

Utilization of Kinnow Peel For The Development Of Candy And Preserve

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Abstract- Kinnow, a citrus fruit is grown widely in Punjab, Haryana, Rajasthan, Himachal Pradesh in India. The peel has used in the preparation of kinnow candy and preserve. Kinnow peel candy and preserve were prepared by varying the sugar concentration and three treatments (Pricking+Steeping, pricking+boiling+steeping and lye treatment) were conducted. The preserve and candy prepared from peels were analysed. Significant effect of pre-treatments was found on the chemical and sensory properties of kinnow peel preserve and candy.

Keywords- Kinnow peel, Preserve, Candy, Sugar syrup and Sensory evaluation.

I. INTRODUCTION

Citrus which originated from South East Asia, is one of the most important fruit crops in Asia. Citrus fruits are classified under the family Rutaceae and genus *citrus*, but botanically they are classified as berries. Citrus is botanically a large family whose dominant members are the sweet orange (*Citrus sinensis*), mandarin or tangerine orange (*Citrus reticulata*), grapefruit (*Citrus paradise*), lemon (*Citrus aurantifolia*) (Bocco *et al.*, 1998).

Citrus peel is also an interesting source of phenolic compounds which include phenolic acids and flavonoids. The citrus flavonoids which include Hesperidin and Naringin, have been found to have antioxidant as well as other health related properties like anticancer, antiviral and anti-inflammatory activities, etc. (Bocco *et al.*, 1998).

The consumption of citrus fruits is also believed to confer some protection against diseases such as cardiovascular disease and cancer (Baghurst, 2003; Guimaraes *et al.*, 2010; Atolani *et al.*, 2012).

It has attained much importance as it has a great variety of beverage, industrial and medicinal uses due to its attractive color, distinctive flavor and being rich source of vitamin 'C', vitamin 'B', β -carotene, calcium and phosphorous (Sogi & Singh, 2001). Also, Kinnow is known for its superior characteristics such as heavy bearing, wide

adaptability, fruit quality and high juice content (Nagar 1993). On an average, Kinnow peel contains 22.45 percent total solids, 12.5°B TSS, 1.38 percent acidity, 41.57 mg/100g ascorbic acid, 6.23 percent total sugars, 5.99 percent reducing sugars, 0.67 percent ash, 13.65 mg/100g carotenoids, 7.43 mg/100g β -carotene, 1.85 percent pectin & 0.77 percent fat (Aggarwal & Sandhu 2003).

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 (Shamrez *et al.*, 2013). Fruits and vegetables like apples, ginger, mangoes, guava, carrot and citrus peels have been used to prepare candies (Mehta and Bajaj, 1984)

The fruit peels are rich in nutrients and contain many phytochemicals; they can be efficiently used as drugs or as food supplements too. Since there is an increase in the number of antibiotic resistance pathogens, there is always a search of an alternative drug that is regarded as safe. Fruit peels if proved to have antibacterial activity; they can be also used in same food industry which generates large peel wastes as a food preservative (Kumar *et al.*, 2011).

II. MATERIALS AND METHODS

Kinnows were washed under running tap water to remove the dust and dirt. Then the kinnows were hand peeled and the peels were carefully sliced according to requirement manually. Peels were thereafter has been employed for following processing steps: All experiments carried out were referred from Ranganna. S (2005)

3.1 Physical characteristics

3.1.1 Peel colour

Peel colour was given by panel of five judges and ratings were given from Hedonic scale.

3.1.2 Peel thickness (cm)

Fruits were hand peeled and the peel thickness in cm was measured with the help of Vernier caliper. The mean peel thickness was calculated by taking the average of peels.

3.2 Physicochemical Characteristics

3.2.1 Total soluble solids (%).

Total soluble solids of the peel was determined with the help of Erma digital refractometer and the values were recorded and corrected at 20°C with the temperature correction chart and expressed as percent. (Ranganna S 2005)

3.2.2 Acidity (%)

The titrable acidity was determined by method as suggested in A.O.A.C. (Ranganna S 2005)

3.2.3 Reducing sugars (%)

Reducing sugars were calculated by the method and formula. (Ranganna S 2005)

3.2.4 Total sugars (%)

Total sugars were calculated by the method and formula. (Ranganna S 2005)

3.2.5 Ascorbic acid (mg/100 g peel)

Ascorbic acid was estimated by indophenols dye method. (Ranganna S 2005)

3.2.6 % Moisture Content

The % moisture content was determined as mentioned by Ranganna, (2005).

3.2.7 pH

The pH was determined as mentioned by Ranganna, (2005).

3.2.8 % Pectin

The % pectin was determined as mentioned by Ranganna, (2005).

3.3 Development of kinnow peel preserve

For the preparation of kinnow peel preserve, fresh kinnows of good quality were procured from local market of Amritsar.

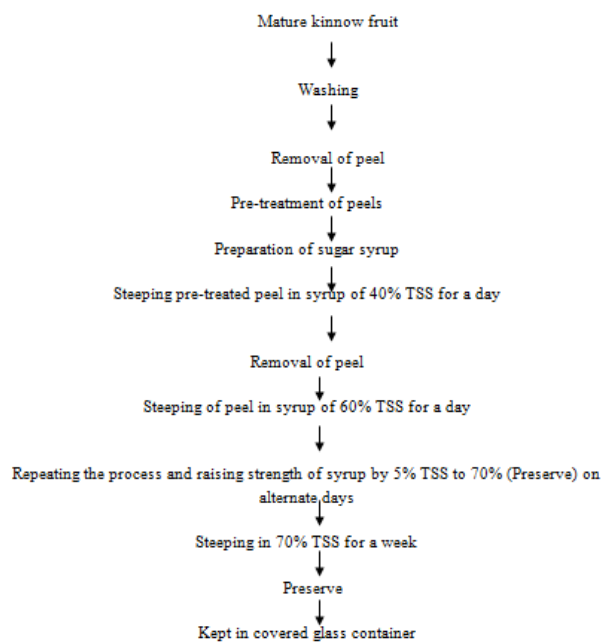
3.3.1 Pre-Treatment

- T1 - Pricking + Steeping
- T2 - Pricking + Boiling + Steeping
- T3 - Salting or Lye treatment

3.3.2 T1 – The peels are pre-treated for the development of preserve and candy. The peels are made free of dust and dirt followed by pricking process. The peels are pricked with the help of tooth pick. This was done in order to remove the bitterness from the peel. The pricked peels are then steeped in water for a day.

3.3.3 T2 – Fresh and sound peels were taken and the peels are pricked followed by boiling process. The pricked peels were then boiled for 10 minutes in water. The contents were then transferred to a beaker covered with muslin cloth and left undisturbed for a day. This was done in order to remove bitter components from the kinnow peel.

3.4 T3 – In this the pricked peels were treated with 2% salt solution and boiled the peels in water for 15 minutes and kept for a day.



Fig; 3.1 Process Flow Sheet for the Development of preserve.



Fig: 3.2 Process Flow Sheet for the development of candy.



IV. RESULTS AND DISCUSSION

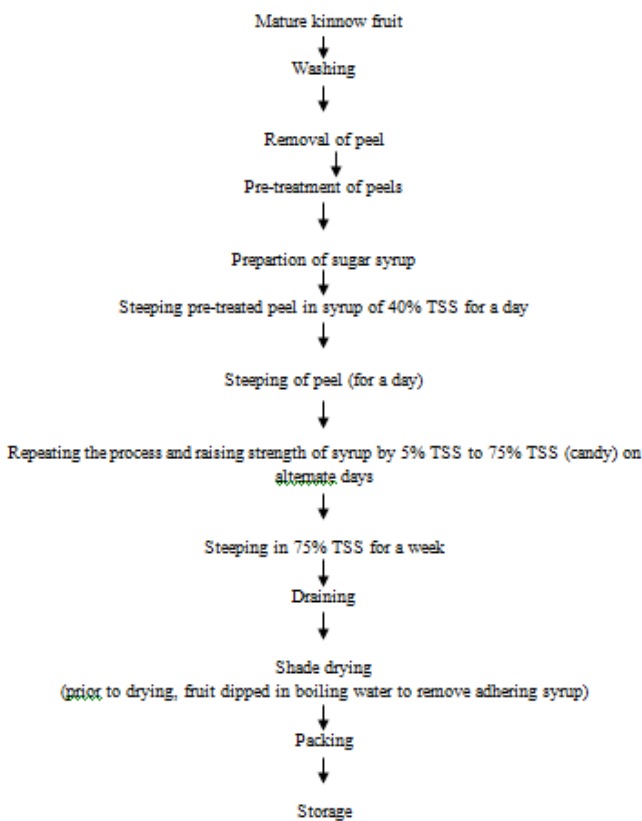
4.1 Physical and Physico Chemical Parameters of Fresh Kinnow peels

The data regarding colour of fresh kinnow peel is presented in Table: 4.10. The Fresh kinnow peel was examined as per the hedonic scale (1-9).The Peel colour was got maximum score (9). with overall excellent acceptability. It is evident from the data presented in Table: 4.10 .Maximum peel thickness measured the verniar caliper was 0.30 cm and minimum peel thickness was measured 0.27 cm. The data regarding acidity of fresh kinnow peel is presented in Table: 4.10. The acidity was recorded (0.55%). The results of this study were lower than the values reported by Mohamed (1999) and Eaks (1980), they found 0.15- 0.185 g/100 g for grapefruit peels and orange lemon peels respectively. The data regarding moisture of kinnow peel was recorded in Table: 4.10. The fresh kinnow peel recorded moisture (72.5%). Mohamed (1999) reported moisture content of grapefruit peels to range between 75.25% and 75.37% and Mohamed (1999) obtained 72.5% moisture content of orange peels on fresh weight basis. The pH of the fresh kinnow peel was recorded (3) and is presented in Table: 4.10.

It is evident from the data presented in Table: 4.10 fresh kinnow peel contain 68.6 mg/g reducing sugars. The value of fresh kinnow peel was higher if compared to the rnge of 10.2- 10.4% reported by Mohamed (1999) for grapefruit peel. The data regarding total sugars of fresh kinnow is represented in Table: 4.10 total sugars was recorded as (172 mg/g) The ascorbic acid found to be as (136 mg/100 g) in fresh kinnow peel. The data regarding this is represented in Table.

4.2 Physico Chemical Parameters of processed product

The data regarding colour of proccesed kinnow peel is presented in Table: 4.12. Maximum score (8.46) was given to peel treated with T1 treatment.T1 were excellent among all other treatments. It was followed by T2 treatment with (8.21) score. The peel treated with T3 attained minimum score (7.73). Data regarding the total soluble solids presented in the Table:4.12. Maximum TSS (70°B) was attained with T3. It



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was closely followed by T2 with (69°B). The minimum TSS was recorded as (63°B) with T1. Results of Kumar *et al* (2011) observed highest Brix in orange peel jam (85°B). The sugar (Brix) present in jam comprises natural and added sugar and is an important preservative. The proportion of sugar to fruit varies according to the type of fruit and its ripeness Eke-Ejifor and Owuno, (2013) Data regarding the titrable acidity of preserve in Table: 4.12. Maximum titrable acidity (0.20%) was attained with T2. Both of treatments T2 and T3 were found to be same.

The minimum titrable acidity (0.10%) was recorded in T1 treatment. Acidity in orange peel jam was recorded (0.47%) by Shamrez *et al* (2013). Variation in acidity among different fruits might be due to activity of citric acid glyoxalase during process which leads to the degradation of citric acid. The data regarding the moisture content of preserve in Table: 4.12. Maximum moisture content (43.25%) was found in T3. The preserve made by treatment T1 recorded moisture (37.24%). Minimum moisture was attained with the T2 (36.65%). Moisture in orange peel jam was recorded (32.25%) by Khan (2005). Moisture has a great impact on the shelf life of product.

The data regarding pH was recorded in Table: 4.12. Maximum pH was recorded (3.1) with treatment T1. It was closely followed by T3 (3.06). Minimum pH was recorded with T2 (2.95). The data presented in Table: 4.12. Maximum reducing sugars 58.5% were obtained with T1 followed by 48.5% with T3. minimum reducing sugar with 45% was observed with T2. The data presented in Table: 4.12. Maximum total sugars were obtained with T2 (41.2) T1 recorded (37.2) total sugars. Minimum total sugars were recorded with T3(35.4) The data regarding ascorbic acid of preserve was recorded in Table: 4.12.

Maximum ascorbic acid was attained (22 mg) with T3. The T2 recorded (20 mg). Minimum ascorbic acid was found (9.87) with T1. The data presented in Table: 4.12. Maximum pectin content was recorded (10.4%) with T1. It was closely followed by T3 with (9%). The minimum pectin content was recorded as (6.6%) with T2. Data presented in Table: 4.12.

Table: 4.1 Effect of treatments on colour of kinnow peel product

| Treatments | Preserve | Candy |
|------------|----------|-------|
| T1 | 8.46 | 7.54 |
| T2 | 8.21 | 7.48 |
| T3 | 7.73 | 7.74 |

Table: 4.2 Effect of treatments on TSS (°B) of kinnow peel product

| Treatments | Preserve | Candy |
|------------|----------|-------|
| T1 | 63 | 64 |
| T2 | 69 | 65 |
| T3 | 70 | 75 |

Table: 4.3 Effect of treatments on (%)acidity of kinnow peel product

| Treatments | Preserve | Candy |
|------------|----------|-------|
| T1 | 0.10 | 0.08 |
| T2 | 0.20 | 0.09 |
| T3 | 0.20 | 0.04 |

Table: 4.4 Effect of treatments on (%)moisture of kinnow peel product

| Treatments | Preserve | Candy |
|------------|----------|-------|
| T1 | 37.24 | 25.24 |
| T2 | 36.65 | 26.15 |
| T3 | 43.25 | 35.0 |

Table: 4.5 Effect of treatments on pH of kinnow peel product

| Treatments | Preserve | Candy |
|------------|----------|-------|
| T1 | 3.1 | 2.2 |
| T2 | 2.95 | 1.94 |
| T3 | 3.06 | 2.06 |

Table: 4.6 Effect of treatments on (%)total sugars of kinnow peel products

| Treatments | Preserve | Candy |
|------------|----------|-------|
| T1 | 37.2 | 40.2 |
| T2 | 41.2 | 43.4 |
| T3 | 35.4 | 38.5 |

Table: 4.7 Effect of treatments on (%)reducing sugar of kinnow peel product

| Treatments | Preserve | Candy |
|------------|----------|-------|
| T1 | 58.5 | 45.5 |
| T2 | 45 | 37.3 |
| T3 | 48.5 | 39.5 |

Table: 4.8 Effect of treatments on (mg/100g) ascorbic acid of kinnow peel products

| Treatments | Preserve | Candy |
|------------|----------|---------|
| T1 | 9.87 mg | 7.33 mg |
| T2 | 20 mg | 15 mg |
| T3 | 22 mg | 11 mg |

Table: 4.9 Effect of treatments on (%)pectin of kinnow peel products

| Treatments | Preserve | Candy |
|------------|----------|-------|
| T1 | 10.4 | 8.0 |
| T2 | 6.6 | 4.5 |
| T3 | 9 | 7.2 |

Table: 4.10 Physicochemical parameter of fresh kinnow peel

| Physicochemical Parameters | Values |
|------------------------------|-------------|
| Peel color (9-point Hedonic) | 9 |
| Peel thickness (cm) | 0.27-0.30 |
| Acidity (%) | 0.55 |
| Moisture (%) | 72.5 |
| pH | 3 |
| Reducing Sugar | 68.6 mg/g |
| Total Sugar | 172 mg/g |
| Ascorbic Acid | 136 mg/100g |

Table : 4.11 Physicochemical composition of prepared kinnow peel preserve

| Sample | Total soluble solids | Acidity (%) | pH | Moisture (%) | Total sugars °Brix | Reducing Sugars (%) | Ascorbic acid mg/100g | Pectin (%) |
|--------|----------------------|-------------|------|--------------|--------------------|---------------------|-----------------------|------------|
| T1 | 63°B | 0.10 | 3.1 | 37.24 | 37.2 | 58.5 | 9.87 mg | 10.4 |
| T2 | 69°B | 0.2 | 2.95 | 36.65 | 41.2 | 45 | 20 mg | 6.6 |
| T3 | 70°B | 0.2 | 3.06 | 43.25 | 35.4 | 48.5 | 22 mg | 9 |

Table : 4.12 Physicochemical composition of prepared kinnow peel candy

| Sample | Total soluble solids | Acidity (%) | pH | Moisture (%) | Total sugars °Brix | Reducing Sugars (%) | Ascorbic acid mg/100g | Pectin (%) |
|--------|----------------------|-------------|------|--------------|--------------------|---------------------|-----------------------|------------|
| T1 | 64 | 0.08 | 2.2 | 25.24 | 40.2 | 45.5 | 7.33 mg | 8.0 |
| T2 | 65 | 0.09 | 1.94 | 26.15 | 43.4 | 37.3 | 15 mg | 4.5 |
| T3 | 75 | 0.04 | 2.06 | 35.00 | 38.5 | 39.5 | 11 mg | 7.2 |

Table : 4.13 Sensory evaluation of kinnow peel preserve

| Sample | Appearance | Colour | Flavour | Texture | Taste | Overall acceptability |
|---------|------------|--------|---------|---------|-------|-----------------------|
| Control | 7.5 | 7.9 | 7.2 | 6.5 | 6.8 | 7.18 |
| T1 | 8.5 | 8.46 | 8.11 | 8.24 | 8.14 | 8.29 |
| T2 | 9.0 | 8.21 | 8.24 | 8.32 | 8.43 | 8.45 |
| T3 | 8.6 | 7.73 | 7.15 | 8.82 | 8.00 | 8.06 |

Table : 4.14 Sensory evaluation of kinnow peel candy

| Sample | Appearance | Colour | Flavor | Texture | Taste | Overall acceptability |
|---------|------------|--------|--------|---------|-------|-----------------------|
| Control | 7 | 7.2 | 7.5 | 7 | 7 | 7.14 |
| T1 | 8.2 | 7.54 | 8.00 | 7.15 | 7.99 | 7.77 |
| T2 | 9.00 | 7.48 | 7.83 | 7.43 | 8.45 | 8.03 |
| T3 | 8.4 | 7.74 | 7.17 | 7.89 | 7.43 | 7.72 |

4.3 Sensory Evaluation of the kinnow peel products

Sensory evaluation of the kinnow peel preserve and candy was conducted by thirty panel members using a five point hedonic scale to evaluate the organoleptic properties like appearance, colour, flavor, texture, taste and acceptability of kinnow peel preserve/candy.

V. CONCLUSION

From the above study, it was concluded that treatments (pricking+steeping, pricking+boling+steeping, pricking+lye) showed significant effect on sensory evaluation and chemical properties of kinnow peel preserve and candy. The overall acceptability of preserve and candy made from treatment T2 (Pricking+Boiling+Steeping) was found to be best. Hence, it can be concluded that peel from kinnow is considered as waste of beverage industry and can be utilized in preparation of preserves and candies as it is rich in phytochemicals than pulp itself.

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