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Analysis of shelf life of dehydrated tomato powder

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Abstract
Preservation of vegetables involving chemical additives is cheap and easy to operate technology best suited for application in developing countries to preserve perishable commodities like vegetables. An investigation was undertaken to study the shelf life of De-hydrated tomato powder. Control as well as pretreated tomato pieces were subjected to dehydration experiments and tomato powder was prepared. Powder samples were evaluated for peroxide value and sensory parameters. Results found that the appearance, colour, flavor, taste and texture of stored powders were changed as seen visually, due to this reason, organoleptic score of the recipes prepared with stored powder had decreased with increasing storage period. It was observed that, as storage period increased, mean score for colour of recipes had decreased significantly at one percent level. It was noticed that even though there was decrease in organoleptic score for sensory characteristics, recipes from powder were acceptable by the judges. Peroxide value of stored powders differed significantly between the months of storage, higher value being recorded on the third month of storage.

Keywords: Preservation, sensory, characteristics, organoleptic evaluation, Dehydration, storage period.

Introduction
Fresh fruits have been preserved with additives like sugar, salt and various condiments for a long time. The simple technique of preservation with sugar and salt was principally based on reduction of moisture in preserved fruits to a level when the development of microorganisms is largely restricted. Spices and condiments not only added flavour but some of them also played a synergistic role in preservation due to antimicrobial activity of their essential oil contents. Preservation of fruits with sugar in the form of preserves and with salt in the form of pickles has been widely practiced both in homes and commercially from the very early days.
Preservation of vegetables involving chemical additives is cheap and easy to operate technology best suited for application in developing countries to preserve perishable commodities like vegetables. Fresh vegetables when stored in solution containing salt, sugar, organic acids and other food additives can be used straight way in pickles and salads after removing them from the covering brine. The excess salt and acid from vegetables, if not required could be washed in frequent changes of water and they standardised a simple solution having ingredients like five per cent salt, 1.2 per cent glacial acetic acid and 1000 ppm potassium metabi sulphite in which fresh vegetables could be dipped and preserved for long term storage. The present investigation to undertaken to analyse the shelf life of dehydrated tomato powder in terms of chemical and sensory parameters.

Materials and Methods
Firm Sadabahar (S-28) were obtained from the market and used for dehydration purpose as it was available in large quantities and had more flesh content.

Dehydration process
Healthy tomatoes were washed thoroughly with cold tap water to remove adhering extraneous matter. Tomatoes were blanched in boiling water for two to three minutes (Giridharlal *et al.,* 1960) [1]. After that tomatoes were peeled manually. They were cut in to small pieces with stainless steel knife.
Prior to drying, for pretreatments the separate batches of tomato pieces were dipped in 0.25 per cent, 0.5 per cent, 0.75 per cent of potassium metabisulphate solution for 15 minutes. The batch without sulphitation was kept as control.

The pretreatments selected were as follows:

T_1 Blanched alone - control
T_2 Blanched plus potassium metabisulphite 0.25%
T_3 Blanched plus potassium metabisulphite 0.5%
T_4 Blanched plus potassium Meta bisulphite 0.75%

Control as well as pretreated tomato pieces were subjected to dehydration experiments and tomato powder was prepared. The powder samples were packed in polythene bags, sealed and stored at ambient temperature in glass bottles for a period of three months. The powders were evaluated for peroxide value and sensory parameters.

Peroxide value

Peroxide value is a measure of peroxides present are determined by titration against thiosulphate in the presence *of* potassium iodide. Starch was used as indicator (Sadasivam and Manikam, 1992) [2]. Weighted one gram of powder in to clean dry boiling tube and added one gram of powdered potassium iodide and 20 ml of solvent mixture. Place the tube in boiling water bath so that the liquid boils within 30 seconds and allowed to boil vigorously for not more than 30 seconds. Transferred the contents quickly to a conical flask containing 20 ml of five per cent potassium iodide solution. Washed the tube twice with 25 ml water each time and collect into the conical flask. Titrated against N/500 sodium thiosulphate solution until yellow colour is almost disappeared. Added 0.5 ml of starch, shaked vigorously and titrated carefully till the blue colour just disappears. A blank should also be set at the same time. Peroxide value + (mill equivalent peroxide/g sample).

$$= \frac{S \times N \times 100}{g \text{ sample}}$$

Where, S = ml $Na_2S_20_3$ (Test blank)
W = Normality of $Na_2 S_2 0_3$

Sensory evaluation of stored samples

Powder samples was reconstituted and incorporated in to a popular recipe viz., chutney. The acceptability of chutney was evaluated every month by trained panel judges of ten members.

Powder samples was reconstituted and incorporated in to a popular recipe viz., chutney. The acceptability of chutney was evaluated every month by trained panel judges of ten members. The prepared recipes evaluated immediately after the storage period.

The data pertaining to acceptability of dehydrated tomato powder by oven and sundrying methods and pretreatment effect were analysed with two factorial CRD and data pertaining to sensory evaluation of tomato products and for stored powder recipes were analysed with CRD.

Statistical analysis

The data pertaining to acceptability of dehydrated tomato powder by oven and sundrying methods and pretreatment effect were analysed with two factorial CRD and data pertaining to sensory evaluation of tomato products and for stored powder recipes were analysed with CRD.

Results

Shelf-life of dehydrated tomato powder

Mean score of recipes prepared from dehydrated powder which was stored for three months are given in Table 1.

The appearance, colour, flavour, taste and texture of stored powders were changed as seen visually, due to this reason, organoleptic score of the recipes prepared with stored powder had decreased with increasing storage period.

Mean score for appearance of the recipe had decreased in the third month when compared to first month. Mean score of recipe for appearance of first, second and third months were 2.8, 2.7 and 2.2, respectively.

Analysis of variance table revealed a significant difference for appearance at one per cent level.

Colour of the stored powders had changed as seen visually. The colour of the stored powder had become dark red to pinkish red during storage. It was observed that, as storage period increased mean score for colour of recipes had decreased significantly at one per cent level.

Taste of the powders was affected during third month but not in first and second months. Mean score for taste of the recipes had decreased significantly during the third month when compared to first and second months.

Table 1: Visual observation of stored tomato powder during three months of storage.

Sensory parameters	0 month storage	1st month storage	IInd month storage	IIIrd month storage
Appearance	Highly attractive	Moderately attractive	Fairly attractive Light red	Poorly attractive
Colour	Dark red	Red	Light red	Pinkish red
Taste	Highly acceptable tomato taste	Taste was not affected	Taste was not affected	Taste is slightly affected
Flavour	Characteristic tomato flavor	Flavour was not affected	flavour was not affected	Flavour was slightly affected
Texture	Graisny structure	Texture was not affected	Texture was not affected	Texture was slightly affected
Acceptabi1ity	Powders were highly acceptable	Powders were acceptable	Powders were fairly acceptable	Powders were neither acceptable nor unacceptable

Table 2: Peroxide value of tomato powder during 3 months storage

Months of Storage	Peroxide value m.eq/g
I	0.0023
II	0.021
III	0.2340

C.D. 0.02 at 1% level S.Em.± 0.004

Table 3: Mean scores* of sensory parameters of tomato chutney prepared from stored tomato powder

Sensory qualities	Duration of storage (months)				
	0	1st	2nd	3rd	C.D. ± S.Em.
Appearance	3.1	2.8	2.7	2.2	0.47 ± 0.164
Colour	3.2	2.9	2.5	2.2	0.53 ± 0.136
Taste	3.3	2.5	2.5	1.5	0.65 ± 0.167
Flavour	3.1	2.4	2.3	1.3	0.61 ± 0.156
Overall acceptability	3.3	2.8	2.4	1.5	0.60 ± 0.155

* 5 point scale

Mean score for flavour of the powder recipe was decreased lower score being recorded on the third month of storage and differed significantly between the months of storage. From the overall acceptability, it was noticed that even though there was decrease in organoleptic score for sensory characteristics, recipes from powder were acceptable by the judges commonly no visual mold or any other decisive growth of microorganisms were visible.

The peroxide value of stored tomato powders of first, second, third months were 0.0023, 0.021 and 0.2340, respectively. Peroxide value of stored powders differed significantly between the months of storage, higher value being recorded on the third month of storage.

Discussion

Acceptability of stored tomato powder

Stored tomato powder was evaluated in terms of chemical and sensory parameters. Chemical evaluation of tomato powder revealed that peroxide value increased with storage period. The powder became lighter in colour during three months of storage at room temperature. Nevertheless, the powder at room temperature was acceptable in terms of sensory attributes commonly, no visual mold, or any other decisive growth of microorganisms were visible. A slight off flavour was detected at the end of three months storage in room temperature, at the onset of Exposure, which diminished after a while. The chutney prepared using stored powder was acceptable even at the end of three months of storage and were acceptable to Indian palette. However, browning in tomato powder affected the organoleptic score, indicating quality deterioration of the sample. Sensory evaluation of dehydrated powder stored in glass bottles also revealed that they could be easily kept well upto three months of duration.

As tomatoes are highly perishable, they should be processed and stored. Dehydration is one of the cheapest method. But as powder is in a concentrated form, one spoon of powder (5g) found to give acceptable colour, taste and flavour in recipes which would be adequate in five servings. The yield of tomato powder ranged from 10 to 11 per cent on dry weight basis. As tomatoes are cheaper (Rs.2/- per kg) during the season and are easily available, they can be processed in the form of powder. One kilogram powder costs around Rs. 20/- excluding labour and chemical charges. Whereas in the offseason tomatoes are costly, the prices may raise upto Rs. 20/- per kg and the cost of one kilogram powder will be Rs. 200/-. Hence, the powder processing method at household level on small scale basis is cheap and can be prepared during the season and recommended for use both during the season and off season. The powder can be used in the preparation of curries, soup and as an additive such as colouring and flavouring agent in bakery and confectionary and alike products.

As hot air oven method is expensive at household level, the sundrying with chemical pretreatment (Blanched + KMS 0.5% + salt %) can be adopted. In general, chemical treatment before drying is necessary for longer shelf life and proper dehydration.

Thus, the chemical pretreatment (Blanched + KMS 0,5% + Salt 1%) can be adopted for preparation of tomato powder and can be successfully stored for three months. This powder can be used in recipes like rice, dosa, chutney, soup, burfi in place of fresh tomatoes which are highly perishable and combersome to store and use.

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