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INFLUENCE OF PRE-TREATMENTS ON PHYSICAL PARAMETERS DEHYDRATED ONION SLICES

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Abstract

An investigation was carried out to study the effect of different chemical pre-treatments on the physical parameters of dehydrated onion slices. The different chemical pre-treatments like soaking in $NaHSO_3$, KMS, sodium metabisulphite and NaCl with different concentrations and in combination with citric acid and studied the effect of these chemicals on physical parameters like drying time, dehydration ratio, recovery percentage, rehydration ratio and reconstitutability ratio. The slices treated with 0.5 per cent sodium metabisulphite had recorded the highest recovery per cent, reconstitutability ratio and lower dehydration ratio. The slices pre-treated with 1 per cent sodium metabisulphite taken less time for drying and the slices pre-treated with 1 per cent sodium hydrogen sulphite had recorded the maximum rehydration ratio.

Key words : Onion, dehydration, KMS, $NaHSO_3$, NaCl.

Introduction

Onion (*Allium cepa* L.) is one of the major bulb crop of the world. It is most important commercial vegetable and also a spice crop grown in India. A distinctive characteristic of onion is due to presence of alliaceous odour which accounts for its use as a food, salad, condiment and in medicine. Onion has a paramount effect in preventing heart diseases and other ailments. The pungency in onion is due to volatile oil known as allyl-propyl-disulphide. Nutritionally fresh onions contain about 86.8% moisture, 11.6% carbohydrates, 9mg/100g ascorbic acid, 1.2% proteins, 0.2-0.5% calcium, 0.05% phosphorus and traces of iron, thiamine, riboflavin.

Among the onion producing countries, India has the largest area under onion cultivation (8,34,230 hectares) with 1,35,65,000 lakh tones of production in the country, which accounts for 18 per cent of world's area and 15 per cent of world's production under onion. India ranks second in onion production, next to China. In India, it is commercially cultivated in Maharashtra (25% of area and 30% of the production of the country), Karnataka, Gujarat, Orissa and Uttar Pradesh with a very low average productivity of 11 tones/ha (Anon, 2010).

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Dehydrating the produce we can reduce the bulkiness of the fresh produce which in turn reduces the transportation cost and easy to handle. By dehydrating the onion, we can reduce the storage loss due to sprouting and rotting, and also avoid the market glut thereby can get the good price in the market.

Preservation of onion through proper processing is one such approach to tackle this problem. The heart of the onion processing operation centers on the dehydration of the produce. "Dehydration" of onion is one of the economical and feasible methods of preservation of surplus produce, for use in season of short fall, thereby minimizing the fluctuation in the market price. In dehydration of onion, the moisture content is reduced to a safe storage level without destroying its texture, colour, flavour and nutritive value under controlled conditions. Therefore dehydration is defined as the process of removal of moisture by the application of artificial heat under controlled conditions of temperature, humidity and rate of air flow.

Materials and Methods

The present investigation was carried out in Department of Post-harvest Technology, Kittur Rani Channamma College of Horticulture, Arabhavi during

2010-11. This experiment was carried out in Completely Randomised Design with seventeen treatments and two replications.

White fresh onions of uniform size and shape were selected, rotten and sprouted bulbs were discarded. Ten kilogram of onions was taken for each treatment. The onion slices were treated with potassium metabisulphate, sodium chloride, sodium metabisulphite, sodium hydrogen sulphite and in combination with citric acid in different concentrations of these chemicals as mentioned in the treatment details.

Treatment details :

T_1- 0.5% Sodium hydrogen sulphite ($NaHSO_3$)

T_2- 1 % $NaHSO_3$

T_3- 0.25 % Potassium metabisulphite (KMS)

T_4- 0.5 % KMS

T_5- 0.5 % Sodium metabisulphite

T_6- 1% Sodium metabisulphite

T_7- 1 % NaCl

T_8- 2 % NaCl

T_9- 0.5 % $NaHSO_3$ + 0.50 % citric acid

T_{10}- 1 % $NaHSO_3$+ 0.50 % citric acid

T_{11}- 0.25 % KMS + 0.50 % citric acid

T_{12}- 0.5 % KMS + 0.50 % citric acid

T_{13}- 0.5 % Sodium metabisulphite + 0.50 % citric acid.

T_{14}- 1% Sodium metabisulphite + 0.50 % citric acid

T_{15}- 1 % NaCl + 0.50 % citric acid

T_{16}- 2 % NaCl + 0.50 % citric acid

T_{17}- control (untreated)

After respective pre-treatments the onion slices were placed in a single layer on stainless steel trays. The loaded trays were kept in electric dryer with temperature of 60^0C. After completion of drying, dried onion slices were packed air tight polythene bags of 400 gauges and stored at ambient conditions for storage.

Results and Discussion

Significantly minimum time taken for drying was observed in the slices pre-treated with 1 per cent sodium meta bisulphite (33.58 hours) followed by the slices pre-treated with 1 per cent sodium metabisulphite + 0.5 per cent citric acid (39.15 hours), whereas maximum time taken for drying was observed in the slices pre-treated with 0.25 per cent KMS + 0.5 per cent citric acid (49.38 hours). Similar observations were reported by some earlier workers (Manimeghalai and Ramah, 1998; Mudahar and Bains, 1982). The least time taken for drying may due to the nature of the chemical and efficacy of drying method to remove higher moisture content in unit time (Desayi, 2010).

The data reveals that there were significant differences between the treatments on recovery of dehydrated onion slices. Significantly highest recovery of dehydrated slices was observed in slices treated with 0.5 per cent sodium metabisulphite (14.75 %), which was on par with 0.5 per cent $NaHSO_3$ treated samples (14.32 %), whereas the least recovery was recorded in 2 per cent NaCl treated samples (9.70). Similar results were also found by Vaghini and Chundawat (1986) in Sapota. The increase in yield (per cent recovery) may be attributed to reduction in osmotic losses.

The data reveals that dehydration ratio had significant differences among the treatments (table 1). Significantly lowest dehydration ratio was recorded in the slices pre-treated with 0.5 per cent sodium meta bisulphite (6.77) which were on par with 1 per cent $NaHSO_3$ pre-treated slices (6.98) and the highest dehydration ratio was recorded in 2 per cent NaCl pre-treated slices (10.30) followed by 1 per cent NaCl pre-treated slices (8.68). Wherever the recovery was found higher, dehydration ratio was lower. This reveals the inverse relationship between the percent recovery and its dehydration ratio. Similar results were also found by Vaghini and Chundawat (1986).

With respect to reconstitutability ratio, highest reconstitutability ratio was recorded in both 1 per cent $NaHSO_3$ treated and 0.5 per cent sodium meta bisulphite pre-treated slices (0.80), which were on par with 0.5 per cent $NaHSO_3$ pre-treated samples (0.77), whereas the lowest value was recorded in 2 per cent NaCl pre-treated slices (0.46) followed by 1 per cent NaCl pre-treated slices (0.55). The results were in confirmation with those reported by Sagar *et al*. (1997) and Suman and Krishnakumari (2002).

Similarly significant highest rehydration ratio was observed in 1 per cent $NaHSO_3$ (6.12, 5.83, 5.75 and 5.52), followed by 0.5 per cent $NaHSO_3$ (5.35, 5.17, 5.11 and 4.82) pre-treated slices during initial period, one month after dehydration, two months later and three months after storage, respectively. So, in this experiment, onion slices treated with 1 per cent $NaHSO_3$ had maximum rehydration ratio which attribute to the above mentioned characteristics of $NaHSO_3$ to increase the rehydration ratio. Similar results were reported by Akpapunam and Abiante (1991) in sweet potato.

Table 1 : Effect of pre treatments on time taken for drying, recovery percent, dehydration ratio and reconstitutability ratio of dehydrated onion slices.

Treatment	Recovery percent	Dehydration ratio (%)	Reconstitution ratio	Time taken for drying (hrs)
T_1- 0.5% Sodium hydrogen sulphite ($NaHSO_3$)	14.32	6.98	0.77	42.28
T_2- 1 % $NaHSO_3$	13.17	7.59	0.80	40.15
T_3- 0.25 % Potassium metabisulphite (KMS)	13.22	7.56	0.72	42.38
T_4- 0.5 % KMS	13.47	7.43	0.68	42.55
T_5- 0.5 % Sodium metabisulphite	14.75	6.77	0.80	44.10
T_6- 1% Sodium metabisulphite	13.42	7.44	0.64	33.58
T_7- 1 % NaCl	11.55	8.68	0.55	42.10
T_8- 2 % NaCl	9.70	10.30	0.46	41.05
T_9- 0.5 % $NaHSO_3$ + 0.50 % citric acid	12.25	8.16	0.62	41.18
T_{10}- 1 % $NaHSO_3$ + 0.50 % citric acid	12.92	7.73	0.64	40.00
T_{11} - 0.25 % KMS + 0.50 % citric acid	12.67	7.89	0.64	49.38
T_{12}- 0.5 % KMS + 0.50 % citric acid	11.82	8.45	0.63	41.25
T_{13}- 0.5 % Sodium metabisulphite + 0.50 % citric acid	12.12	8.24	0.61	43.70
T_{14}- 1% Sodium metabisulphite + 0.50 % citric acid	12.30	8.13	0.60	39.15
T_{15}- 1 % NaCl + 0.50 % citric acid	13.37	7.47	0.64	40.55
T_{16}- 2 % NaCl + 0.50 % citric acid	13.20	7.57	0.66	40.10
T_{17}- Control (untreated)	13.90	7.19	0.68	45.20
S Em ±	0.279	0.181	0.0252	0.232
C D at 1%	0.809	0.526	0.0730	0.672

Table 2 : Effect of pre treatments on rehydration ratio of dehydrated onion slices during storage.

Treatment	Rehydration ratio			
	Months After Storage			
	Initial	I	II	III
T_1- 0.5% Sodium hydrogen sulphite ($NaHSO_3$)	5.35	5.17	5.11	4.82
T_2- 1 % $NaHSO_3$	6.12	5.83	5.75	5.52
T_3- 0.25 % Potassium metabisulphite (KMS)	5.47	5.09	4.98	4.76
T_4- 0.5 % KMS	5.09	4.70	4.56	4.35
T_5- 0.5 % Sodium metabisulphite	5.39	5.07	4.94	4.61
T_6- 1% Sodium metabisulphite	4.80	4.40	4.30	4.04
T_7- 1 % NaCl	4.75	4.90	4.82	4.61
T_8- 2 % NaCl	4.80	4.61	4.50	4.28
T_9- 0.5 % $NaHSO_3$ + 0.50 % citric acid	5.07	4.93	4.83	4.57
T_{10}- 1 % $NaHSO_3$ + 0.50 % citric acid	4.99	4.61	4.53	4.34
T_{11} - 0.25 % KMS + 0.50 % citric acid	5.08	4.92	4.75	4.52
T_{12}- 0.5 % KMS + 0.50 % citric acid	5.33	5.13	5.07	4.76
T_{13}- 0.5 % Sodium metabisulphite + 0.50 % citric acid	5.08	4.99	4.91	4.70
T_{14}- 1% Sodium metabisulphite + 0.50 % citric acid	4.90	4.76	4.67	4.45
T_{15}- 1 % NaCl + 0.50 % citric acid	4.77	4.60	4.52	4.24
T_{16}- 2 % NaCl + 0.50 % citric acid	4.97	4.65	4.59	4.32
T_{17}- Control (untreated)	4.92	4.55	4.49	4.20
S. Em ±	0.145	0.122	0.124	0.134
C. D. at 1%	0.421	0.355	0.360	0.389

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