Madras Agric. J., 101 (4-6): 197-200, June 2014
https://doi.org/10.29321/MAJ.10.001181

Studies on Physico-Chemical Characteristics of Dehydrated Onion Powder

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Dehydrated onion powder was prepared by grinding the dried onion slices and stored at room temperature upto 90 days. The samples of dehydrated onion slices used were 2mm thickness, KMS treated solar drier samples (S_1), 2mm thickness; treated open sun dried (S_2), 2mm thickness, untreated solar dried, (S_3) and 2mm thickness, untreated sun dried (S_4).Various quality parameters *viz.*, acidity, ascorbic acid, total sugar, reducing sugar and rehydration ratio were evaluated after 15 days interval. The acidity, ascorbic acid and rehydration ratio continually decreased during storage at room temperature, whereas total sugar, reducing sugar increased. In case of acidity, initial and final values of S_2 sample was higher in comparison with S_1, S_3 and S_4 samples. In case of ascorbic acid, the initial and final values were higher for S_1 samples in comparison with S_1, S_3 and S_4 samples. The initial and final values of total sugar and reducing sugar were higher in S_4 sample in comparison with S_2, S_3 and S_1 samples. In case of rehydration ratio the initial and final values were higher in S_1 sample in comparison with S_2, S_3, and S_4 samples.

Key words: Dehydrated onion powder, Acidity, Ascorbic acid, Total Sugar, Reducing sugar, Rehydration ratio

India is the second largest producer of onion after China. The four major onion producing countries in the world are China (20.56 million tonnes), followed by India (12.15 million tonnes), USA (3.60 million tonnes) and Turkey (1.86 million tonnes) reported by Food Agriculture Organization 2010). India exports onions to Bangladesh, Malaysia, UAE, Sri Lanka and Nepal (National Horticulture Board estimates, 2010). Maharashtra is the largest producer of onion in India with a market share of 29%, followed by Karnataka with a market share of 22.35% and Gujarat with a market share of 10.39%, Uttar Pradesh with a market share 8.39%. Onion powder comes in a few varieties: white, yellow, red and toasted. Onion adds taste and flavour to a food, and it is invariably used in several cuisines and culinary preparation in India. The pungent taste of onion is due to volatile oil, ally propyl disulphide present in it. Onion serves as a good medicinal compound for cataract, cardiovascular disease and cancer due to its hypo cholesterolemic, thrombolitic and antioxidant effects as stated by Block (1985), Block *et al.* (1997), Stavric (1997), Nuutila *et al.* (2003) and Vidyavati *et al.* (2010).

According to the USDA National Nutrient Database for Standard Reference (USDA, 2012), the nutritional composition of raw onions, per 100 g of edible portion is 89.11 g of water, 1.10 g of protein, 0.10 total lipids (fat), 0.35 g of ash, 9.34 g of carbohydrate, 4.24 g of total sugars and 1.7 g of total dietary fibre, corresponding to an energy of 166 kcal. The most important minerals are potassium, calcium and selenium. Onions are a very good source of vitamins B6 and C, chromium, biotin, and fiber. They are also good sources of folic acid and vitamins B1.

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Materials and Methods

Matured, fresh onion, free from diseases and insects were procured from the local market and used for the present investigations. Other raw materials including glass bottles, chemicals and preservatives were also procured from the local market. Potassium metabisulphite (KMS) was used as preservative. The entire study was conducted in the Department of Agricultural Engineering and Food Technology, S.V.B.P. University of Agric. & Technology, Meerut (U.P.).

Preparation of dehydrated onion powder

Ripe onion washed and sliced by hand operated slicer. The onion slices were pretreated by potassium metabisulphite in the ratio of 1:4 (w/w), whereas some untreated onion slices used as control were taken and dried in open sun light (41.68ºC) and solar drying (54.48ºC) . After drying both treated and untreated samples were powdered and packed in polythene bags (film thickness 95 micron, density 0.922), sealed air tight and stored at room temperature for further analysis.

Determination of Physico-chemical characteristics of onion powder

The physico-chemical characteristics viz., ascorbic acid, total sugar, reducing sugar and rehydration ratio of onion powder were evaluated using the method as recommended by Ranganna (2001). Acidity was evaluated using the method

recommended by Saini *et al*. (2000).

Results and Discussion

The effect of storage period and storage temperature on acidity, ascorbic acid, total sugar, reducing sugar and rehydration ratio were determined.

Ascorbic acid

Table 1 and Figure 1 shows the data on ascorbic

Table 1. Ascorbic acid content of dried onion powder in room temperature during storage

Storage time (days)	Ascorbic acid content, mg/100g at different days			
	S_1	S_2	S_3	S_4
0	13.31	8.315	13.23	7.951
15	13.11	7.677	13.05	7.348
30	12.98	7.147	12.8	6.79
45	12.12	6.234	11.9	6.229
60	11.84	5.81	11.1	5.739
75	10.91	5.513	10.5	5.238
90	10.54	4.877	10.2	4.847

acid content (mg/100g) at 0, 15, 30, 45, 60, 75, and 90 days of storage. For S_1, the reduction was 13.31 mg/100g (0 day) to 10.54 mg/100g (90 days). For S_2

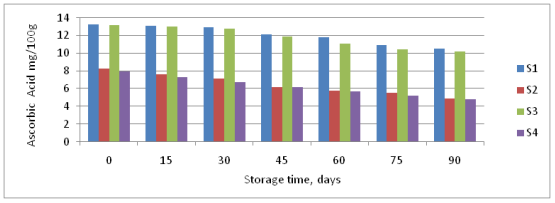

Fig. 1. Change in Ascorbic Acid of dried onion powder during storage periods at room temperature

the reduction was 8.315 mg/100g (0 day) to 4.877 mg/100g (90 days). For S_3, the reduction was 13.23 mg/100g (0 day) to 10.2 mg/100g (90 days). For S_4 the reduction was 7.951 mg/100g (0 day) to 4.847

Table 2. ANOVA for change in ascorbic acid during storage periods at room temperature

Source of Variation	SS	Df	MS	F	P-value	Fcrit
Rows	904.8233	6	150.8039	2.508189	0.677611	0.666136
Columns	7385.816	4	1846.454	8.156225	0.000266	2.776289
Error	5433.261	24	226.3859			
Total	13723.9	34				

Rows: Change in Ascorbic Acid during storage periods at room temperature
Colums: 2mm thickness chemical treated and untreated samples
At 5% level of significance

mg/100g (90 days).The higher loss of ascorbic acid may be attributed to sensitivity of vitamin C at room temperature (30 - 40 ^{0}C) during 3 months of storage in $S_3$and S_4samples. Similar trend was also reported by Pawar *et al.* (1988). Table 2 shows the ANOVA for

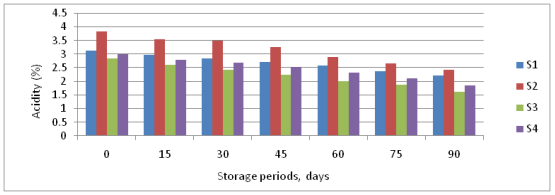

Fig. 2. Change in Acidity of dried onion powder during storage periods at room temperature

change in ascorbic acid content in dried onion powder during storage periods.

Acidity

Table 3. Acidity (%) content of dried onion powder at room temperature during storage

Storage time(days)	Acidity (%) at different days			
	S_1	S_2	S_3	S_4
0	3.121	3.813	2.823	2.987
15	2.970	3.549	2.612	2.841
30	2.835	3.481	2.426	2.686
45	2.715	3.239	2.242	2.511
60	2.574	2.881	1.991	2.315
75	2.363	2.653	1.882	2.107
90	2.20	2.41	1.611	1.856

Table 3 and Figure 2 shows the data on acidity content (%) at 0, 15, 30, 45, 60, 75, and 90 days of storage. For S_1, the reduction was 3.12 % (0 day) to

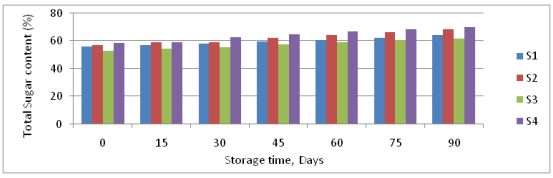

Fig. 3. Change in total sugar of dried onion powder during storage periods at room temperature

2.20 % (90 days). For S_2, the reduction was 3.813 % (0 day) to 2.41 % (90 days). For S_3, the reduction was 2.823 % (0 day) to 1.611 % (90 days). For S_4 the reduction was 2.987 % (0 day) to 1.856 % (90

Table 4. ANOVA for change in acidity (%) content during storage periods at room temperature

Source of Variation	SS	Df	MS	F	P-value	Fcrit
Rows	Rows	1134.31	6	189.0516	0.877614	0.52590255
Columns	Columns	10056.68	4	2514.171	11.67127	0.00002095
Error	Error	5169.968	24	215.4153		
Total		16360.96	34			

Raws: change in acidity during storage periods at room temperature
Coloums: 2mm thickness chemical treated and Untreated samples
at 5% level of significance

days).The higher loss of acidity may be attributed to sensitivity of acidity at room temperature (30 - 40^{0}C) during 3 months storage. The acidity in open sun dried samples is less than solar drier samples after

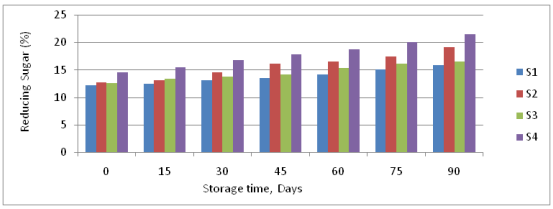

Fig. 4. Change in reducing sugar of dried onion powder during storage periods at room temperature

90 days. Similar trend were also reported by Sagar (2001). ANOVA for change in acidity during storage periods is shown in table 4.

Effect of storage time on total sugar

Table 5 and Figure 3 shows the data on total sugar

Table 5. Total sugar (%) content of dried onion powder in room temperature during storage

Storage time(days)	Total sugar content (%) at different days			
	S_1	S_2	S_3	S_4
0	56.10	57.05	53.23	58.95
15	57.11	58.98	54.56	59.43
30	58.41	59.34	55.61	62.82
45	59.66	62.22	57.44	64.92
60	60.74	64.43	59.44	66.82
75	62.34	66.55	60.72	68.72
90	64.55	68.54	61.82	70.34

content (%) at 0, 15, 30, 45, 60, 75, and 90 days of storage. For S_1, the increase in total sugar was from 56.10 % (0 day) to 64.55 % (90 days). For S_2, the increase was from 57.05 % (0 day) to 68.54 % (90 days). For S_3, the increase was from 53.23 % (0 day) to 61.82 % (90 days). For $S_4$the increase was 56.95 % (0 day) to 70.34 % (90 days). Total sugar was found to increase during storage. Higher increase was observed in untreated sample in both the methods.

Table 6. ANOVA for change in total sugar content during storage periods at room temperature

Source of Variation	SS	Df	MS	F	P-value	Fcrit
Rows	2697.764	6	449.6273	2.725204	0.036594	2.508189
Columns	1631.358	4	407.8396	2.776289	0.071675	2.471927
Error	3959.724	24	164.9885			
Total	8288.846	34				

Raws: change in acidity during storage periods
Coloums: 2mm thickness chemical treated and Untreated samples
5% level of significance

Table 7. Reducing sugar content of dried onion powder at room temperature

Storage Period (Days)	Reducing sugar content (%) at different days			
	S1	S2	S3	S4
0	12.23	12.67	12.54	14.55
15	12.45	13.15	13.35	15.49
30	13.03	14.57	13.78	16.69
45	13.53	16.05	14.15	17.81
60	14.15	16.54	15.34	18.69
75	15.05	17.41	16.09	20.05
90	15.78	19.11	16.48	21.45

Similar results were reported by Sagar (2001) for onion powder. ANOVA for change in total sugar content during storage periods shown in table 6.

Effect of storage time on reducing sugar

Table 7 and Figure 4 shows the data on reducing sugar content (%) at 0, 15, 30, 45, 60, 75, and 90 days of storage. For S_1, the increase in reducing sugar was from 12.23 % (0 day) to 15.78 % (90 days). For S_2, the increase was from 12.67 % (0 day) to 19.11 % (90 days). For S_3, the increase was from 12.54 % (0 day) to 16.48 % (90 days). For $S_4$the increase was 14.55 % (0 day) to 21.45 % (90 days). ANOVA for change in reducing sugar is given in table 8.

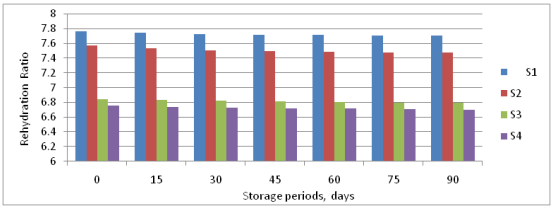

Fig. 5. Change in rehydration ratio of dried onion powder during storage periods at room temperature

Table 8. ANOVA for change in reducing sugar content during storage periods at room temperature

Source of Variation	SS	Df	MS	F	P-value	Fcrit
Rows	1966.383	6	327.7305	2.508189	0.147547	1.772518707
Columns	5008.309	4	1252.077	6.771814063	0.000851	2.776289
Error	4437.489	24	184.8954			
Total	11412.18	34				

Rows: change in Reducing Sugar during storage periods
Coloums: 2mm thickness chemical treated and Untreated samples
5% level of significance

Rehydration ratio

Table 9. Rehydration ratio of dried onion powder in room temperature during storage

Storage time (days)	Rehydration ratio at different days			
	S_1	S_2	S_3	S_4
0	7.774	7.577	6.845	6.755
15	7.749	7.537	6.832	6.742
30	7.734	7.514	6.825	6.731
45	7.725	7.503	6.818	6.723
60	7.718	7.492	6.812	6.718
75	7.713	7.484	6.802	6.711
90	7.710	7.477	6.799	6.702

Table 9 and Figure 5 shows the data of rehydration ratio at 0, 15, 30, 45, 60, 75 and 90 days of storage. It was observed that the rehydration ratio was found to decrease during storage.

Table 10. ANOVA for change in rehydration ratio during storage periods at room temperature

Source of Variation	SS	Df	MS	F	P-value	Fcrit
Rows	1253.092	6	208.8487	2.508189	0.452175181	0.993154
Columns	8007.934	4	2001.983	9.520179	0.0000931	2.776289
Error	5046.922	24	210.2884			
Total	14307.95	34				

Raws: change in Rehydration Ratio during storage periods
Coloums: 2mm thickness chemical treated and Untreated samples
5% level of significance

Reduction in rehydration ratio after 90 days was minimum (6.702%) for S_4(open sun drying untreated sample) followed by S_1 (7.710%), S_2(7.774%) and S_3 (6.799%) samples, respectively. The minimum reduction in rehydration ratio over 90 days storage period may be due to the minimum change in the cellular structure during storage. ANOVA for change in rehydration ratio is shown in table 10.

Conclusion

The product in terms of acidity, ascorbic acid, total sugar, reducing sugar and rehydration ratio was found to be the most acceptable, when samples were treated in the solution of potassium metabisulphite

(KMS), and dried under solar drier after slicing to 2 mm thickness.

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Received: August 27, 2013; Accepted: November 12, 2013