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Economic Analysis of Pumpkin and Papaya as Fruit Leathers and their Utilization as Protective Cover against Cancer in the Medical Science

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Abstract

The present project entitled "Utilization of Pumpkin & Papaya for preparation of Fruit Leather" was undertaken in the School of Bioengineering & Food Technology, Shoolini University, Solan in 2014. Papaya & Pumpkin were undertaken in regard to physico-chemical analysis, effect of processing treatment on organoleptic characteristics of fruit leather. Papaya fruit contained 88.5% moisture, TSS 9°Brix, Titrable acidity 0.10% citric acid, colour pale yellow, %edible portion 80%, ascorbic acid 185.81mg/100g and total sugars 12.97g/100g. Pumpkin contained 83% moisture, TSS 10°Brix, Titrable acidity 0.38% citric acid, colour yellow, %edible portion 75%, ascorbic acid 14mg/100g and total sugars 9g/100g. Papaya leather made from different TSS of pulp had constant moisture content of 11%, ash content decreased from 6.9% in control sample to 0.9% in leather made from pulp of 25°Brix TSS, ascorbic acid content decreased from 60mg/100g in control sample to 40mg/100g in sample C and total sugar increased from 13g/100g in control sample to 20g/100g in sample C.

Pumpkin leather made from different TSS of pulp had constant moisture content of 10%, ash content decreased from 15% in control sample to 5% in leather made from pulp of 25°Brix TSS, ascorbic acid content decreased from 10mg/100g in control sample to 7.5mg/100g in sample C and total sugar increased from 11g/100g in control sample to 12.5g/100g in sample C. On the basis of sensory analysis of papaya leather, sample B i.e. leather made from pulp of TSS 20°Brix showed maximum overall acceptability. On the basis of sensory analysis of pumpkin leather, sample C i.e. leather made from pulp of TSS 25°Brix showed maximum overall acceptability.

Economic analysis for both type of Papaya and Pumpkin fruit leathers were performed. The results revealed that total cost for manufacturing 1kg of papaya leather was Rs. 140 and 1kg of pumpkin leather was Rs. 88.

Keywords: Pumpkin; Papaya; Fruit Leather.

Introduction

Papaya and Pumpkin are the fruits of commercial importance because of their nutritive and medicinal values. Papaya(*Carica papaya L*) belongs to the family of Caricaceaewhere as Pumpkin (*Cucurbitamoschata*) belongs to the family of Cucurbitaceae. There are three common types of pumpkin worldwide, namely *Curcurbitapepo*, *Curcurbita maxima* and *C. moschata* (Lee *et al.*,2003), whereas papaya comprised of six genera and 35 species (Ming *et al.*, 1975).

Cultivation

Papaya cultivation had its origin in South Mexico and Costa Rica. Total annual world production is estimated at 6 million tonnes of fruits. India leads the world in papaya production with an annual output of about 3 million tonnes. Other leading producers are Brazil, Mexico, Nigeria, Indonesia, China, Peru, Thailand and Philippines, Asia has been the leading papaya producing region, accounting for 52.55 percent of the global production

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between 2008 and 2010, followed by South America (23.09%), Africa (13.16%), Central America (9.56%), the Caribbean (1.38%), North America (0.14%), and Oceania (0.13%) (FAOSTAT, 2012). Pumpkins originated in America. Fragments of stems, seeds, and fruits have been identified and recovered from cliff dweller ruins in the southwestern United States. Some pumpkin varieties may have originated in Mexico and Central America, while others probably developed in Peru, Colombia, and Ecuador (Geisler, 2010).

Physico-Chemical Properties

Agriculture, food-processing, pharmaceutical as well as feed industry have all taken growing interest in pumpkin fruit and pumpkin-derived products in the past few years because of the nutritional and health protective value of the proteins and oil from the seeds as well as the polysaccharides from the fruit (Sojak*etal.,*2010). Pumpkin is a good source of carotene, pectin, mineral salts, vitamins and other substances that are beneficial to health (Jun *et al.,*2006). Traditionally, the pulp is used to relieve dyspepsia, stomach disorders and intestinal inflammation (Sentu & Debjani, 2007) and papaya contain high content of vitamin C and provitamin A, which has a protective effect against cancer. It is recommended for low hypo caloric diets for its low calorie status. For all these reasons, the acceptance of papaya as fruit is rising upward worldwide (Lobo *et al.,*1998). Papaya fruit is also a potential source of proteolytic enzymes like papain and chymopapain. As it contains proteolytic enzymes, it is used conveniently as digestive protein, meat tenderizer, digestive medicine, etc. in different manufacturing industries like pharmaceutical, brewing and tanning industries (Nakasone *et al.,*1998). Pumpkin fruit is an excellent source of vitamin A which the body needs for proper growth,healthy eyes and protection against diseases. It is rich in vitamin C, vitamin E, lycopene and dietary fibre (Pratt & Matthews,2003).

Fruit Leather

The origin of fruit leathers may go back to the PersianEmpire. 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 (Maskan*et al.,* 2002), (Chan *et al.,* 1978).

Fruit leather is made by drying thin layers of pureed fruit in the oven or dehydrator. Sometimes called fruit rolls or taffies, fruit leathers make delicious, wholesome and nutritious high-energy snacks for people on the go. They are relatively light in weight, easy to prepare and a good way to use left-over canned fruit and slightly over-ripe fresh fruit. Fruit leathers can be eaten as is, or made into a beverage by combining 5 parts water with 1 part leather in a food blender. They also can be used in pie fillings, in cooking and as a dessert topping. Nutritional food values become concentrated in dried fruit, and so do calories. Since moisture is gone, the residue is concentrated. So it becomes necessary to analyse changes in physical and chemical properties. Fruit 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).

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 left over 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 times, increased attention has been focused on under utilized indigenous crops, for example thepumpkin, and their promotion would help maximize the available resources, eradicate the dearth in foodsupply and be useful in food industries in the formulation of value added products thus cater for the dailyneeds of the citizens nutritionally. Despite the pumpkin being regarded as a ‘poor mans’ food and as anorphaned crop, it represents a cheap but quality nutrition for large parts of the population in both rural andurban areas (Chweya and Eyzaguirre, 1999).

Papaya and pumpkin are fruits having large amount of moisture content so they have a shelf life of few days only. These fruits should be preserved because of their so much nutritional and functional benefits. Fruit leather manufacturing is a step in this direction. So keeping in view the shelf life, nutritional and functional aspects, following objectives had been chosen for the present research work.

- Development of fruit leather from papaya and pumpkin
- Analysis of physico-chemical properties of fruit leather from papaya and pumpkin

Materials and Methods

The details of the materials used and methods adopted during present investigation are presented in this chapter.

Materials Required

Pumpkin and Papaya

The well matured and fully ripened pumpkin and papaya were purchased from local market of Solan. The colour of both was yellow and they were checked for defects before purchasing.

Sugar

Granulated sugar was purchased from local market of Solan and was grinded before use.

Potassium Metabisulphite

Preservative used was of CDH(Central Drug House).

Packaging Material

White glass bottles were purchased from local market of Solan having capacity of 250gms.

Methods

Determination of Weight of Fruits

The weight was taken in gram with the help of an electric balance.The percentage of edible portion of fruit was calculated by using the formula: % of edible portion= (weight of edible parts ÷ weight of whole fruit)* 100

Determination of Titrable Acidity

Titrable acidity is an indication of the level of sourness of fruits (Rangana, *etal.,* 1979).Titrable acidity was analyzed using the titration method, fruit pulp (5g) was homogenized with 10mL of distilled water using homogeniser, and the mixture was filtered through sieve.Five mL of the filtrate with one to two drops of phenolphthalein (1%) as indicator was titrated using 0.1N NaOH to an endpoint pink. The results were expressed as percentage of citric acid per 100 g fresh weight.

Formula: $\% \text{ citric acid} = \frac{N*V*Eq.\ wt.\ *100}{W*\ 1000}$

Where N is normality of base

V is titre value

Eq. wt. is equivalent weight of acid

W is weight of sample

Determination of Ascorbic Acid

Ascorbic acid was determined using the Dye Method (Ranganna, 1979). Fruit pulp tissues (10 g) from papaya and pumpkin were homogenized with 90 mL of 3% metaphosphoricacid(HPO_3) using a homogeniser, the mixture was filtered through sieve. Five mLof aliquot was titrated with a standard dye solution (2, 6-dichlorophenol-indophenol) to a pink colour that persisted for 15 seconds. The ascorbic acid content(Vitamin C) was expressed as (mg / 100g) of fresh fruits.

Formula: mg of ascorbic acid per 100g=

$$\frac{\text{titre*dye factor*volume made up*100}}{\text{Aliquot of extract *Wt. of sample}}$$

Determination of Total Sugars

The Phenol - Sulphuric Acid method is an example of a colorimetric method that is widely used to determine the total concentration of carbohydrates present in foods(Ranganna, 1979). A clear aqueous solution of the carbohydrates to be analyzed was placed in a test-tube, and then phenol and sulphuric acid were added. The solution turned to yellow-orange colour as a result of the interaction between the carbohydrates and the phenol. The absorbance at 420 nm was proportional to the carbohydrate concentration initially in the sample. The sulphuric acid causes all non-reducing sugars to be converted to reducing sugars, so that this method determines the total sugars present. This method is non-stoichemetric and so it is necessary to prepare a calibration curve using a series of standards of known carbohydrate concentration.

Determination of Ash Content

Two porcelain crucibles were washed and dried in an oven to a constant weight at 100ºC for 10min. They were allowed to cool in a desiccators, then labelled A and B and weighed. 2.0 g of each sample were weighed into each of the previously weighed porcelain crucibles and reweighed. The crucibles containing the samples were transferred into a furnace, which was set at 550ºC for 8 hr to ensure proper ashing. They were then removed and allowed to cool in the desiccators then finally weighed (AOAC,1980).

Formula: $\% \text{ ash} = \frac{\text{weight of ash}*100}{\text{Weight of sample}}$

Determination of Moisture Content

Two petriplates were properly washed and allowed to dry in an air oven at 110ºC for 10 min to a constant weight. The petriplates were allowed to cooled in a desiccators for 30 min, then labelled A and B and weighed. 2.0 g of each sample was accurately weighed into the previously labelled petriplates and reweighed. The petriplates containing the samples were placed in an oven maintained at 100ºC till constant weight came. They were removed and transferred to desiccators to cooled, finally weighed(AOAC, 1980).

Formula: $\% \text{ moisture content} = \frac{(W_1 - W_2)*100}{W_1 - W}$

Where W_1 is weight of sample and petriplate before drying

W_2 is weight of sample and petriplate after drying

W is weight of empty petriplate

Method for Sensory Evaluation

The Organoleptic evaluation of fruit leather with respect to colour, flavour, texture, taste, appearance and overall acceptability were carried using departmental semi-trained panel members. The panel members were requested to evaluate the product on 9 Point Hedonic Scale (Ranganna, 1979).

Comments –

Table 3.1: Performa for sensory evaluation

Sample	Colour	Texture	Flavour	Sugar Acid Blend	Appearance	Overall acceptability

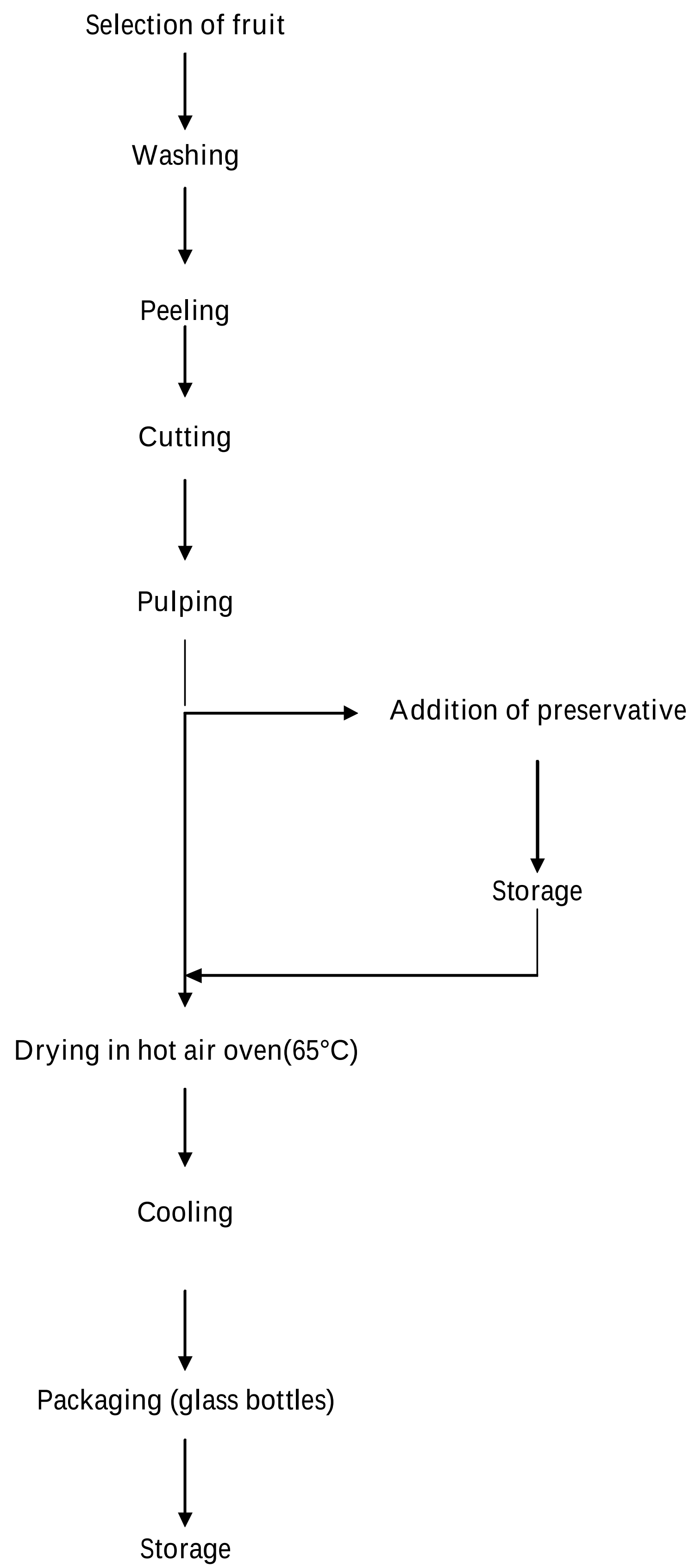
Name of evaluator **Signature**

Hedonic scale

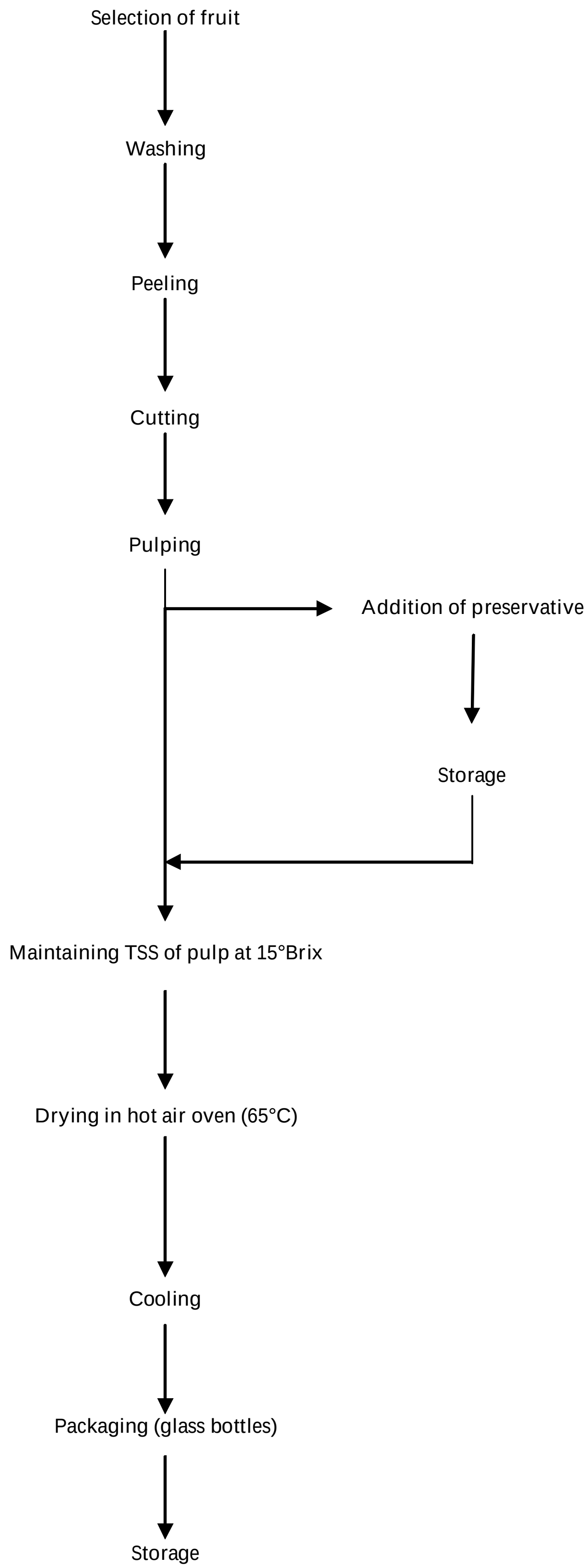
Score	Specifications
9	Like extremely
8	Like very much
7	Like moderately
6	Like slightly
5	Neither like nor dislike
4	Dislike slightly
3	Dislike moderately
2	Dislike very much
1	Dislike extremely

Preparation of Fruit Leather

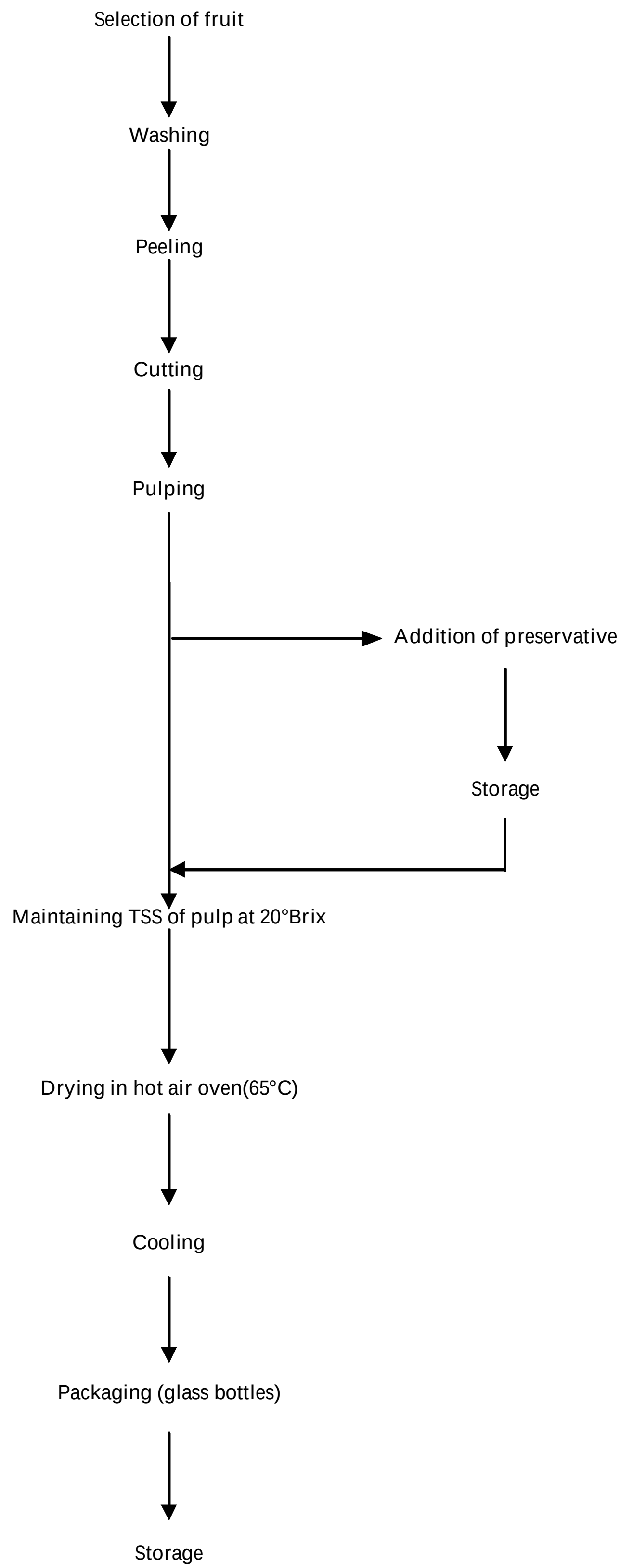
Standard Method (Flow sheet)



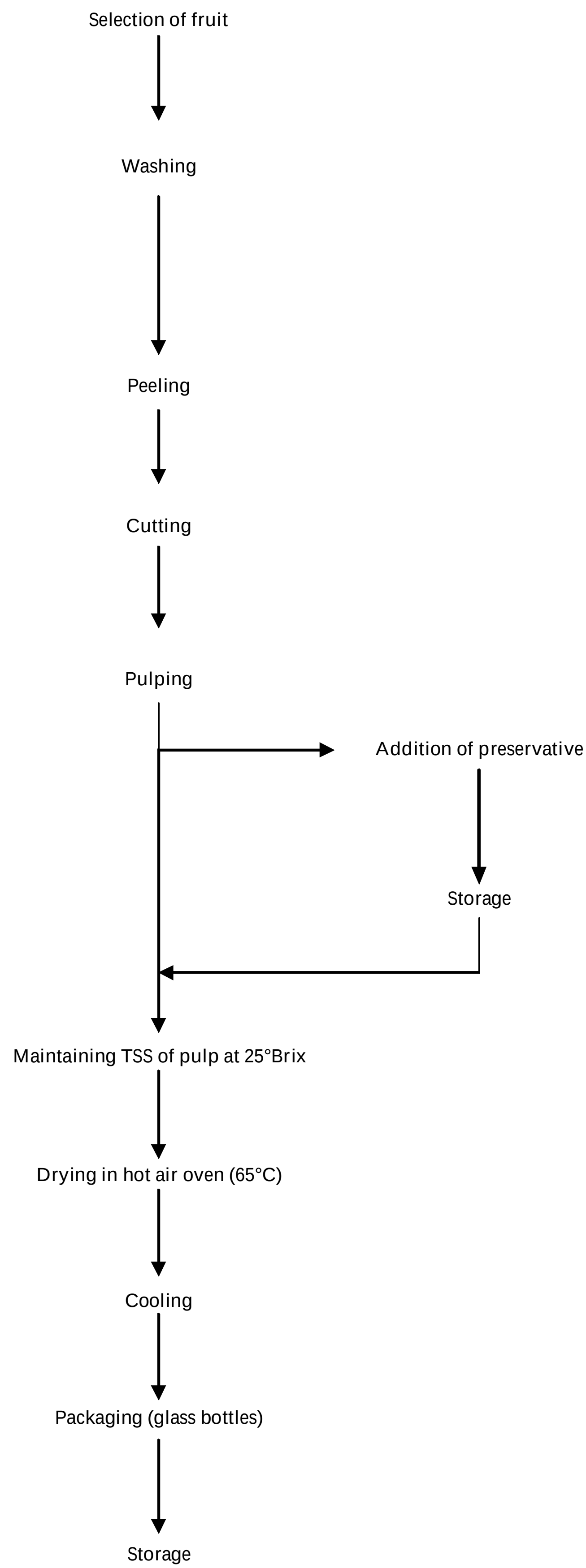
Method A (flow sheet)



Method B (flow sheet)



Method C(flow sheet)



Results and Discussion

The present research was undertaken to study thevarious physico-chemical properties of fruit leather prepared from pumpkin and papaya. The results obtained in the present investigation are presented and are discussed under suitable headings.

Physico-Chemical Analysis of Raw Papaya and Pumpkin

Table 4.1 shows the physico-chemical properties of raw pumpkin and papaya. Fruits have been incorporated in the class of perishable foods because of containing high amount of moisture content (Anonymous, 1979). Papaya and Pumpkin were also not found different from this as their moisture content 88.75% and 83% respectively was also higher in proportion. The moisture content also increases as the fruit ripens and its juiciness proves its higher amount of moisture. Such high moisture papaya fruits had also been reported by Akaniwor & Arachie, (2002) in Nigeria and Zaman*et al.,* (2006) in India. There was not much variation in the TSS, edible portion and colour of both fruits as pumpkin had slightly higher TSS and Papaya had slightly higher amount of edible portion.

The Titrable acidity of Papaya and Pumpkin was estimated as 0.10% and 0.38% citric acid. Early season fruits have higher amount of Titrable acidity than late season ripened fruit. Such a decrease in acidity during ripening of papaya had been reported by Bron and Jocomino, (2006). Ascorbic acid, also known as Vitamin C, content in both fruits was significantly varied. Papaya had much higher amount of ascorbic acid than Pumpkin. According to Cho, (2004), papaya contains 313% of daily requirement while pumpkin serves only 8% of the daily requirement of Vitamin C for our body. The values of ascorbic acid mentioned in Table 4.1 also had match with Oathman, (2009) and Rao, (2013). The total sugar content of papaya and Pumpkin was analysed as 12.97 and 9g/100g pulp. According to Oathman, (2009), the total sugar content increases with the ripening of fruit as the pectin content converts in to sugars.

Physico-Chemical Analysis of Papaya and Pumpkin Leather

The fruit leather samples containing different concentration of sugar (Control, 15%, 20%, and 25%) were prepared from pumpkin and papaya by following the methodology mentioned in material and method section. Control sample contain only natural sugar present in fruit and no sugar was added from outside. All the samples were dried in hot air oven at 65°C.Physico-chemical properties are important qualitative indexes of any fruit for fresh consumption (Zaman*et al.*, 2006).

Various physico-chemical properties of Pumpkin and Papaya leathers have been given in Table 4.2. There was not significant variation in the moisture content of all samples of leathers prepared from Pumpkin and Papaya. The moisture content of Papaya leather ranged between 11.06 - 11.85% and 12.04 - 12.55% in Pumpkin leather. It has been reported by Prabhanjan, *et al.*, (1995) that the higher temperatures provide a larger water vapor pressure deficit (the difference between the saturated water vapor pressure and partial pressure of water vapor in air at a given temperature), which is one of the driving forces for the outward moisture diffusion process (drying). According to Che Man *et al*., (1997), when higher temperatures and longer drying times are used, leather with lower moisture content is obtained.

According to Pathak*et al*., (1991), when heated air is used as drying medium, the primary factor influencing the rate of drying is temperature. During preliminary investigations, it was observed that leathers dried at temperatures above 60°C burnt the product. Studies have proved that prolonged exposure during hot air drying can lead to burning of the material which happens nearly at zero moisture content (Fasina*et al.,*1998). Similarly, higher temperatures and short time or distance can also result in burning of product. The latter is the reason for the observed burns during the experiment and shown in Figure 4.1.

The ash content of Papaya and Pumpkin leather ranged from 2.7-4.7% and 8.25–15.22% respectively (Table 4.2) and the reason for this variation is the addition of sugar. Bansal*et al* (2013) reported in his research that sugar content lowers the ash content. This implies that temperature had no effect on the ash content of leathers. The ash content is a measure of the total amount of minerals present within a food. High mineral contents are sometimes used to retard the growth of certain microorganisms and can have beneficial effects on the physicochemical properties of foods.

Drying caused loss of ascorbic acid (Tables 4.2) and it was ranged in between 40–60mg/100g sample in Papaya leather and 7.5–10mg/100g sample in Pumpkin leather. The research conducted by Guang-yuan and Bo, (2000) had shown that furaldehyde and 5-(hydroxymethyl)furaldehyde (5-HMF) are the two main compounds responsible for degradation of ascorbic acid. Their presence has been proposed as an index of browning (Kanner*et al*., 1981). The oxidation and polymerization of phenolic compounds does not only lead to colour browning but also the formation of new colour pigments. The individual decrease of ascorbic acid in Papaya and Pumpkin leather was may be due to the increase of sugar content because temperature used for drying was the same.

Non-enzymatic browning reactions such as Maillard could possibly explain the browning that took place during drying. The Maillard reaction is the action of amino acids and proteins on sugars. Water activity levels <0.8 and associated moisture levels attained <25% could favour non enzymatic

Table 4.1: Physico-chemical analysis of raw papaya and pumpkin

Parameters	Papaya	Pumpkin
Moisture Content	88.75%	83%
TSS	9°Brix	10°Brix
Titrable Acidity	0.10% citric acid	0.38% citric acid
Colour	Pale yellow	Yellow
% Edible portion	80%	75%
Ash content	0.48%	2.1%
Ascorbic Acid	185.8mg / 100g of pulp	18mg / 100g of pulp
Total Sugars	12.97g / 100g	9g / 100g

Table 4.2: Physico-chemical analysis of papaya and pumpkin leather

Leather Type	Papaya Leather				Pumpkin Leather	
Parameters	**Control Sample**	**15%**	**20%**	**25%**	**Control Sample**	**25%**
Moisture	11.22%	11.85%	11.06%	11.55%	12.55%	12.04%
Ash	4.7%	3.6%	3.1%	2.7%	15.22%	8.25%
Ascorbic acid	60mg / 100g	50mg / 100g	45mg / 100g	40mg / 100g	10mg / 100g	7.5mg / 100g
Total Sugars	13g / 100g	16g / 100g	18g / 100g	20g / 100g	11g / 100g	12.5g / 100g

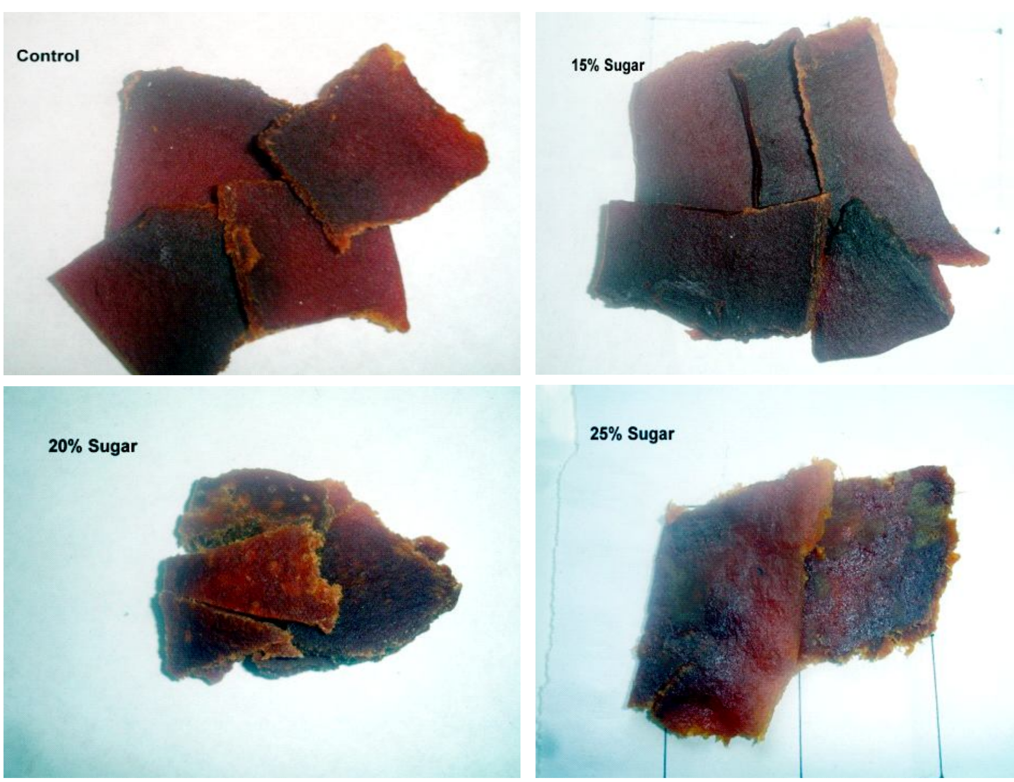


Fig. 4.1: Samples of papaya fruit leather prepared by different blends of sugar

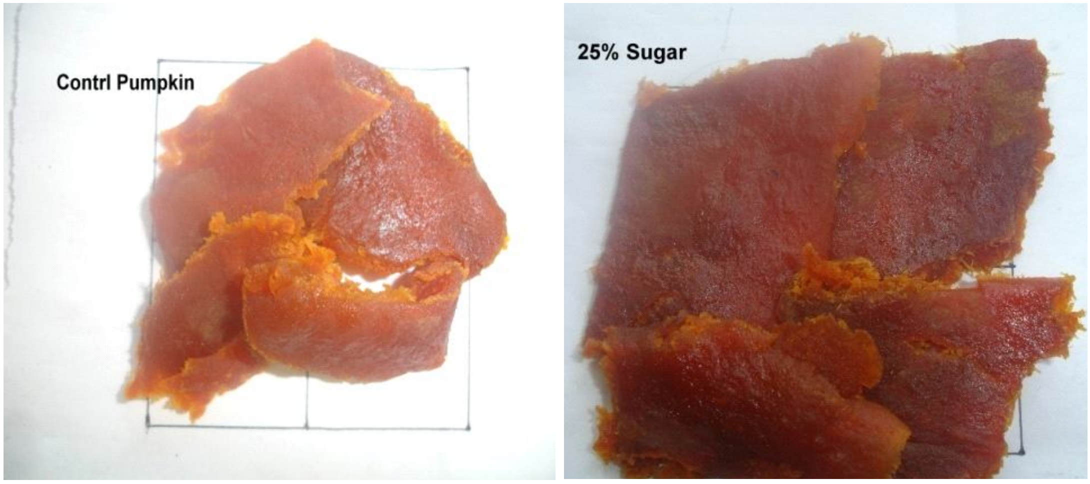


Fig. 4.2: Samples of pumpkin fruit leather prepared by different blends of sugar

browning (Sumaya-Martinez *et al*., 2005). Nonetheless these reactions occur mainly at temperatures greater than 95°C (Sumaya-Martinez *et al*., 2005). Since the temperature of drying (50°C) was lower than 95°C, other factors as vitamin C and polyphenols oxidation could have resulted in browning.

Total sugar content showed the increasing trend in both Papaya and Pumpkin leather (Table 4.2) and this was ranged in between 13-20 g/100g and 10-12.5 g/100g in Papaya and Pumpkin leather, respectively. The reason was the addition of sucrose from outside which also enhanced the taste and flavour of the final product.

Research conducted by McClements, (1999) has shown that the physico-chemical properties of foods ultimately determine their perceived quality and behaviour during storage and consumption. The values obtained indicate that leathers produced by hot air oven drying are similar to those reported in literature. Overall, the values obtained indicate that the leathers are of good quality in terms of vitamin C content, color (purplish) and Moisture content.

Sensory Evaluation of Papaya Leather and Pumpkin Leather

The leatherprepared by various methods was served to semi – trained panel members to get the good quality product. Table 4.3 is clearly indicating that the leatherprepared by standard method and leather prepared by method A were showing similar sensory attributes of panel members. The leather prepared by method C had shown slightly less overall acceptability than standard method. Leather prepared by method B showed maximum overall acceptability.

Color is one of the quality parameters of fruit leathers because of its aesthetic appeal to consumers. The color of the fruit leather was not significantly affected. On average, the color of the Papaya fruit leather with 20% sugar content was liked very much by all respondents. In Pumpkin fruit leather 25% sugar content containing sample was liked the most.

Higher values were recorded for mouth feel compared to all the other parameters. This indicates that panelists disliked the mouthfeel slightly and could be attributed to the fact that panelists were not used to the chewy nature of the leathers. This is because about 40% of the panelists commented that it got stuck to their molars and this could have affected the values for mouthfeel. For leathers with no Sugar and 15% sugar, no significant differences existed between them. However, they differed from both leathers with 20% and 25% sugar. This indicates that mouthfeel as perceived by panelists was affected by the percentage of sugar and acceptability increased with increased amount of sugar. From literature low sugar content leather is harder and has more chewiness, whereas increased sugar content makes texture more viscous and therefore less chewiness

Table 4.3: Sensory evaluation of papaya leather

Sample	Colour	Mouth feel	Taste	Smell	Appearance	Overall Acceptability
Control Sample	8.0	7.0	7.0	7.0	7.0	7.0
Sample A	8.0	8.0	7.5	7.0	7.5	7.0
Sample B	8.5	9.0	8.5	9.0	8.5	8.0
Sample C	7.0	7.0	8.0	7.5	8.0	6.0

Table 4.4: Sensory evaluation of pumpkin leather

Sample	Colour	Mouth feel	Taste	Smell	Appearance	Overall Acceptability
Control Sample	7.0	7.0	6.0	6.0	7.0	6.0
Sample C	8.0	8.0	8.0	7.0	7.0	7.0

(Jain and Nema, 2007). The highest mean score indicates slightly hard texture whilst lower rating shows soft texture.

The taste recorded high average values from 8.5 to 6 (like very much-like slightly). It is evident from Table 4.3 and 4.4 that consumer preference increased with increasing sugar content.

The smell (flavor) of foods is a very essential component of sensory evaluation. From the sensory analysis result, the smell of the leathers was not affected significantly by the amount of sugar added. Papaya only and 15% sugar had no significant difference but differed slightly from 20% and 25% sugar. Significant difference in smell of Pumpkin fruit leather sample was noticed because of the difference in sugar amount i.e. control sample and 25% sugar sample. Therefore, based on the panelists' preference, incorporating sugar affected the flavor but did not follow any trend.

The overall acceptability of Papaya and Pumpkin fruit leather was not significantly affected. This shows that 20% sugar can be used in leather production without consumers detecting any change when it is compared with leather made from Papaya only. Similarly 25% sugar can be beneficial to add in preparation of Pumpkin leather.

Economic Analysis of Papaya Leather

Development costs, while generally a small percentage of total cost, can have significant effects on technology choice and lead to substantial cost savings. A thorough economic analysis of the product and the required development effort is necessary in order to define the remainder of the development project (Adler *et al.,* 1995). Various types of cost calculated during the manufacturing of both papaya and pumpkin fruit leather has been mentioned in Table 4.5 and 4.6

Cost A:

Cost of Papaya fruit = Rs 30 per Kg.

Total quantity of fruit purchased = 2.5 Kg

Total cost of fruit = 2.5*30 = Rs. 75

Cost B:

Cost of Sugar = Rs. 36 per kg

Quantity of sugar purchased = 500g

Cost of sugar purchased = 36*0.5 = Rs. 18

Cost C:

Processing cost is generally taken as 10% of the Raw material cost.

The total cost of raw material was sum of Cost A and Cost B.

Cost A+ Cost B = Rs. 93

So 10% of this was Rs. 9.3

Cost D:

This cost included Packaging Cost. The glass container was used to store the fruit leather. The cost of one glass container was Rs. 20.

Total Cost of the Papaya fruit leather was calculated as sum of all costs.

Total cost = Cost A + Cost B + Cost C + Cost D

Total Cost = 75+18+9.3+20

= 122.3

The quantity of papaya fruit leather prepared was 875g. So the cost of 875g papaya fruit leather was Rs. 122.3. From this, the cost of one kg of papaya fruit leather was calculated and it was estimated as Rs. 139.77 ~ 140.

Table 4.5: Economic analysis of papaya leather

Sr.No	Component	Quantity	Cost (Rs)
1.	Papaya Fruit	2500gms	75
2.	Papaya Pulp	2000gms	-
3.	Sugar	500gms	18
4.	Total Raw Material Cost		93
5.	Packaging Cost	4	80
6.	Processing Cost		9.3
7.	Final Cost of leather	875gms	122.3
8.	Production Cost per kg of leather		139.77

Cost A:

Cost of Papaya fruit = Rs 30 per Kg.

Total quantity of fruit purchased = 4.0 Kg

Total cost of fruit = 4.0*30 = Rs. 120

Cost B:

Cost of Sugar = Rs. 36 per kg

Quantity of sugar purchased = 500g

Cost of sugar purchased = 36*0.5 = Rs. 18

Cost C:

Processing cost is generally taken as 10% of the Raw material cost.

The total cost of raw material was sum of Cost A and Cost B.

Cost A+ Cost B = Rs. 138

So 10% of this was Rs. 13.8

Cost D:

This cost included Packaging Cost. The glass container was used to store the fruit leather. The cost of one glass container was Rs. 20.

Total Cost of the Papaya fruit leather was calculated as sum of all costs.

Total cost = Cost A + Cost B + Cost C + Cost D

Total Cost = 120+18+13.8+20

= 171.8

Table 4.6: Economic analysis of pumpkin leather

Sr. No	Component	Quantity	Cost (Rs)
1.	Pumpkin	4000gms	120
2.	Pumpkin Pulp	3000gms	-
3.	Sugar	500gms	18
4.	Total Raw Material Cost		138
5.	Packaging Cost	2	40
6.	Processing Cost		13.8
7.	Final Cost of leather	1950gms	191.8
8.	Production Cost per kg of leather		98.35

The quantity of papaya fruit leather prepared was 875g. So the cost of 1950g papaya fruit leather was Rs. 171.8. From this, the cost of one kg of papaya fruit leather was calculated and it was estimated as Rs. 88.10 ~ 88.

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