30 days of storage, the values of β-carotene were 55072.5, 50058.6, 45059.6 and 40084.1 µg respectively. Carotenoids are the pigments which are sensitive to heat. Due to treatment, at different temperature thermal degradation occur there by reducing the carotenoids content [9].

Effect of different temperatures on Vitamin A content of dehydrated carrot slices during storage period (µg/100 g)

The effect of different temperatures and storage period on vitamin A content of dehydrated carrot slices at 50°C, 60°C, 70°C, 80°C, at regular interval of 15 days during storage is shown in Table 11. 0th day readings of vitamin A content of samples treated at 50°C, 60°C, 70°C and 80°C were found to be 550.757, 500.617, 450.617 and 400.873 µg respectively. On 15th day of storage, Vitamin A value was found to be 550.736, 500.606, 450.606, and 400.852 µg respectively. From the obtained results, it was found that the Vitamin A content decreased with increase in temperature as well as during storage period. On the 30th day of storage study, the values of Vitamin A were 550.725, 500.586, 450.596 and 400.841 µg respectively. Due to the thermal treatment (at different temperature) the Vitamin A content of dehydrated carrot slices decreases due to thermal degradation [16].

Microbial analysis

Dehydrated carrot and onion slices: Dehydrated products have such a restricted that there is little difficulty in preventing the growth of micro-organisms as long as they are kept dry. There moisture content is too low to support even the growth of moulds. If, however these products become moistened above the minimum of microbial growth, growth will follow. A little moistening will permit only the growth of moulds. Moulds are thus most common and most important cause of spoilage. So, the mould count at room temperature was studied for samples of dehydrated carrot and onion slices to study the accuracy in the microbial quality and also to determine the frequency of distribution within standard limits with interval of 0 days up to 30 days. But, there was no mould count seen for 30 days when pre-treated with blanching and KMS. Therefore, minimum shelf life is 30 days (Table 12).

Conclusion

From the results of this study it is concluded that the quality evaluation at different drying temperatures for carrot and onion slices showed similar trend or nature towards the storage conditions that were provided after packing in the LDPE for 30 days to observe the shelf life of dried carrot and onion slices. The temperatures were the most pronounced factors affecting moisture content, rehydration ratio, carotenoid content, vitamin A content of carrot and onion slices during tray drying. Results obtained showed that the effect of application of pre-treatment was significant on the initial moisture content of the carrot and onion slices and were found to be best as base material for the preparation of carrot and onion powder for the off-season. The dehydrated products will be of great use particularly in off season of carrot and dehydrated onion powder is primarily used for preparation of ready to make foods. No mould growth was observed during storage period. The Physico-chemical properties of carrot and onion slices were preserved in KMS treatment because KMS had some leaching effect on products due to the release of SO_2 in water during treatment. On the basis of quality attributes, and sensory attributes especially colour and appearance the products were acceptable. However, there was difference in the overall acceptability of the product. Suggestions for future work.

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