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Studies on effects of different packaging material on shelf life of processed tomato paste

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Abstract
Packaging plays an immense role in shelf life extension of food products. In this study attempst were made to evaluate the effects of different packaging material on the qualities of tomato paste. Present investigation were carried over a 45 days to assess the quality of prepared tomato paste during storage. Furthermore, tomato paste packed in PET (Plastic bottle) and Glass bottle analyzed for its TSS, Moisture content, Acidity, and pH. At the end of storage period of 45 days it was evident that tomato paste packed in glass bottle retains good results as compared to plastic bottle.

Keywords: Tomato paste, packaging material, glass bottle, plastic bottle (PET)

1. Introduction
Tomato (*Lycopersicon esculentum* Mill.) is one of the most important edible and nutritious vegetable crops in India. It is cultivated in almost all home gardens and also in the field by the use of rainfall and irrigation for its adaptability to wide range of soil and climate in India. It ranks next to potato and sweet potato in respect of vegetable production in the world. It iswidely cultivated in tropical, sub-tropical and temperate climates and thus it ranks third in terms of world vegetable production FAO (2006).

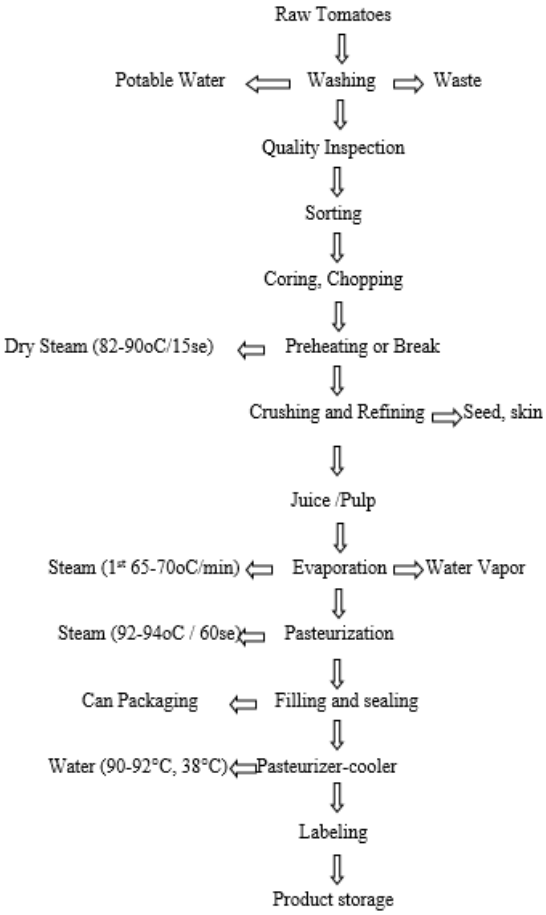
Tomato is third vegetable next to potato and sweet potato in consumption. Its processed form include pulp, putee, sauce, juice, paste and peeled whole tomato Hayes *et al*., (1998) [6]. Tomato is popular vegetable fruit because it supplies vitamin-c, adds variety of color and flavour to the foods. Tomatos are used as salad, [aste ketchup, puree, juice, sauce, powder, and in many other ways. Tomatoes are low in calories, about 35 for a medium tomato, but proportionately high in sugar corresponding 8 grams. Its juice is naturally low in sodium (one cup has 1% of your daily value) and zero fat. It is also a good source of copper, iron, magnesium, manganese, niacin, pantothenic acid, Thiamine and vitamin K; and a very good source of Flolate, potassium, vitamins A, B6 and C Gould, (1974) [4].

Customer ae increasingly offering PET bottles due to reason of hygiene and being able to carry Vottle home. The major soft drink manufacturer such as Pepsi, Coke, and Parle are installing new PET bottling line in all their bottling plants in India to cater the growing demant for PET bottles. In the present investigation the various packaging material used inclusive of glass bottle and PET bottle. Plastic packaging is increasingly used for economic reasons and most widely used as PET (Polyethylene Terephthalate). Development of new PET technologies as multilayer PET, tend to decrease permeability to oxygen of in order to maintain quality of tomato paste.

In view of the various facts of tomato paste and its nutritional composition it is important to evaluate shelf life of tomato paste by different packaging material.

2. Materials and Methods
The packaging of tomato paste in glass and PET bottles to increase the shelf life of paste were carried out in the department of food process engineering. SHUATS, Allahabad. During the summer season of the year 2017-2018.

2.1 Methods for Standardization of Tomato-Paste



2.2 physico-chemical analysis

Tomato paste were analysed for its physic- chemical properties *viz*., TSS (AOAC, 2002) [1], Moisture content (AOAC, 1980) [2], Titrable acidity (AOAC, 2002) [1], pH (AOAC 2002) [1].

2.3 Statistical analysis

The experiment was conducted by adopting completely randomized design. The data recorded during the course of investigation were statistically analyzed by the Analysis of Variance suggested by Gupta (1997) [5]. The significant effect of treatment was judged with the help of F (variance ratio). Calculated F value was compared with the table value of F at 5% level of significance. If calculated value exceeded the table value the effect was considered to be significant. The data of rate of drying was analyzed by student 'T'-distribution test. The significant of the study was tested at 5% level.

$T = r\sqrt{(n-2)} / \sqrt{(1- r^2)}$

$SEd = \sqrt{(2MESS/R_o)}$

CD = Sed x t5% at e.d.f

Where,

T = distribution of observation
r = coefficient of correlation
n = number of observations
SEd = standard error of difference
Ro = Number of replications
e.d.f. = error degree of freedom
CD = Critical difference
MESS = error mean sum of squares

3. Results and Discussion

3.1 Effects on total soluble solids (°Brix) of tomato paste

PET bottle and glass bottle at 28°Brix, which were evaluated for TSS composition of tomato paste. TSS composition were found for 28°Brix.It is clearly seen that TSS were not so affected after storage for given days. Table comprised the mean value of TSS content of various tomato paste packed in glass and pet bottle at 28°brix and stored for 45 days. The results are further depicted through bar diagram for more comparison of results.

TSS of tomato paste showed no significant change during storage. The TSS content in original and fresh tomato is 4.5° Brix While the TSS content of the tomato paste prepared and packed in glass and PET bottle were found to vary from 27° Brix tomato paste.

Table 1: Effects of Packaging Material on TSS of Tomato Paste

Brix	Packaging	TSS			
		0 Day	15 Day	30 Day	45 Day
28	Control	28.00	28.00	27.46	27.06
	Glass Bottle	28.03	27.93	27.36	24.60
	Plastic Bottle (PET)	27.96	27.80	27.06	26.90
	T Test	N/ A	N/A	S	S
	C. D.	-	-	0.21	0.63
	SE (m)	0.06	0.09	0.05	0.15
	SE (d)	0.08	0.13	0.07	0.22
	C.V.	0.38	0.57	0.33	1.04

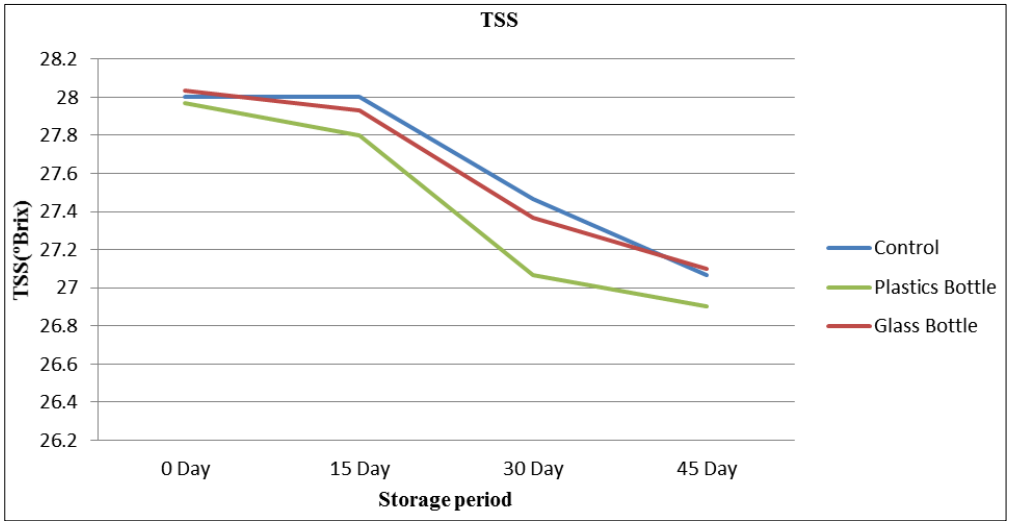


Fig 1: Effect of different packaging material on TSS (°Brix) of Tomato paste.

3.2 Effect of storage period on Moisture content % of Tomato paste during storage

PET bottle and glass bottle at 28°Brix, which were evaluated for Moisture Content Measurement composition of tomato paste. Moisture Content Measurement composition were found for 28°Brix. It is clearly seen that Moisture Content Measurement were not so affected after storage for given days. Table comprised the mean value of Moisture Content Measurement content of various tomato paste packed in glass and pet bottle at 28°brix and stored for 45 days. The results are further depicted through bar diagram for more comparison of results.

Moisture Content Measurement of tomato paste showed no significant change during storage. The Moisture Content Measurement content in original and fresh tomato is 94% while the Moisture Content Measurement content of the tomato paste prepared and packed in glass and PET bottle were found to vary from 78% tomato paste.

Table 2: Variation in moisture content of % Tomato paste during storage

Brix	Packaging	Moisture Content Measurement (%)			
		0 Day	15 Day	30 Day	45 Day
28°B	Control	76.60	76.60	76.60	78.10
	Glass Bottle	78.95	78.95	78.95	79.13
	Plastics Bottle	77.55	77.55	77.55	79.93
	T Test	N/A	N/A	N/A	S
	C.D.	-	-	-	0.45
	SE(m)	0.62	0.62	0.62	0.11
	SE(d)	0.87	0.87	0.87	0.16
	C.V.	1.13	1.13	1.13	0.25

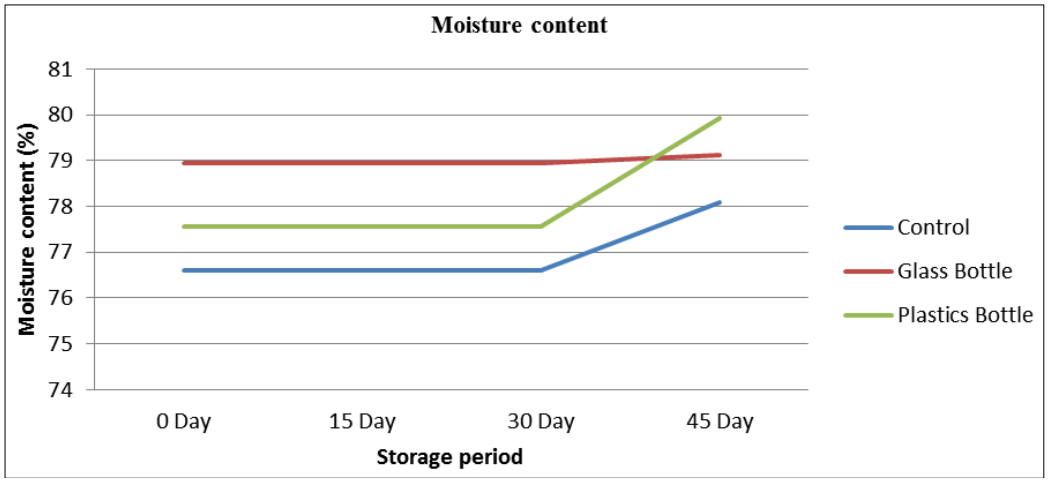


Fig 2: Effect of storage period on Moisture content % of Tomato paste during storage

3.3 Titrable Acidity

PET bottle and glass bottle at 28° Brix, which were evaluated for titrable acidity composition of tomato paste. Titrable acidity composition were found for 28 °Brix. It is clearly seen that titrable acidity were not so affected after storage for given days. Table comprised the mean value of titrable acidity content of various tomato paste packed in glass and pet bottle at 28° brix and stored for 45 days. The results are further depicted through bar diagram for more comparison of results.

Titrable acidity of tomato paste showed no significant change during storage. The titrableacidity content in original and fresh tomato is 0.54% while thetitrable acidity content of the tomato paste prepared and packed in glass and PET bottle were found to vary from 0.62% tomato paste.

Table 3: Effect of different packaging material on Titrable Acidity (%) of Tomato paste.

Brix	Packaging	Titrable Acidity (%)			
		0 Day	15 Day	30 Day	45 Day
28 °B	Control	0.55	0.58	0.62	0.63
	Glass Bottle	0.54	0.56	0.56	0.57
	Plastics Bottle	0.48	0.51	0.51	0.51
	F Test	N/S	S	S	S
	C.D.	-	0.03	0.07	0.05
	SE(m)	0.01	0.01	0.01	0.01
	SE(d)	0.02	0.01	0.02	0.01
	C.V.	4.87	3.01	5.64	3.99

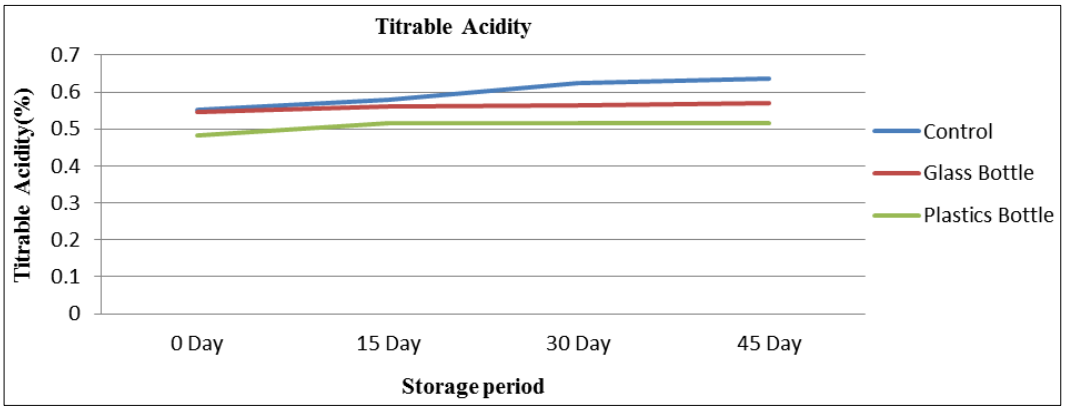


Fig 3: Effect of different packaging material on Titrable Acidity (%) of Tomato paste.

3.4 pH (Hydrogen ion concentration)

PET bottle and glass bottle at 28°Brix, which were evaluated for pH of tomato paste. pH were found for 28 Brix. The mean value of pH content of various tomato paste packed in glass and pet bottle at 28 Brix and stored for 45 days. The results are further depicted through bar diagram for more comparison of results. It is clearly seen that pH were reduced during the storage period. It was found that there was general fall of pH during storage. The maximum fall in pH was recorded in PET bottle sample (5.37). For 45 days of storage. The pH of glass bottle was found to be the best after long storage of 45 days (5.50).

It was evident from the table that there was decreasing trend in the pH value of the tomato pulp during storage period. This fall is mainly due to formation of sulphurous acid during storage.

Table 4: Effect of different packaging material on pH of Tomato paste.

Brix	Packaging	pH			
		0 Day	15 Day	30 Day	45 Day
28 °B	Control	4.14	4.70	4.97	5.40
	Glass Bottle	4.42	4.91	5.40	5.50
	Plastics Bottle	4.27	4.27	4.79	5.37
	F Test	S	S	N/S	N/S
	C.D.	0.03	0.44	-	-
	SE(m)	0.00	0.10	0.13	0.11
	SE(d)	0.01	0.15	0.19	0.16
	C.V.	0.37	4.09	4.69	3.64

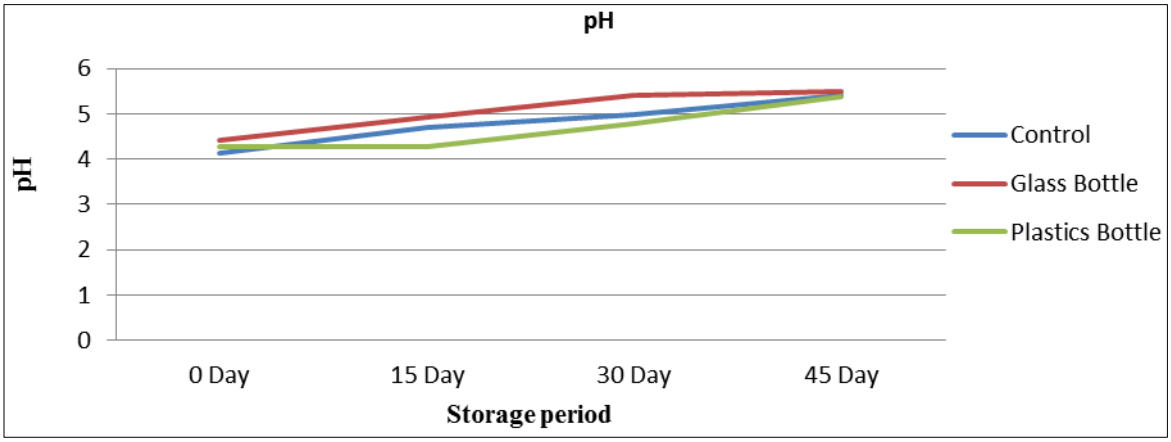


Fig 4: Effect of different packaging material on pH of Tomato paste

4. Conclusion

From the present research work following conclusion were drawn

- The result of Total Soluble Solid, Moisture content, Titrable acidity, pH, Lycopene is best in glass bottle as compared to plastic bottle.
- Overall acceptability of tomato paste package in glass bottle gave the best result.

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