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Research on Dehydrated Tomato Leathers: A Review

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Abstract
Tomato leathers are pectic gels obtained by dehydrating tomato purees to produce restructured, attractive flexible sheets which retain shape and are eaten as snack or dessert. Home preparation is usual to preserve fruits. This product adds variety to a healthy diet and possesses dietary fibre, vitamins and minerals while providing a good energy intake. Tomato leather is prepared from fluid-like formulations placed in trays and dehydrated in hot- air dryers at 60-80 ºC and 2-4 m/s. The formulation usually consists of fruit puree added with sucrose or glucose syrup to increase sweetness, solids content, and to reinforce the sugar-acid-high methoxyl pectin gelation. Besides, citric acid may be added to decrease the pH below 3.5. At low pH, carboxyl groups of pectins are undissociated and participate in hydrogen bonds that support gel structure. Investigations on fruit leathers began in 1978 and kept an irregular pace, except in the last five years. The aim of this work is to review published research on Tomato leathers in order to summarize available information on formulations, quality indices and nutritional retention in relation to the drying technique utilized, being this useful to industry and health-conscious consumers.

Keywords: Calcium; dehydration; Tomato leather.

Introduction
Tomato leathers are dehydrated fruit-based products that are eaten as candy or snacks, and presented as flexible stripes or sheets. They receive this name because of the final product aspect (it is shiny and has the texture of leather).

The origin of fruit leathers may go back to the Persian Empire. They are known as "Pestil" in Turkey, "Bastegh" or "Pastegh" in Armenia, "Qamar al deen" in Lebanon, Syria and other Arab countries and "Fruit roll" or "Fruit leather" in the United States. The last denomination is possibly more usual in the scientific literature [1, 2]. Due to its novel and attractive structure, and for being products that do not require refrigeration, they constitute a practical way to incorporate fruit solids, especially for children and adolescents. Fruit leathers allow leftover ripe fruits to be preserved. Moreover, fruit pulp left from making jellies, during prolonged time in reduced volumes may also be converted into leathers. In recent years, their popularity has increased, transforming from a homemade preparation into an industrial product.

Fruit leather is one product that can be made using a drying process. Fruit leathers are dried sheets of fruit pulp that have a soft, rubbery texture & a sweet taste. Fruit leathers can be dried using various drying forces including sun drying, oven drying, cabinet drying & dehydrator drying. The edible portion of fruit (one or more types) is pureed, mixed with other ingredients to improve its physico-chemical & sensory characteristics [3].

Preparation of Fruit Leathers

Tomato (*Lycopersicum esculentum* Mill.) & Sugar was purchased from the local market of Allahabad city while Citric acid & Calcium carbonate ware purchased from Thermo Fisher Scientific India Pvt. Ltd.

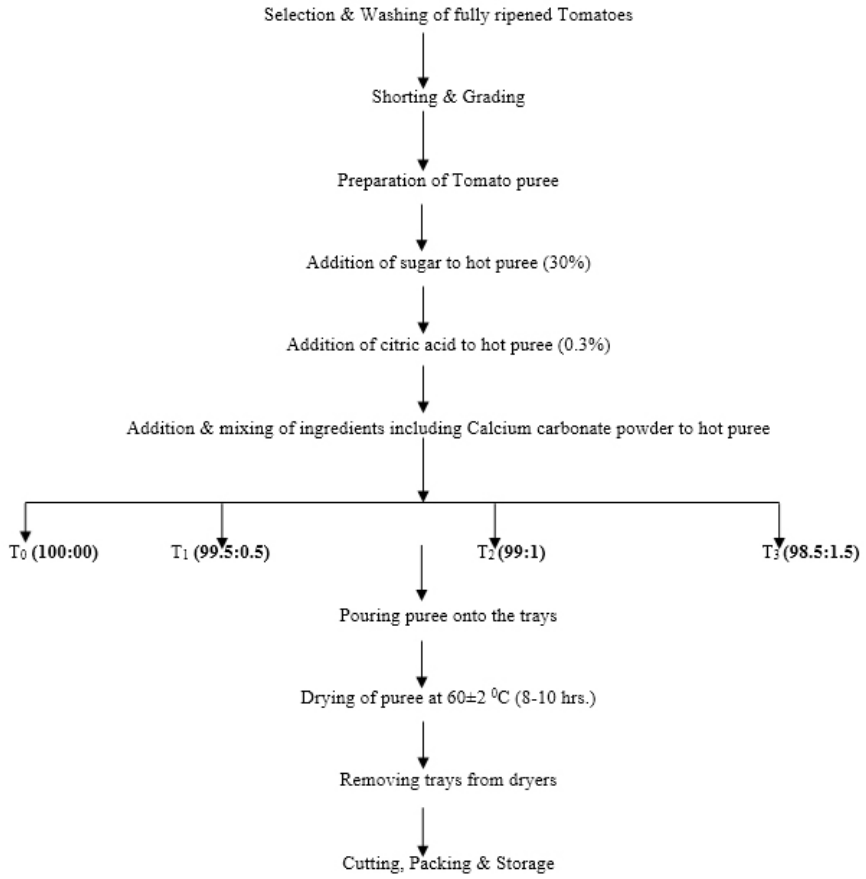

Fig 1: Schematic diagram of the preparing process of tomato Leather.

Results & Discussion

Table 1: Mean value, F-test, S. Ed. & C.D. value of all parameters.

Parameters	Scores / Values based on mean values of different parameters of treatment				F-Test	S. Ed.	C.D.
1. Sensory score (9- point Hedonic Score)							
	T_0	**T_1**	**T_2**	**T_3**			
(a) Colour & Appearance	8.12	8.29	7.54	7.05	*	**0.42**	**0.92**
(b) Flavour & Taste	7.64	8.55	7.24	7.43	*	**0.40**	**0.87**
(c) Body & Texture	7.72	8.08	7.59	7.21	*	**0.19**	**0.41**
(d) Overall acceptability	7.58	7.80	7.29	7.26	*	**0.15**	**0.32**
2. Physio-Chemical analyses (%)							
(a)Total Solides	80.28	80.18	79.92	78.84	*	**0.42**	**0.91**
(b) Total Mois ture	19.72	19.82	21.08	21.16	*	**0.42**	**0.91**
(c) Total Protéine	1.37	1.39	1.40	1.42	*	**0.01**	**0.03**
(d)Titratabe Acidité	1.29	1.34	1.39	1.42	*	**0.01**	**0.02**
(e) Total Ash	0.70	0.66	0.54	0.48	*	**0.08**	**0.017**
(f) Crude Fat	0.59	0.62	0.64	0.65	*	**0.01**	**0.01**
(g) Total Calcium	0.10	0.60	0.80	0.90	*	**0.008**	**0.020**

* = Significant

The different parameters of experimental samples are as follows

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(a) Colour & Appearance: The highest scores for colour & appearance was received in the experimental samples T_1 (6.74) followed by T_2 (6.49) & T_3 (6.43). There was non-significant difference between all the treatments which may be ascribed by the different level of calcium carbonate powder in experimental samples.

(b) Flavour & Taste: The highest scores for flavour & taste was received in the experimental samples T_1 (6.35) followed by T_2 (6.34) & T_3 (6.31). There was non-significant difference between all the treatments which may be ascribed by the different level of calcium carbonate powder in experimental samples.

(c) Body & Texture: The highest scores for body & texture was received in the experimental samples T_1 (5.94) followed by T_2 (5.86) & T_3 (5.75). There was significant difference between all the treatments which may be ascribed by the

different level of calcium carbonate powder in experimental samples.

(d) Overall Acceptability: The highest scores for overall acceptability was received in the experimental samples T_1 (6.34) followed by T_2 (6.30) & T_3 (6.16). There was significant difference between all the treatments which may be ascribed by the different level of calcium carbonate powder in experimental samples.

Physico-chemical parameters of experimental samples are as follows

(a) Total Solids: The highest mean of total solid % was recorded in the experimental sample T_3 (85.33) in comparison to T_2 (83.83) & T_1 (82.55). The Increasing tread of total solids content might be due to increasing level of calcium carbonate powder in the final product & Calcium carbonate powder contains 99 % total solids. So, total solids content increases with increase in level of calcium carbonate. There was significant difference between all the treatments which may be ascribed by the different levels of samples.

(b) Total Moisture: The highest mean of total moisture % was recorded in the experimental sample T_1 (17.45) in comparison to T_2 (16.17) & T_3 (14.67). The decreasing trend of moisture content might be due to increasing concentration of total solids content with increasing level of calcium carbonate powder in the final product. There was significant difference between all the treatments which may be ascribed by the different levels of samples.

(c) Total Protein: The highest mean of total protein % was recorded in the experimental sample T_1 (2.46) in comparison to T_2 (2.41) & T_3 (2.38). The decreasing trend of total protein content might be due to decreasing concentration of tomato pulp in the final product & pulp contains protein & there is zero protein in calcium carbonate powder. There was significant difference between all the treatments which may be ascribed by the different levels of samples.

(d) Titratable Acidity: The highest mean of titratable acidity % was recorded in the experimental sample T_1 (1.18) in comparison to T_2 (1.16) & T_3 (1.12). The Decreasing trend of titratable acidity % might be due to increasing concentration of calcium carbonate in the final product & Calcium carbonate is basic in nature & acts as acidity regulator in the product. There was significant difference between all the treatments which may be ascribed by the different levels of samples.

(e) Total Ash: The highest mean of total ash % was recorded in the experimental sample T_3 (1.72) in comparison to T_2 (1.67) & T_1 (1.53). The Increase trends of total ash % might be due to increasing level of calcium carbonate in the final products & Calcium carbonate contains salts of Calcium which increased total ash content in the final product. There was significant difference between all the treatments which may be ascribed by the different levels of sample.

(f) Crude Fat: The highest mean of crude fat % was recorded in the experimental sample T_1 (0.32) in comparison to T_2 (0.29) & T_3 (0.27). The decreasing trends of total fat % might be due to decreasing concentration of tomato pulp & increasing concentration of calcium carbonate in final product also pulp contains total fat & there is no fat content in calcium carbonate powder. There was significant difference between all the treatments which may be ascribed by the different levels of sample.

(g) Total Calcium: The highest mean of total calcium % was recorded in the experimental sample T_3 (0.92) in comparison to T_2 (0.81) & T_1 (0.64). The Increasing trends of total calcium content might be due to increasing concentration of Calcium carbonate powder in experimental samples.

Conclusion

In view of experimental results obtained during the present investigation, it may be concluded that the samples of treatment T_1 was found to be the best in every aspect of sensory quality i.e., colour & appearance (8.29), flavour & taste (8.55), body & texture (8.08) and overall acceptability (7.80).

Therefore, it may be concluded that, there is a great scope of manufacturing fruit lather using tomato pulp fortified with calcium carbonate as it is proved to have nutritional properties as well as health benefits and it is good for old age group people.

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