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Standardization of Honey and Sugar Solution of Osmotic Dehydration of Pineapple (*Ananas comosus* L.) Fruit Slices

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A B S T R A C T

The main purpose of the study was to investigate the effect of solution on the shelf life and quality of pineapple slices and development of high quality dehydrated pineapple products. Pineapples collected from local market cut into 6, 8, 10 and 12 mm slices. Solution effect was assessed using honey, sugar solution. The osmosis samples were dried in a mechanical drier at 55-60°C temperature till the fruits reached the desired moisture content and product quality. Fresh and dehydrated pineapple was analyzed for their chemical composition. The experiment of pretreatments moisture loss (%), weight loss (%), solid gain (%) dehydrated yield (%) was assumed as indicator of solution effect and slightly decreased (per unit weight) with increasing thickness of pineapple slices at constant immersion time (24 hour) and concentration sugar solution and honey. This gain was higher in honey solution followed by sugar solution. After osmotic dehydration, the pineapple slices were packed in low density polythene covers and stored at ambient temperature for a period of 90days.The Physico-chemical properties and organoleptic quality of the products were evaluated during the storage period. Moisture content (11.14 to 13.25%),ascorbic acid(23.11 to12.96mg/100g), acidity(1.09 to 0.83%), total sugars (61.39 to 66.86%) and Reducing sugars(28.47 to 32.38%).However osmotic pretreatment with 50^0sugar syrup at (25^0 C) for 24 hours(T_5) resulted in highest sensory score (8.05) while it was lowest in control (4.22) and steeping of pineapple slices in honey syrup at (25^0 C)for 24 hours (T_5), resulted in the highest sensory score (8.49), while the lowest was recorded 12mm thickness pineapple slice using in honey(T_8).

Introduction

Pineapple (*Ananascomosus* L.) is one of the commercial fruit crops of tropical and sub-tropical fruit, belonging to the family Bromeliaceae (Fig. 1). Pineapple is non-climacteric fruits and harvesting at optimum ripening stage is able to ensure satisfying quality. India is the fifth largest producer of pineapple. In India, its cultivation is mostly confined to southern part of India (Karnataka, Tamil Nadu, Andhra Pradesh and Kerala). Pineapple is one of the most important fruit crops in West Bengal and Arunachal Pradesh of India Pineapple fruits are an excellent source of vitamins (vitamin A, B and fairly rich in vitamin C) and minerals (ca, mg, k iron) and supply arrays of color, flavor and texture to the pleasure of eating. Drying and dehydration are the most important methods that are widely practiced for fruits and vegetables because of considerable saving in packaging and storage. Drying is one of the most common methods of food preservation for a long time. Innovation of novel technologies and developments are constantly taking place in the existing methods of drying (Sagar and Suresh, 2009).Preparation of good quality pineapple slices by using sugar solution and honey as an osmotic agents. Honey has been reported to be eff ective in preventing enzymatic browning and can improve organoleptic characteristics (Oszmianski and Lee, 1990). Honey has been used to inhibit polyphenol oxidase activity in apple slices and grape juice (Oszmianski and Lee, 1990).To get good quality dehydrated product osmotic dehydration is one of the novel drying technique consists of partial removal of moisture from the produce by placing it in concentrated sugar solution and honey. Osmotic dehydration is a useful technique for the production of safe, stable, nutritious, tasty, economical and concentrated food obtained by placing the solid food, whole or in pieces in sugar or salt solution of high osmotic pressure (Rashmi *et al.,* 2005). (Gurumeenakshi *et al.*, 2005) reported the osmotic concentration process for mango and papaya slices in sugar syrup of 60°Brix for 18 h and packed in metalized polypropylene covers for storage up to 6 months. There were little changes in chemical, physical and sensory properties and consumer acceptability was high during storage period. Sachadev *et al.*, (2007) studied the osmotic dehydration of apple slices by using 50 and 70Brix osmotic solution and KMS and blanching as pretreatments and reported that samples treated with KMS for 15 min with 50°Brix osmotic syrup found to be better for the retention of fruit colour, appearance and taste.

The principle used in this process is that water diffuses from dilute solution to the concentrated solution (Hypertonic solution) through a semi-permeable membrane until concentration equilibrium is reached. The technique can be used to remove water from cellular materials such as fruits and vegetables. The cell membrane of these materials is semi-permeable in nature and is more selective for water and acid than solute.

Considering these points, there is a greater scope and need for drying of pineapple for making it available throughout the year and value addition for pineapple fruit in good quality.

Treatments Combinations

T_0: Control

T_1: Steeping of 6 mm slices in 50^0 Brix Sugar syrup

T_2: Steeping of 8 mm slices in 50^0 Brix Sugar syrup

T_3: Steeping of 10 mm slices in 50^0 Brix Sugar syrup

T_4: Steeping of 12 mm slices in 50^0 Brix Sugar syrup

T_5: Steeping of 6 mm slices in Honey

T_6: Steeping of 8 mm slices in Honey

T_7: Steeping of 10 mm slices in Honey

T_8: Steeping of 12 mm slices in Honey

Materials and Methods

The experiment was undertaken in the Department of Horticulture Post Harvest Lab, Sam Higginbottom University of Agriculture Technology and Sciences, Allahabad. To study the effect of osmotic solutions and sample size on Osmotic dehydration thereby formulating good quality Osmotic dehydrated pineapple. The data from the study was subjected to analysis in a Completely

Randomized Design (CRD).The experiment was replicated three times for statistical purposes and analysis of variance was used to evaluate the significant differences of the data at $p < 0.05$.

Results and Discussion

The parameters like sample size and osmotic solutions had significantly affected the kinetics of osmotic dehydration in Pineapple (Table 1). 6mm thickness samples dehydrated using honey had maximum Moisture loss(35.34%) solid gain (15.54%), which was at par with 6 mm samples in sugar solution moisture loss (27.12%), and solid gain (11.28%) Per cent water loss was maximum (22.82) in 6mm thickness samples dehydrated using honey and it was on par with other honey samples except and per cent water loss minimum (13.11%) in 12 mm slice thickness samples dehydrated using sugar solution.6 mm samples dried in sugar solution and 6 mm, 8mm samples dehydrated using honey had maximum Dehydrated yield (%) with 26.34 and 31.95, 29.31 respectively (Fig. 3).

Physic- Chemical quality parameters viz., Moisture content (%), Ascorbic acid (%) (mg $100g^{-1}$), Acidity (%), Total sugars (%), Reducing sugars (%) of the Osmotic dehydration product were recorded varied significantly with varying sample size and osmotic solutions (Table 2). The minimum percentage of moisture content was observed in 6 mm pineapple slices immersed in honey syrup (T_5) from initial to 90th days of storage respectively. The steeping of 12 mm slices in 50^{O}Brix sugar syrup for 24 hours (T_4) recorded higher moisture content percentage 17.54 %) at initial to 90th days of storage respectively (Sneha *et al.,* 2013), (Chenlo *et al.,* 2012). The ascorbic acid content decreased with increase the period storage and increase in syrup concentration. The ascorbic acid content was maximum (17.7 mg 100 g^{-1}) in 12 mm slices immersed in 50^{O}Brix sugar syrup for 24 hours (T_4) The ascorbic acid content was minimum in steeping 6 mm slices in honey for 24 hours (T_5) (Fig. 2), (9.72mg 100 $g^{-1)}$ at 90days interval (Surabhirai *et al.*, 2007) while minimum acidity was recorded at 90 days interval in term of treatment (T_8), (0.02 %) (Riya and Khatkar, 2013) in Aonla. The total sugars and reducing sugars of osmotic ally dehydrated pineapple as affected by different slice thickness and concentrations of sugar syrup are presented in table 2. The data showed maximum total sugars was observed in T_1 (78.65 %) steeping 6 mm slices in 50^{O}Brix sugar syrup for 24 hours and minimum total sugar was recorded in steeping 12 mm slices in honey at for 24 hours (T_8), (63.45 %) at 90days interval (Sneha *et al.*, 2013), while maximum reducing sugars was observed in (T_1), (41.05) and minimum was recorded observed (T_8), (29.13) at 90days interval (Damame *et al.*, 2002).

Fig.1 Fresh and uniformed ripened pineapple fruit

Fig.2 Steeping of 6mm slices of pineapple in honey

Fig.3 Dehydrated pineapple slices

Fig.4 Process of osmotically dehydrated pineapple slices using honey and sugar solution

Fig.5 Effect of slice thickness, honey and sugar concentration on Moisture content (%) in Osmotically dehydrated Pineapple during storage

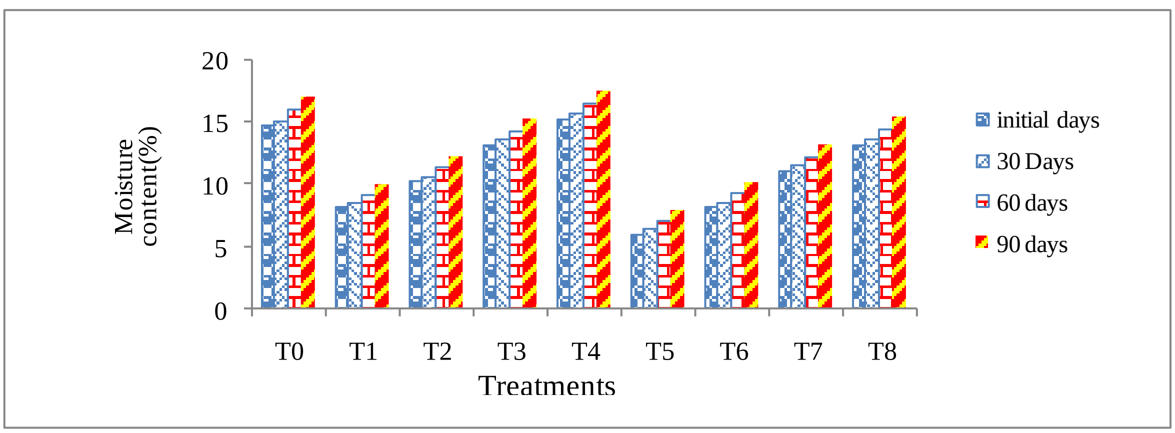

Fig.6 Effect of slice thickness, honey and sugar concentration on Ascorbic acid (mg /100g) in Osmotically dehydrated pineapple during storage

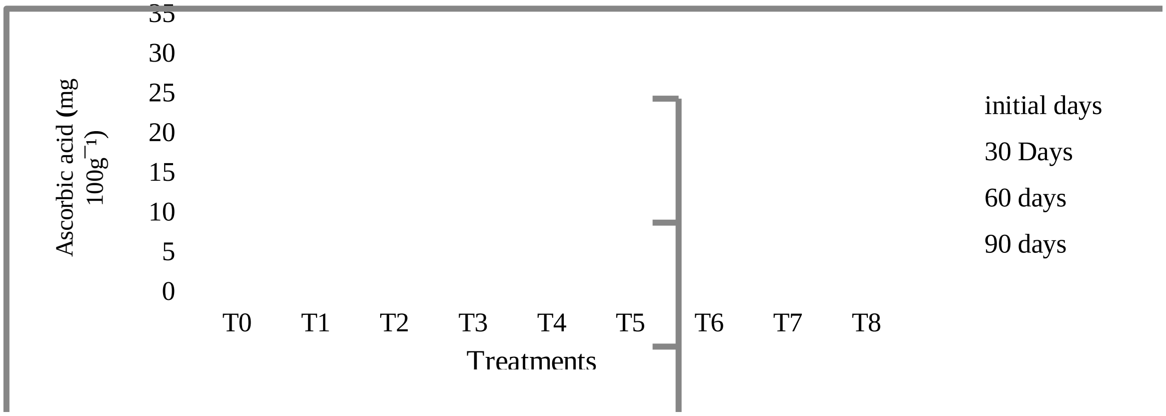

Fig.7 Effect of slice thickness, honey and sugar concentration on Colour in Osmotically dehydrated pineapple during storage

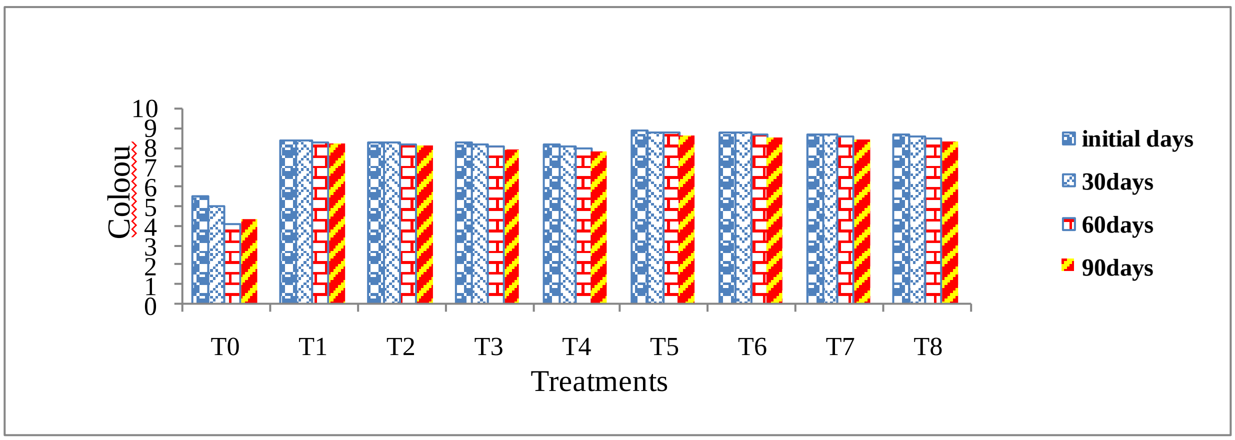

Table.1 Effect of slice thickness, honey and sugar concentration on per cent moisture loss, Weight loss, solid gain, dehydrated yield of pineapple after osmosis

Treatments	Moisture loss %	Water loss%	Solid gain %	Dehydrated yield%
T_0	24.7	15.03	10.92	19.13
T_1	27.12	14.79	11.28	26.34
T_2	26.22	14.45	10.74	23.76
T_3	25.23	14.04	10.08	20.22
T_4	24.12	13.11	9.36	15.87
T_5	35.34	22.82	15.54	31.95
T_6	34.47	22.08	15.27	29.31
T_7	33.36	21.78	14.61	25.86
T_8	32.13	21.15	13.86	23.22
Mean	**29.19**	**17.69**	**12.41**	**24.99**
F- test	S	S	S	S
S. Ed. (±)	1.763	0.500	0.345	1.189
C. D. (P = 0.05)	3.668	1.060	0.732	2.520

Treatments Moisture Total sugars (%) Reducing

		Ascorbic acid (mg $100g^{-1}$) 90DAT	Acidity (%) 90DAT		
T_0	17.13	7.8	0.51	32.81	14.72
T_1	10.12	10.22	1.94	78.65	41.05
T_2	12.31	11.35	1.14	73.78	37.01
T_3	15.3	16.86	0.57	70.49	33.22
T_4	17.54	17.7	0.21	65.7	31.42
T_5	8.01	9.72	1.8	76.53	38.82
T_6	10.22	10.65	1.01	71.86	35.05
T_7	13.22	15.73	0.3	68.44	31.02
T_8	15.45	16.67	0.02	63.45	29.13
Mean	**13.25**	**12.96**	**0.83**	**66.86**	**32.38**
F- test	S	S	S	S	S
S. Ed. (±)	0.010	0.009	0.007	0.013	0.011
C. D. (P = 0.05)	0.021	0.019	0.014	0.028	0.023

Table.2 Effect of osmotic solution and sample size on Physico-chemical characteristics of Osmotic Dehydration of pineapple slice during storage

Table.3 Effect of osmotic solution and sample size on Sensory quality (%) and Osmotic Dehydration of pineapple slice during storage

Treatment	Color 90DAT	Flavor 90DAT	Taste 90DAT	Texture 90DAT	Overall acceptability 90DAT
$\mathbf{T_0}$	4.33	4.10	4.23	4.21	4.22
$\mathbf{T_1}$	8.15	7.82	8.14	8.09	8.05
$\mathbf{T_2}$	8.06	7.77	8.03	7.89	7.94
$\mathbf{T_3}$	7.91	7.64	7.92	7.56	7.76
$\mathbf{T_4}$	7.78	7.52	7.64	7.41	7.59
$\mathbf{T_5}$	8.60	8.28	8.57	8.51	8.49
$\mathbf{T_6}$	8.51	8.18	8.43	8.35	8.37
$\mathbf{T_7}$	8.41	8.11	8.26	8.08	8.22
$\mathbf{T_8}$	8.29	8.03	8.06	7.94	8.08
Mean	**7.78**	**7.49**	**7.69**	**7.56**	**7.63**
Result	S	S	S	S	S
S. Ed. (±)	0.74	0.74	0.76	0.78	0.74
C.D. at 5%	1.58	1.58	1.62	1.66	1.58

Sensory analysis of the developed products revealed that the 6mm thickness osmotic dehydrated pineapples in honey had maximum colour (Sensory score) was recorded in the term of treatment (T_5), (8.72) Chandan *et al.,* (2012), while maximum flavor (Sensory score) war recorded for 90days interval in the term of treatment (T_5), (8.58).

The data should be presented in table 3 showed maximum taste (Sensory score) war recorded for 90days interval in the term of treatment (T_5), (8.76), while texture (Sensory score) war recorded for 90 days interval in the term of treatment (T_5), (8.71) (Thippanna 2005).

The maximum overall acceptability (Sensory score) was recorded for 90days interval in the term of treatment (T_5), (8.69) (Sumitha, 2010).

In conclusion, Osmotic dehydrated pineapple is a novel value added product developed from the Post-Harvest Lab, Department of Horticulture, SHUATS, Allahabad. Based on the finding of the present experiment it is concluded the treatment T_5 (steeping of 6mm slices in honey syrup for 24 hours) was found to be best in respect of Moisture content (8.1%), Ascorbic acid (9.72mg /100g), Acidity (1.8%), Total sugars (76.53%), Reducing sugars (38.82%) and also excellent in Sensory quality (Colour, Flavour, Taste, Texture and Overall acceptability) (Figs. 4-7).

Currently available technology for the development of value added Pineapple products utilizes sugar as the raw material, whereas sugar has been completely replaced with honey in preparation of this product, hence having medicinal property with no side effect of sugar.

This is a 'ready to eat' high quality snack food with extended shelf life, preserving natural qualities of pineapple. By developing this value added products, it is possible to make the seasonal fruit available to the consumers throughout the year.

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