

## Preparation and Evaluation of Candies from Citron Peel

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**Abstract:** Candy was prepared with 4 different combinations of  $T_0$  (control), sliced citron peel + 30% sugar + Potassium metabisulphite,  $T_2$  (Sliced citron peel + 40% sugar + Potassium metabisulphite and  $T_3$  (sliced citron peel + 50% sugar + Potassium metabisulphite) To establish the best product, sensory evaluation was done on 9-point Hedonic scale.  $T_2$  was found to be most preferred candy. These were assessed for organoleptic quality during storage at room temperature (25–30 °C) for 6 months. Candy can be preserved safely for 6 months in polythene bags.

**Keywords:** Citron peel, candy and sugar.

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### I. Introduction

Candy is a sweet food prepared from fruits or vegetables by impregnating them with sugar syrup followed by draining of excessive syrup and then drying the product to a shelf stable state. Fruits and vegetables like apples, ginger, mangoes, guava, carrot and citrus peels have been used to prepare candies (Mehta and Bajaj, 1984)

Citrus medica *L.*, commonly known as citron is among the most important horticultural products belongs to the family *Rutaceae* and enjoyed universally. It has a great potential for value addition products. Citrus fruits are important due to nutritive, medicinal values and source of prosperity. In Pakistan, citrus is the largest group of fruits produced over an area of about 5 lac acres, which is about 40% of the total fruit produced in Pakistan. The production of Citrus fruit is more than 20 million ton (Agri. Stat. Pakistan, 2008-09). Citrus fruits, frozen concentrated orange juice and candies are in a great demand. In ancient times and in the middle Ages, the 'Citron' was employed as a remedy for seasickness, pulmonary troubles, intestinal ailments and other disorders.

Citron is a small tree, having large fruit (20-22.5 cm. long) resembling pineapple in shape. The most important part of the citron is the peel which is a fairly important article in international trade. After partial desalting and boiling to soften the peel, it is candied in a strong sucrose/glucose solution. The candied peel is sun-dried or put up in jars for future use. The candied peel is widely employed in the food industry, especially as an ingredient in fruit cake, plum pudding, buns, sweet rolls and candy. In Bangladesh, India, Indonesia, citron peel is eaten raw with rice. The entire fruit of the 'Fingered citron' is usually eaten (Z. Fleisher *et al.* 1991). In Guatemala, it is used as flavoring for carbonated soft-drinks. In Malaya, citron juice is used as a substitute for the juice of imported, expensive lemons (E. Nicolosi, *et al.* 2005). In Spain, syrup made from the peel is used to flavor unpalatable medical preparations (R. L. Luis, 2003). In India, the peel is a remedy for dysentery and is eaten to overcome halitosis (E. Isaac, 1959). *C. medica* is relevant to treatment of diabetes and Alzheimer's disease (C. Filomena, 2007). The candied peel is sold in China as a stomachic, stimulant, expectorant and tonic. In West Tropical Africa the citron is used only as a medicine, particularly against rheumatism. (Z. Fleisher, 1991). Srivastava *et al.* (2006) have recently developed jaggery based petha (Ash gourd) candy, which could be stored for 45 days under refrigerated condition.

Sulphites additives are used largely in the food industry as preservatives, anti browning agents and antioxidants. In many foods sulphites performs more than one function due to their versatile nature, cheap and easily availability (Taylor *et al.*, 1986). Sugar provides energy and enhances the taste and texture of the food (Benitez *et al.*, 2009). Thus studies were conducted to utilize the wasted citron peel for candies preparation, because of its great potential for value addition products as well as important due to nutritive and medicinal values.

### II. Materials And Methods

The research was conducted to study the organoleptic changes occurring during the storage of citron candies at ambient conditions in the laboratory of Agricultural Research Institute Tarnab, Peshawar. Good

quality, fresh *Citrus medica* were collected from the experimental field of Agricultural Research Institute Tarnab, Peshawar, Pakistan. Diseased free and fully ripe fruits were selected and washed to remove dust, dirt and any other foreign material. The fruits were cut into two halves and juice was extracted by using Rose Head machine and peel was washed and cutted into small slice shape.

### Preparation of Candies

Sliced citron peels were blanched thrice for 2/5 minutes in water at 170° F (76.7° C). Then peel turn into translucent, semisoft, and free from opaque spots. The pulpy centers are removed by hand and discarded, and the citrons are then preserved by gradually increasing the sugar content of the peel by immersion in a series of sugar syrups of increasing strength, over a period of three days. The product was then drained and kept in the dehydrator at a temperature of 60° C so as to dry it to the desired moisture level i.e 13-14%. All the four treatments were dried in the same way. After drying these were packed in polythene bags.

### Treatments

T<sub>0</sub> = Control

T<sub>1</sub> = Sliced citron peel + 30% sugar + Potassium metabisulphite

T<sub>2</sub> = Sliced citron peel + 40% sugar + Potassium metabisulphite

T<sub>3</sub> = Sliced citron peel + 50% sugar + Potassium metabisulphite

### Storage

The samples were stored at ambient conditions for sensory evaluation after 0, 30, 60, 90, 120, 150 and 180 days.

### Sensory evaluation

The samples were evaluated by the panel of trained judges for color, flavor, texture and overall acceptability. Judges evaluated the samples using 9 point hedonic scale method as described by Larmond (1977) where 1 represents extremely disliked and 9 represent extremely liked.

### STATISTICAL ANALYSIS

All the data regarding treatments and storage intervals was analyzed statistically by using Randomized Complete Block Design (RCBD) as recommended by Gomez & Gomez (1984) and the means were divided by applying LSD Test at 5% probability level as described by Steel and Torrie (1997).

## III. Results And Discussion

### Organoleptic evaluation

Citron peel candies were stored for a period of six months and were evaluated organoleptically for color, flavor, texture and overall acceptability at the storage interval of 30 days for a period of 180 days. The evaluation was carried out by using 9 points hedonic scale of Larmond (1977). The results obtained were summarized as:

### Color

The mean score of judges for color were significantly ( $p < 0.05$ ) decreased from 8.83 to 4.84 during storage (Table-1). For treatments maximum mean score was observed in sample T<sub>2</sub> (7.86), while minimum mean score was recorded in sample T<sub>0</sub> (2.19).

Color of treatment T<sub>2</sub> was comparatively attractive during storage period at ambient temperature. Similar results have been reported by Durrani *et. al.* (2011) in development and quality evaluation of honey based carrot candy that osmotic drying had a protective effect upon the color and flavor of fully dried fruits.

**Table 1. Effect of storage period and treatments on color of citron peel candies stored at room temperature.**

Treatments	Storage Intervals							% Decrease	Mean
	Initial Day	30	60	90	120	150	180		
T <sub>0</sub>	8.33	2.00	1.00	1.00	1.00	1.00	1.00	88.00	2.19b
T <sub>1</sub>	9.00	8.33	7.67	7.00	6.33	6.00	5.67	37.00	7.14a
T <sub>2</sub>	9.00	8.67	8.33	8.00	7.33	7.00	6.67	25.89	7.86a
T <sub>3</sub>	9.00	8.33	8.00	7.67	7.00	6.33	6.00	33.33	7.48a
Mean	8.83a	6.83b	6.25bc	5.92bc	5.42bc	5.08c	4.84c		

Figures having different small letters are significantly different ( $p < 0.05$ ).

### Flavor

Flavor is a vital quality factor that determines the consumer attraction to the product. The panelists clearly identified the changes in flavor profile of the samples rating the stored sample inferior as compared to the freshly prepared candies. The results pertaining to the response of flavor on the storage interval of the candies

prepared from citron peel are presented in Table II. The mean score of judges for flavor significantly ( $p < 0.05$ ) decreased from 8.25 to 4.92 during storage. For treatments maximum mean score was recorded in sample  $T_2$  (8.05), while minimum mean score was observed in  $T_0$  (1.71). Bhattacharjee *et al.* (2012) reported similar results in quality evaluation of aonla candy and segments in syrup prepared from steep preserved fruits in water during storage.

**Table II. Effect of storage period and treatments on flavor of citron peel candies stored at room temperature.**

Treatments	Storage Intervals							% Decrease	Mean
	Initial Day	30	60	90	120	150	180		
$T_0$	6.00	1.00	1.00	1.00	1.00	1.00	1.00	83.33	1.71c
$T_1$	9.00	8.00	7.33	6.00	5.67	5.33	5.00	44.44	6.62b
$T_2$	9.00	8.67	8.33	8.00	8.00	7.33	7.00	22.22	8.05a
$T_3$	9.00	8.00	7.67	7.33	7.00	7.00	6.67	25.89	7.52a
Mean	8.25a	6.42b	6.08bc	5.58bc	5.42bc	5.17c	4.92c		

Figures having different small letters are significantly different ( $p < 0.05$ ).

### Texture

The mean score of judges for texture significantly ( $p < 0.05$ ) decreased from 9.00 to 5.25 during storage as presented in Table III. For treatments maximum mean score was observed in  $T_2$  (8.14), while minimum was recorded in  $T_0$  (2.29). Similar results were observed by Muhammad *et al.* (2007) during storage of pear glaces.

**Table III. Effect of storage period and treatments on texture of citron peel candies stored at room temperature.**

Treatments	Storage Intervals							% Decrease	Mean
	Initial Day	30	60	90	120	150	180		
$T_0$	9.00	2.00	1.00	1.00	1.00	1.00	1.00	89.00	2.29b
$T_1$	9.00	8.33	8.00	7.33	7.00	6.67	6.00	33.33	7.48a
$T_2$	9.00	9.00	8.67	8.33	8.00	7.00	7.00	22.22	8.14a
$T_3$	9.00	8.67	8.33	8.00	8.00	7.33	7.00	22.22	8.05a
Mean	9.00a	7.00b	6.50b	6.17b	6.00b	5.50b	5.25b		

Figures having different small letters are significantly different ( $p < 0.05$ ).

### Overall acceptability

The results pertaining to the response of the storage interval and treatment on overall acceptability are pertaining in Table IV. The mean score of judges for overall acceptability significantly ( $p < 0.05$ ) decreased from 8.70 to 5.00. for treatments maximum mean score was recorded in  $T_2$  (8.02), while minimum mean score was observed in  $T_0$  (2.06). Similar results were observed by Saini *et al.* (1992) that osmotically dehydrated pear preserved with sugar and other preservatives retain maximum overall acceptability.

**Table IV. Effect of storage period and treatments on overall acceptability of citron peel candies stored at room temperature.**

Treatments	Storage Intervals							% Decrease	Mean
	Initial Day	30	60	90	120	150	180		
$T_0$	7.78	1.67	1.00	1.00	1.00	1.00	1.00	87.14	2.06b
$T_1$	9.00	8.22	7.67	6.78	6.33	6.00	5.56	38.22	7.08a
$T_2$	9.00	8.78	8.44	8.11	7.78	7.11	6.89	23.44	8.02a
$T_3$	9.00	8.33	8.00	7.67	7.33	6.89	6.56	27.11	7.68a
Mean	8.70a	6.75a	6.28bc	5.89bc	5.61bc	5.25bc	5.00c		

Figures having different small letters are significantly different ( $p < 0.05$ ).

## IV. Conclusion

From the present study it can be concluded that the candy prepared from 40° brix solution ( $T_2$ ) is best for commercialization purpose.

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