FORMULATION AND STANDARDIZATION OF PASSION FRUIT AND PINEAPPLE BLENDED BEVERAGE

[1]Misal S. A., [2] Prof. (Dr.) Devkatte A. N., [3]Prof. Shere P. D., [4]Prof. Chaudhari D. N.

[1]M. Tech. student, [2]Associate Professor, [3]Associate Professor, [4]Assistant Professor
[1]MIT College of Food Technology, MIT-ADT University, Loni Kalbhor, Pune, India.

Abstract: The formulation and standardization of blended passion fruit and pineapple juice was conducted in order to develop innovative formulation of beverage and study the changes in beverage quality during storage. The extraction of juice from passion fruit and pineapple was done and preliminary trials were conducted to standardize optimum level of ingredients for the blended beverage. The optimum levels of passion fruit juice, pineapple pulp, sugar, stabilizer, preservative and water were selected. Based on sensory evaluation by a panel of trained judges, the optimum level of passion fruit juice, pineapple juice, sugar, stabilizer, preservative and water were reported to be 12 ml, 15 ml, 15 g, 0.10%, 0.10% and 57.80 ml, respectively for 100 ml beverage. The beverage was then pasteurized at 80^0C for 10 min. and filled in clean, sterilized dried glass bottles and sealed air tight with the help of a crown corking machine. After sealing the juice bottles were again pasteurized at 80^0C for 10 min. and the bottles were stored at refrigerated temperature (4^oC) and ambient temperature (24^oC).

Index Terms **– Passion Fruit, Pineapple, Preservative, Beverage.**

I. INTRODUCTION

India is evolving as a huge market for juice industry and trade in past few decades. The increase in consumer demands and changing lifestyle fosters the juice industry. In the world of technological development and fast pace, the consumers have moved towards more easy options of lifestyle. This has given easy way for the industries to manufacture and capitalize in the development of products that are ready to serve and possess health benefits as well. Also, the fact that manufacturers have invested in fruit processing to increase the value of product in order to meet the requirements of consumers. Whereas, the soft drink market grows per year, the juices and nectars market are also increasing due to changing lifestyle of population. Same is the observation in developed countries like China and United States.

The beverages are generally classified as alcoholic and non-alcoholic whereas non- alcoholic beverages can further be categorized as carbonated and non-carbonated beverages. Also packaged fruit juices; non-carbonated drinks have added water that are packages with bottles, energy drinks, flavored milk and so on. The packaged drinks have been accepted in India widely and reasonably, also has captured the market very well due to the growing demands. The Compound Annual Growth Rate of juice market in India is growing constantly and is predicted to increase in forthcoming decade. The blending of different fruit juices increases taste and flavor of fruit juices. The rightful blending of juice can enhance taste and nutrients of the beverages leading to the production of delightful and delicious beverages with advancement in organoleptic properties and nutritional value. (Singh S. *et al*., 2012).

Passion fruit (*Passiflora edulis*) belongs to the family *Passifloraceae* is an important fruit crop having economic values, indigenous to the tropical and subtropical regions of South America, especially in Brazil. It is natively called as yellow passion fruit, granadilla, purple granadilla, apricot vine, Jamaican honeysuckle, etc. (Deshmukh N. *et al.*, 2017). It originates in India, as wild in several parts of Kodaikanal Western Ghats Nilgiris and some North Eastern states like Manipur, Nagaland and Mizoram.

Fruits are nearly round to oval in shape with tough rind which is smooth and waxy and weighing about 35 to 40g in yellow species (*P. edulis flavicarpa*) and about 60g in purple species (*P. edulis Sims*) and bears on woody perennial vines. An aromatic mass of double-walled, membranous sacs containing orange color pulpy juice are the edible portion and roughly 250 small, dark brown to black pitted seeds are present inside the fruit. It is a rich source of Vitamin A and C and contains reasonable amounts of iron, potassium, sodium, magnesium, chlorides and has dietary fiber and protein. Fruits are eaten fresh or usually processed into products like jams, squash, ice-cream, cakes, pies and juice. Vines are productive at higher elevations. Fruits are 4-5 cm in diameter, deep purple when ripe each weigh around 35-45 g (juice content differs from 31-35%) (Thokchom *et al*., 2017).

Pineapple (*Ananas comosus*) is found in all the tropical and subtropical zones of the world. Most of pineapple produced are consumed as raw fruit and addition to that most of it are tropical fruits. Pineapples are processed in several products such as dried pineapple, pulp, concentrate and juice. The fresh pineapple juice as a product has got popularity due to its flavor, pleasant aroma and many functional properties. The market provides wide array of pineapple juice to its customers. The types of juices provided include clear juice, juice from concentrate, blended juice with other fruits and also juice that is obtained from pineapple parts by squeezing in mills, called as single strength juice (Paull *et al*., 2011).

Pineapple juice is a rich source of manganese, as well as amino acids, various sugars, vitamins, and polyphenols. It is considered as a functional drink due to its health-promoting feature and has anti-inflammatory, anti-atherosclerotic, antiaging, and many other healing properties. This fruit has been extensively used as a traditional remedy for several health ailments such as digestive problems. Recent research has indicated that pineapple fruit, peel, and juice exhibit robust effects of anti-oxidant capacity, phenolic content, and polysaccharide. Pineapple juice has the capacity to relieve suffering from heart conditions mainly because it reduces blood clots in the blood stream (Khalid *et al.*, 2016).

Generally, the commercialized fruit beverages contain 12% minimum of fruit juice and rest as sugar, citric acid and other ingredients. (European Commission, 2008). The food industries apply some common processes such as thermal treatments because of their ability to kill microorganisms and inactivate enzymes, like pasteurization and sterilization, for preservation of functional beverage. The great potential for commercialization of RTS beverages as natural health drinks in domestic and the export market. The studies confirm the formulation of the blended passion fruit and pineapple beverage portrayed good sensory properties.

II. RESEARCH MATERIAL AND METHODOLOGY

2.1. Materials

The present research work was undertaken in the Department of Ethical Science and Food Technology in MIT College of Food Technology, during the year 2018-2019, entitled 'Studies on formulation and standardization of passion fruit and pineapple blended beverage. The material used and methods adopted during the tenure of study are presented in this chapter.

2.1.1. Fruits

Passion fruits weighing 10 kilograms were obtained from the APMC Market, Navi Mumbai. The fully matured, healthy, flawless and uniform sized fruits were carefully selected and brought to the laboratory for further experimentation.

Pineapples were purchased from Local Market: Loni-Kalbhor, Pune. The fresh, ripe and uniform sized fruits were selected for experimentation.

The fruits were thoroughly washed prior to processing to remove dust and dirt adhered to fruits, to prevent contamination.

2.1.2. Chemicals and Packaging material

Sugar used in the experimentation was obtained from Local Market: Loni-Kalbhor, Pune. Other chemicals and equipment required for experimentation are acquired from MIT-ADT laboratory.

Glass bottles used as packaging material for blended juice, were obtained from Ravivar Peth, Pune.

2.2. Methodology

2.2.1. Fat Content

The fat was estimated by the procedure given in Ranganna (1986) as given below:

Procedure:

A clean, dry Soxhlet flask was weighed (W1). Take 3 g of dried sample (W2) was transferred to a thimble and the top of the thimble was plugged with a cotton plug. The thimble was dropped into a Soxhlet apparatus. Approximately, 75 ml of Petroleum ether was poured through the sample into the flask. One end of the fat extraction tube was attached to the flask and other to condenser. The sample was extracted for 16 hr. After the extraction of fat from the sample into the solvent, the solvent was recovered. The solvent in the flask was evaporated in an oven at 100º C for 1 hr., further cooled and weighed (W3). The crude fat percent was calculated as follows:

$$\text{Fat (\%)} = \frac{\text{W3} - \text{W1}}{\text{W2}} \times 100$$

2.2.2. Moisture Content

The moisture content was determined using the hot air oven method. The sample was weighed (W1) approximately 10 g and kept in a petri plate and allow to dry at 110º C in the hot air oven with periodically weighing until constant. The dried sample was kept in desiccator for cooling. The weight (W2) of cooled sample was obtained. The moisture content was calculated as follows:

$$\text{Moisture content(\% mc)} = \frac{\text{W1} - \text{W2}}{\text{W1}} \times 100$$

2.2.3. Protein content

The nitrogen was determined by Kjeldahl method and protein was then calculated by using the below given formula.

Procedure:

0.4 g of sample was weighed and transferred to Kjeldahl flask. Around 2.5 g of digestion mixture, and 10 ml of concentrated H_2SO_4 was added to it. The Kjeldahl flask was kept in the digestion assembly. The assembly was heated to 420º C and the sample was digested till all the fumes of SO_2 were exhumed. The flask was cooled and transferred to the digestion assembly. 50 ml of 40% NaOH was added to it and distillation was started. The ammonia gas was liberated during the distillation process and was absorbed in the 25 ml of 3 % Boric acid solution taken in a conical flask. 3-4 drops of mixed indicator were added to it and it was titrated against 0.116 N HCl till pink color end point was obtained. The titre value was noted and % nitrogen in sample was calculated using following formula:

$$\text{Nitrogen (\%)} = \frac{(\text{Sample titre} - \text{Blank titre}) \times \text{Normality of HCl} \times 14}{\text{Weight of sample } \times 1000} \times 100$$

% Protein = 6.25 x % Nitrogen

2.2.4. Carbohydrates

The carbohydrates are estimated by anthrone method.

Procedure:

Take clean and dry test tubes and mark all the tubes as per the protocol. Pipette out 0.1-0.5 ml of glucose standard solution in duplicate test tubes. In one test tube take only 1 ml of distilled water and mark it as blank. Make up the volume to 1 ml in each test tube by adding distilled water. Then add 3 ml of anthrone reagent to each test tube and mix thoroughly. Heat the test tubes for 8 min in a boiling water bath. Cool rapidly and read the green to dark green color at 630 nm. Draw a standard graph by plotting concentration of the standard on the X-axis and absorbance on the Y-axis. From the graph calculate the amount of carbohydrate present in the sample tube.

$$\text{Carbohydrate content in 100 mg of sample} = \frac{\text{mg of glucose} \times 100}{\text{Volume of test sample}}$$

2.2.5. Ash Content

The total ash of the sample (raw material and final product) was determined using the procedure explained by Ranganna (1986).

Procedure:

The silica crucible (W1) was weighed. Then, 5 g of sample was weighed (W2) in it. The contents in the crucibles were charred on a Bunsen burner and then were kept in muffle furnace at 525- 550º C for 6 hr. The crucibles were cooled overnight and weighed (W3) again. Percent total ash was calculated as follows:

$$\text{Ash content (\%)} = \frac{W3 - W1}{W2}$$

2.2.6. Fibre Content

Fibre was estimated using the protocol given by Ranganna (1986) using Fibroton apparatus.

Procedure:

2-3 g defatted sample was weighed (W) and transferred to the crucibles for fibre estimation. The crucible was placed in the hot extraction unit. For acid extraction, 150 ml 1.25 % H_2SO_4 was poured in the crucible. The acid wash was done at 400º C for 45 min and then, wash with distilled water. The acid wash was followed by alkali wash with 1.25 % NaOH and after washing with distilled water, the crucibles were dried in hot air oven at 100º C till free from moisture. Then, the weights of crucible were taken (W1) and the crucible were placed in muffle furnace at 400º C for 5-6 h. After cooling the crucibles, weight of crucible with ash was taken (W2).

$$\text{Fibre content (\%)} = \frac{W1 - W2}{W} \times 100$$

2.2.7. Determination of Energy value

Procedure

Energy value = (Carbohydrate + Protein) x 4 + Fat x 9. Ranganna, S. (1986).

2.2.8. Ascorbic acid content

The ascorbic acid content was determined by Assay method given by Ranganna (1986) as portrayed below:

Procedure:

Preparation of sample: 10 g/ml of sample was mixed with 100 ml of 3% HPO_3. It was then filtered. An aliquot (10ml) of the sample was measured and titrated against standard dye till pink color was observed as end point, which persisted for 15 s. The Ascorbic Acid content of the sample was calculated by using the following formula:

$$\text{Ascorbic acid(mg/100 g)} = \frac{\text{Titre value} \times \text{Dye factor} \times \text{Volume made up}}{\text{Aliquot of sample taken for estimation} \times \text{Weight of sample taken for estimation}} \times 100$$

2.2.9. Sensory evaluation of passion fruit and pineapple blended beverage

The sensory evaluation of passion fruit and pineapple blended beverage was done by a panel of 5 semi-trained judges as described by Amerine *et. al.,* (2013) on 9 point hedonic scale. The mean value of sensory score was calculated and reported for each sensory parameter.

2.2.10. Statistical analysis of data

The data obtained were analyzed for statistical significance according to the procedure given by Panse and Sukhatme (1967). However, due to spoilage of some samples before the completion of storage period, simple mean values have been reported.

2.3 Flow chart for preparation of passion fruit and pineapple blended beverage

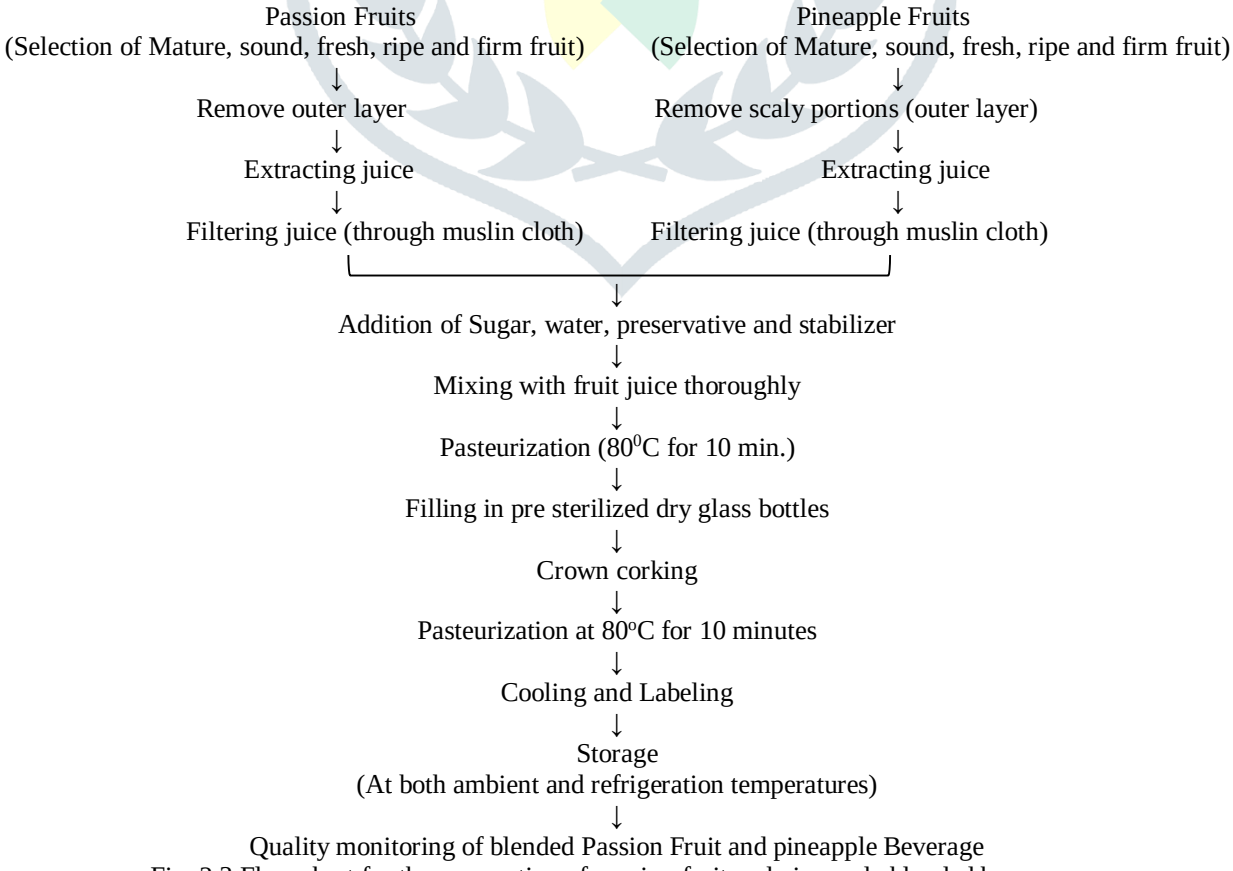

Fig. 2.3 Flow chart for the preparation of passion fruit and pineapple blended beverage.

2.3.1. Procedure of passion fruit and pineapple blended beverage preparation

2.3.2. Selection of fruit

The fully matured healthy uniform fruits were selected for this purpose. As explained above.

2.3.3 Preparation of fruits for pulping

The fruits were washed in running tap water for removing the adhering dirt after washing of fruits, preliminary trial was conducted to standardize the method of extraction of pulp. The pulp was extracted using the following procedure.

2.3.4 Extraction of pulp from fruit

The fruits were peel with the help of stainless-steel knife, then some quantity of water was added and steamed for pulp preparation. The steamed pulp was prepared with the help of mixer cum grinder. The seeds (stones) and fiber and other pulp waste were strained with stainless steel sieve.

2.3.5. Procedure for preparation of Juice

The extracted pulp was used for the preparation of blended passion fruit and pineapple juice. The grinded sugar was added to required quantity of pulp and diluted with water. In all the treatments similar method was used. The pulp and sugar were mixed thoroughly and heated up to 65°C to dissolve it properly. It was homogenized with juicer cum mixer and then strained with muslin cloth to remove impurities if any. The sodium benzoate at 0.10 g/100ml was used as preservative for the prepared juice. The pectin as a stabilizer was added in the juice with concentration of 0.10 g/100ml. The juice was then pasteurized at 80^0C for 10 min.

2.3.6. Bottling

The pasteurized juice was filled in clean, sterilized dried glass bottles of 200 ml capacity leaving 2.0 cm head space and sealed air tight with the help of a crown corking machine. After sealing the juice bottles were again pasteurized at 80^0C for 10 min.

2.3.7. Storage

The juice bottles were cooled and stored in dried place at ambient temperature (24°C) and at refrigeration temperature (4°C).

2.4. Treatment details

2.4.1. Formulations:

Different samples like S_0, S_1, S_2, S_3 and S_4 were prepared by blending Passion fruit and Pineapple juice proportions. The formulation is presented as below in table.

Table No. 2.4.1. Formulation for Passion Fruit and Pineapple BlendedBeverage

Sample code	Passion Fruit (ml/100ml)	Pineapple (ml/100ml)	Sugar (g/100 ml)	Water (ml/100ml)	Stabilizer (g/100ml)	Preservative (g/100ml)
S_0	12.00	-	15.00	72.80	0.10	0.10
S_1	12.00	10.00	15.00	62.80	0.10	0.10
S_2	12.00	15.00	15.00	57.80	0.10	0.10
S_3	12.00	20.00	15.00	52.80	0.10	0.10
S_4	12.00	25.00	15.00	47.80	0.10	0.10

S_0-Controle sample, S_1-Blend with 10% pineapple juice, S_2-Blend with 15% pineapple juice, S_3-Blend with 20% pineapple juice, S_4-Blend with 25% pineapple juice

III. RESULTS AND DISCUSSION

3.1. Formulation and Standardization of passion fruit and Pineapple blended beverage

Several trials (Table 3.1) were conducted to select optimum level of passion fruit juice, pineapple juice, sugar, stabilizer, preservative and water for the blended beverage. Based on sensory evaluation by a panel of trained judges, the optimum level of passion fruit pulp, pineapple pulp, sugar, water, stabilizer and preservatives were reported to be 12 ml, 15 ml, 15 g, 57.80 ml, 0.10 g and 0.10 g respectively for 100 ml beverage.

Table 3.1. Standardization table for Blended Passion Fruit and Pineapple Beverage

Sample code	Passion Fruit (ml/100ml)	Pineapple (ml/100ml)	Sugar (g/100 ml)	Water (ml/100ml)	Stabilizer (g/100ml)	Preservative (g/100ml)
S_0	12.00	-	15.00	72.80	0.10	0.10
S_1	12.00	10.00	15.00	62.80	0.10	0.10
S_2	12.00	15.00	15.00	57.80	0.10	0.10
S_3	12.00	20.00	15.00	52.80	0.10	0.10
S_4	12.00	25.00	15.00	47.80	0.10	0.10

S_0-Controle sample, S_1-Blend with 10%pineapple juice, S_2-Blend with 15% pineapple juice, S_3-Blend with 20% pineapple juice, S_4-Blend with 25% pineapple juice

Based on the sensory evaluation by a panel of trained judges the sample S2 got highest score i.e. 8 which was having, the optimum level of passion fruit pulp, pineapple pulp, sugar, water, stabilizer and preservatives were reported to be 12 ml, 15 ml, 15 g, 57.80 ml, 0.10 g and 0.10 g respectively for 100 ml beverage (Table 3.2).

3.2. Sensory evaluation of passion fruit and pineapple blended beverage

Table 3.2. Sensory evaluation of passion fruit and pineapple blended beverage

Sample code	Color and Appearance	Taste	Flavor	Mouth feel	Overall acceptability
S_0	7.2	7.3	7.3	7.3	7.2
S_1	7.4	7.5	7.5	7.4	7.3
S_2	7.9	8.0	7.9	8.1	8.0
S_3	7.5	7.6	7.5	7.7	7.6
S_4	7.4	7.5	7.5	7.3	7.4
Mean	7.48	7.58	7.54	7.56	7.5
SE (m)	0.5293	0.5364	0.5321	0.5349	0.5341
CD@5%	1.5935	1.6147	1.6019	1.6104	1.6079

S_0 –Control sample, S_1 –Blended with 10% pineapple juice, S_2 - Blended with 15% pineapple juice, S_3 - Blended with 20%pineapple juice, S_4- Blended with 25 % pineapple juice

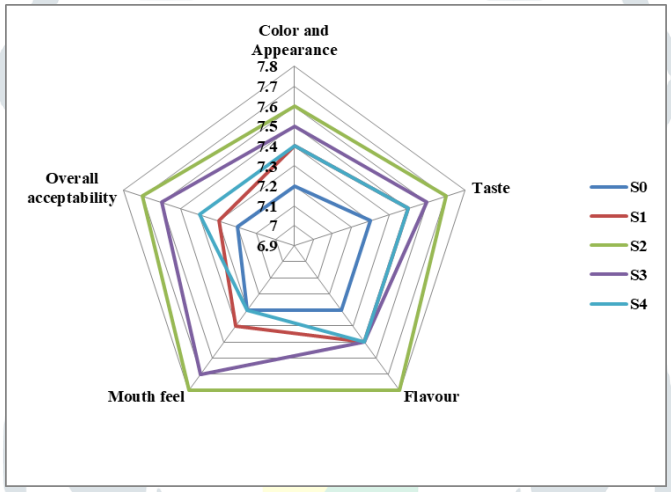

Figure 3.2. Sensory evaluation of Passion fruit and Pineapple blended beverage

3.3 Proximate analysis of selected blended beverage

The data of proximate analysis of passion fruit and pineapple blended beverage is presented in Table 3.3. Among the chemical composition of passion fruit and pineapple blended beverage, the values for energy were 79.68 Kcal, protein content were 2.42 %, carbohydrates were 17.14%, fat were 0.16%, ash content were 0.12 %, moisture were 80.16 %, fiber were 0.11 % whereas vitamin C were 47.19 mg/ml.

Table 3.3 Proximate analysis of selected blended beverage

Sr. no.	Properties	Result (Per 100ml)
1	Energy	79.68
2	Protein	2.42
3	Carbohydrates	17.14
4	Fat	0.16
5	Ash	0.12
6	Moisture	80.16
7	Fiber	0.11
8	Vitamin C	47.19

IV. SUMMERY AND CONCLUSION

Present research work on "Formulation and Standardization of Passion Fruit and Pineapple Blended Beverage" was undertaken to develop a technology for blended beverage making. The juice was extracted from passion fruit and pineapple and preliminary trials were conducted to standardize optimum level of ingredients for the blended beverage. The optimum levels of passion fruit juice, pineapple juice, sugar, water, pectin and sodium benzoate were selected. The S_2P sample with the combination of passion fruit juice 12 ml, pineapple juice 15 ml, sugar 15 g, water 57.80 ml, 0.10% stabilizer and 0.10% preservative for 100ml blended beverage secured the highest score for sensory evaluation so indicates best for consumer acceptance. The beverage was packed in glass bottles and the bottles were stored at refrigerated temperature (4°C) and ambient temperature (24°C).

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