

## **Original Research Article**

**Studies on syrup preparation from mango (*Mangifera indica* L.), citrus (*Citrus aurantifolia* Swingle.), Aloe vera (*Aloe barbadensis* Miller.) and ginger (*Zingiber officinale* Rosc.) blends.**

### **ABSTRACT**

The present investigation was carried out at Post Graduate Laboratory of Department of Fruit Science, College of Horticulture and Forestry, A.N.D. University of Agriculture & Technology, Kumarganj, Ayodhya (U.P.) during the year 2019-2020. Mango, citrus (kagzi lime), Aloe vera and ginger have nutritional, spicy, medicinal and therapeutic values. 25 per cent of blend comprising 55 per cent mango pulp, 25 per cent kagzi lime juice, 10 per cent Aloe vera gel and 10 per cent ginger juice was found best on 9- point hedonic scale for the preparation of syrup with 70 per cent TSS and 1.20 per cent acidity than other blend combinations viz., 100, 0, 0 and 0 percent (T<sub>1</sub>); 0, 100, 0 and 0 percent (T<sub>2</sub>); 0, 0, 100 and 0 percent (T<sub>3</sub>); 0, 0, 0 and 100 percent (T<sub>4</sub>); 25, 25, 25 and 25 percent (T<sub>5</sub>); 40, 20, 20 and 20 percent (T<sub>6</sub>); 70, 10, 10 and 10 percent (T<sub>7</sub>); 20, 40, 20 and 20 percent (T<sub>8</sub>) and 50, 20, 15 and 15 percent (T<sub>10</sub>), mango pulp, kagzi lime juice, Aloe vera gel and ginger juice, respectively. During storage Total Soluble Solids, acidity, reducing sugars and total sugars increased whereas, vitamin-A, vitamin-C, non-reducing sugar and organoleptic score decreased with the advancement of storage period. The syrup was stored into glass and polypet bottles at ambient temperature (20.1-29.4<sup>0</sup>C) and was found organoleptically acceptable up to 5 months of storage in case of both glass and polypet bottles. This study indicates that mango, kagzi lime, Aloe vera and ginger can be utilized for palatable syrup making beneficial for the consumers in terms of taste, colour, flavor, medicinal and therapeutic properties.

**Keywords:-** Syrup, mango pulp (*Mangifera indica* L.), kagzi lime juice (*Citrus aurantifolia* Swingle.), Aloe vera gel (*Aloe barbadensis* Miller.), ginger juice (*Zingiber officinale* Rosc.), blend combination, glass and polypet bottles, storage, organoleptic quality.

## Introduction

A beverage is a liquid intended for human consumption, in addition to their basic function of satisfying thirst, beverages play an important role in human culture (**Wikipedia, 2019**). Beverages are of two types- unfermented (non-alcoholic) and fermented (alcoholic). Blended beverages with using different fruits, vegetables, spices extract and plants of medicinal values as new food products definitely attract the consumers in the interpretation of sensory and nutritional characteristics.

Mango is the king among tropical fruits which is botanically known as *Mangifera indica* L. and belongs to the family Anacardiaceae. It is also known as Aam, National fruit of India, Bathroom fruit and Symbol of love. It is originated in South-East-Asia, particularly in Indo-Burma region. On the basis of analysis of different varieties of mango, it is reported that mango fruit contains moisture 73.0 – 86.7%, carbohydrate 11.6 – 24.3%, protein 0.3 – 1.0%, fat 0.1 – 0.8%, fibers 0.8%, minerals 0.3 – 0.7%, Vitamin A 650 – 25940 I.U., Vitamin C 3 – 83 mg/100g, calcium 0.01%, phosphorous 0.02% and iron 4.5 mg/100g (**Anon., 1966**). Young and unripe mango fruits are utilized for culinary purposes as well as for preparing pickles, chutney and amchur, because of their acidic taste. Ripe mango fruits are utilized in preparation of pulp, juice, syrup, squash, jam, jelly, preserve, nectar, canned slices, dried powder, RTS, baby food, mango leather (Aam Papar), toffee, candy and many other products. These conventional type of mango products have been developed to a considerable level and a significant demand has been built up by the processing industry, both for domestic and export market (**Sadhu and Bose, 1976; Rameshwar et al., 1979; Kalra et al., 1981; 1982**).

Citrus (*Citrus spp.*) is a genus of flowering trees and shrubs, belonging to the family Rutaceae. Citrus fruits are used extensively in food processing industry to prepare a wide varieties of products such as RTS, juice, squash, syrup, chutney, slices, pickles and cordial. Kagzi lime (*Citrus aurantifolia* Swingle) is said to be originated in India. Vitamin C content is the maximum in acid lime (15-65 mg/100 g). The fruit is very sour because of high quantity of acid; hence fresh fruits are not consumed whereas, fresh juice mixed with water and sugar makes a delicious drink during summer season. Lime fruits are also consumed as pickles in India. Lime juice reduces the body heat and increases the appetite. Drinking lime juice with salt

reduces the stomach pain. It helps in digestion of foods. They are refreshing and delicious to eat.

Aloe vera (*Aloe barbadensis* Miller) is perennial, drought resistant succulent plant commonly known as 'Ghrit-kumari' and 'Gheegwar' belongs to the Asphodelaceae or Liliaceae family, which historically has been used for a variety of medicinal purpose. There are 275 species of aloe vera grown all over the world. The most widely used species of aloe vera are *Aloe barbadensis* Miller and *Aloe aborescens* (**Ramachandra and Rao, 2008., Dubick and Michsel, 1983**). Aloe vera gel is colorless, transparent and slippery mucilage containing water and bioactive polysaccharides mainly acemannan and glucomannan. Aloe vera gel is used to treat constipation, coughs, ulcers, diabetes, headaches, arthritis, and immune-system deficiencies (**Bozzi A. et al., 2007**). In food industry, it has been used as an ingredient for preparation of functional foods and production of gel-containing health drinks, energy drinks and different type of beverages like RTS, squash, syrup, tea, milk, ice-cream and confectionary.

Ginger is an ancient medicinal as well as spicy plant belonging to Zingiberaceae family and botanically known as *Zingiber officinale* Rosc. It is indigenous to South-Eastern-Asia. Since a very long time ginger is known for its medicinal values as a digestive aid, spiritual beverage, aphrodisiac, antiemetic, anticancer, anti-oxidant, anti-inflammatory and immune stimulating properties (**Malhotra and Singh, 2003**). The fresh ginger is widely used in pickles and candies making whereas fresh ginger juice is used in RTS, squash, syrup and nectar beverages preparation while ginger powder, oleoresin, essence, soft drink, non-alcoholic beverages and ginger oil are manufactured from dry ginger. Ginger ale and the ginger beer are two most popular ginger drinks which are carbonated ginger, flavored with soft drinks.

The demands of natural beverages rich in nutrients and having therapeutic as well as medicinal values, are increasing because of changing life style, health consciousness and increasing purchasing capacity of the consumers. The present studies were carried out because the blend beverages of fruits, medicinal plants and spices are rich source of nutrients, medicinal properties and flavors to meet the consumers demand in National and International markets.

## Materials and Methods

### Raw materials

Mango (var. Dashehari), kagzi lime purchased from local market, Aloe vera (var. Samsheetal) purchased from National Botanical Research Institute, Lucknow and ginger (Local variety) purchased from local market were used for the syrup preparation.

### Extraction of mango pulp, kagzi lime juice, Aloe vera gel and ginger juice

The methods applied to extract the mango pulp, kagzi lime juice, Aloe vera gel and ginger juice are shown as flow sheets in Fig. 1, Fig. 2, Fig. 3 and Fig. 4, respectively.

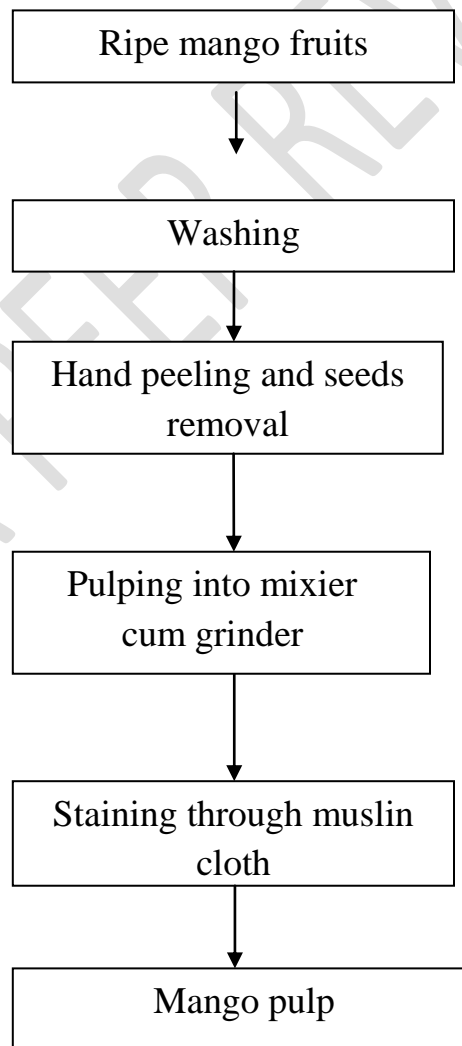


Fig.-1: Flow chart for extraction of pulp from mango fruits

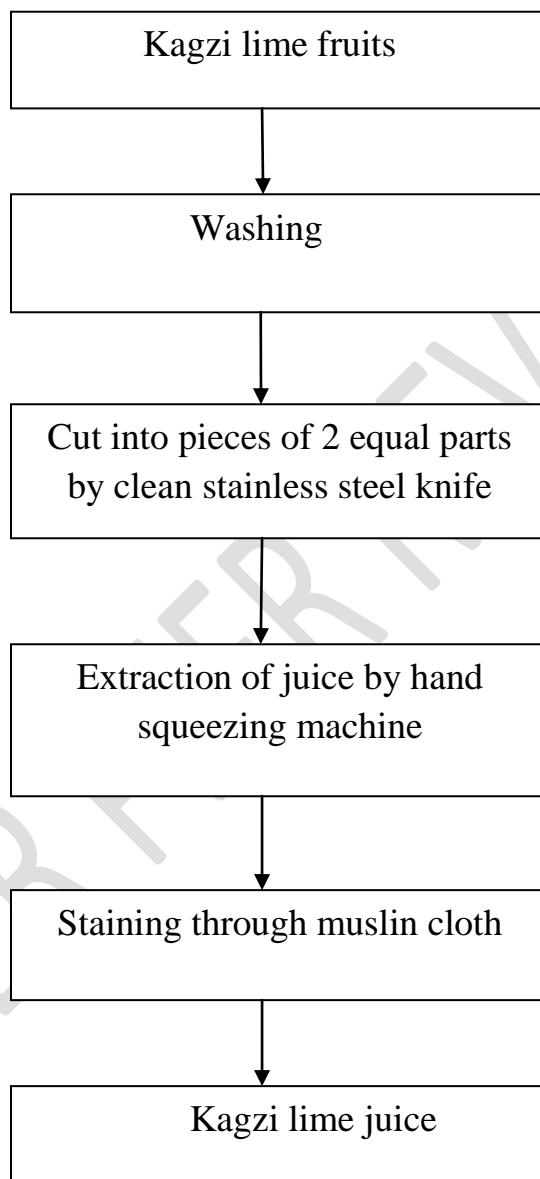


Fig.-2: Flow chart for extraction of juice from kagzi lime fruits

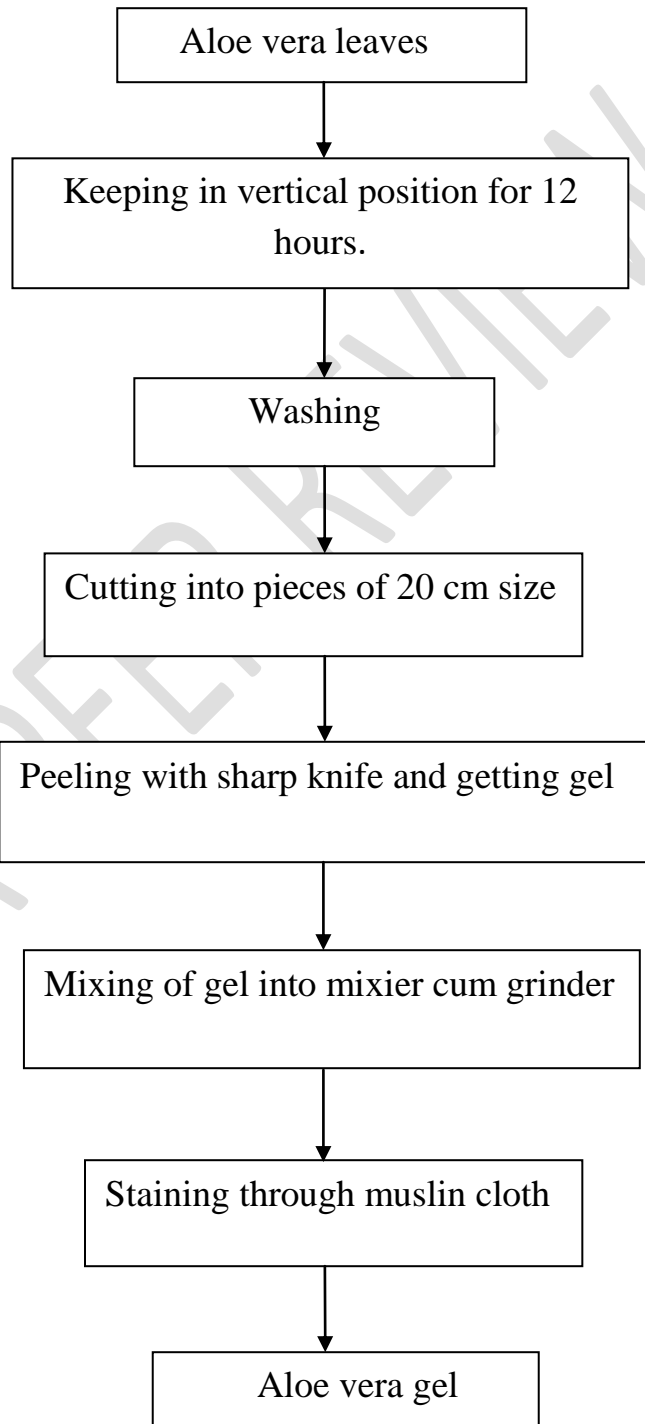


Fig.-3: Flow chart for extraction of Aloe vera gel

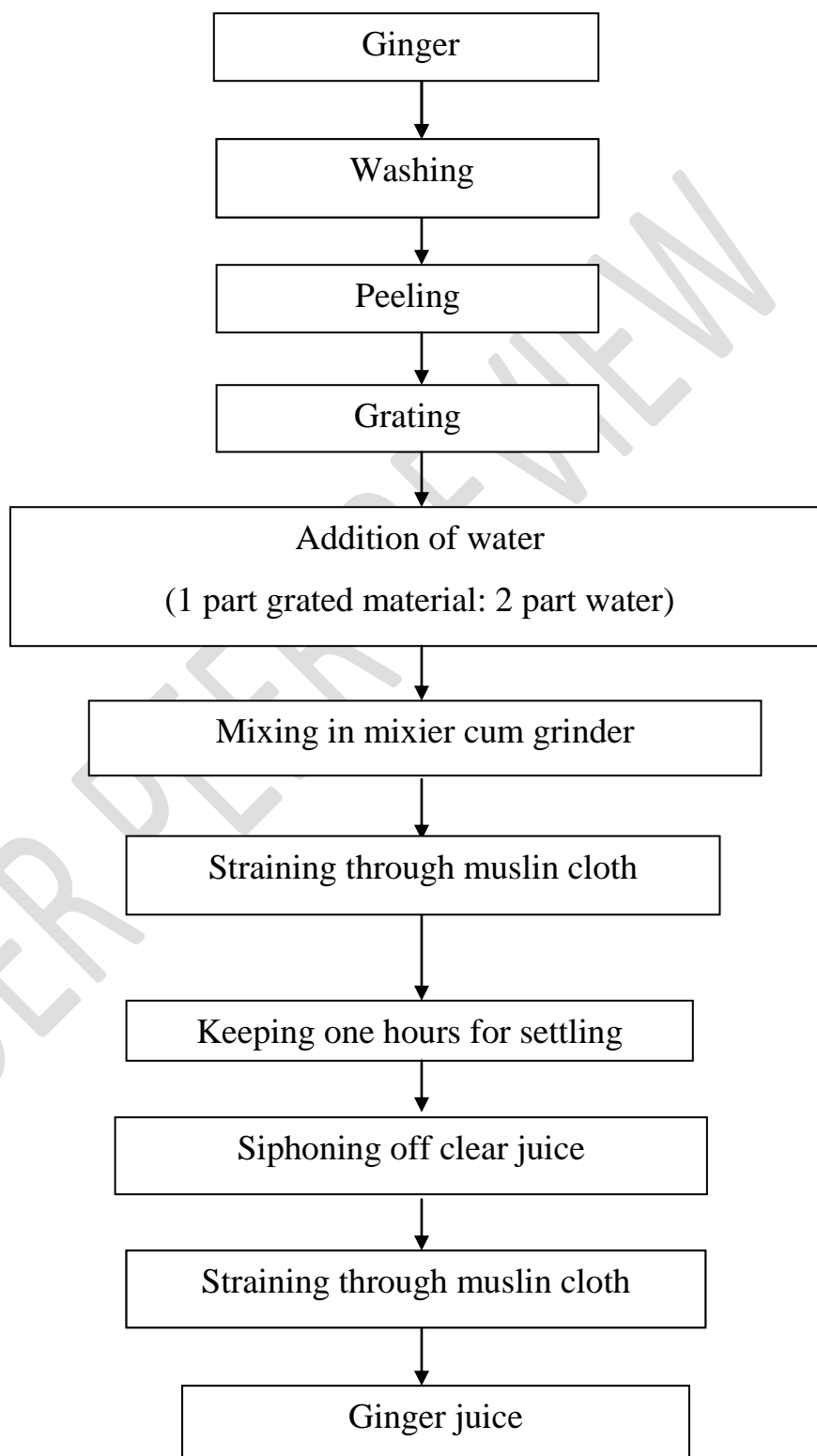


Fig.-4: Flow chart for extraction of ginger juice

### Standardization of blends for syrup

The following combinations of mango pulp, kagzi lime juice, Aloe vera gel and ginger juice were evaluated to standardize the blend for the development of palatable and quality syrup:

- T<sub>1</sub>** 25 % blend comprising 100 % mango pulp + 0 % kagzi lime juice + 0 % Aloe vera gel + 0 % ginger juice and adjusted to 70 % TSS and 1.20 % acidity.
- T<sub>2</sub>** 25 % blend comprising 0 % mango pulp + 100 % kagzi lime juice + 0 % Aloe vera gel + 0 % ginger juice and adjusted to 70 % TSS and 1.20 % acidity.
- T<sub>3</sub>** 25 % blend comprising 0 % mango pulp + 0 % kagzi lime juice + 100 % Aloe vera gel + 0 % ginger juice and adjusted to 70 % TSS and 1.20 % acidity.
- T<sub>4</sub>** 25 % blend comprising 0 % mango pulp + 0 % kagzi lime juice + 0 % Aloe vera gel + 100 % ginger juice and adjusted to 70 % TSS and 1.20 % acidity.
- T<sub>5</sub>** 25 % blend comprising 25 % mango pulp + 25 % kagzi lime juice + 25 % Aloe vera gel + 25 % ginger juice and adjusted to 70 % TSS and 1.20 % acidity.
- T<sub>6</sub>** 25 % blend comprising 40 % mango pulp + 20 % kagzi lime juice + 20 % Aloe vera gel + 20 % ginger juice and adjusted to 70 % TSS and 1.20 % acidity.
- T<sub>7</sub>** 25 % blend comprising 70 % mango pulp + 10 % kagzi lime juice + 10 % Aloe vera gel + 10 % ginger juice and adjusted to 70 % TSS and 1.20 % acidity.
- T<sub>8</sub>** 25 % blend comprising 20 % mango pulp + 40 % kagzi lime juice + 20 % Aloe vera gel + 20 % ginger juice and adjusted to 70 % TSS and 1.20 % acidity.
- T<sub>9</sub>** 25 % blend comprising 55 % mango pulp + 25 % kagzi lime juice + 10 % Aloe vera gel + 10 % ginger juice and adjusted to 70 % TSS and 1.20 % acidity.



**T<sub>10</sub>** 25 % blend comprising 50 % mango pulp + 20 % kagzi lime juice + 15 % Aloe vera gel + 15 % ginger juice and adjusted to 70 % TSS and 1.20 % acidity.

### **Preparation of syrup**

Syrup comprising 25 % blend, 70 % TSS and 1.20 % acidity were prepared from different treatments. The prepared syrup was organoleptically evaluated on 9-point Hedonic scale to find out the best combination of blend for large scale preparation. The technique used for syrup making is shown in Fig-5.

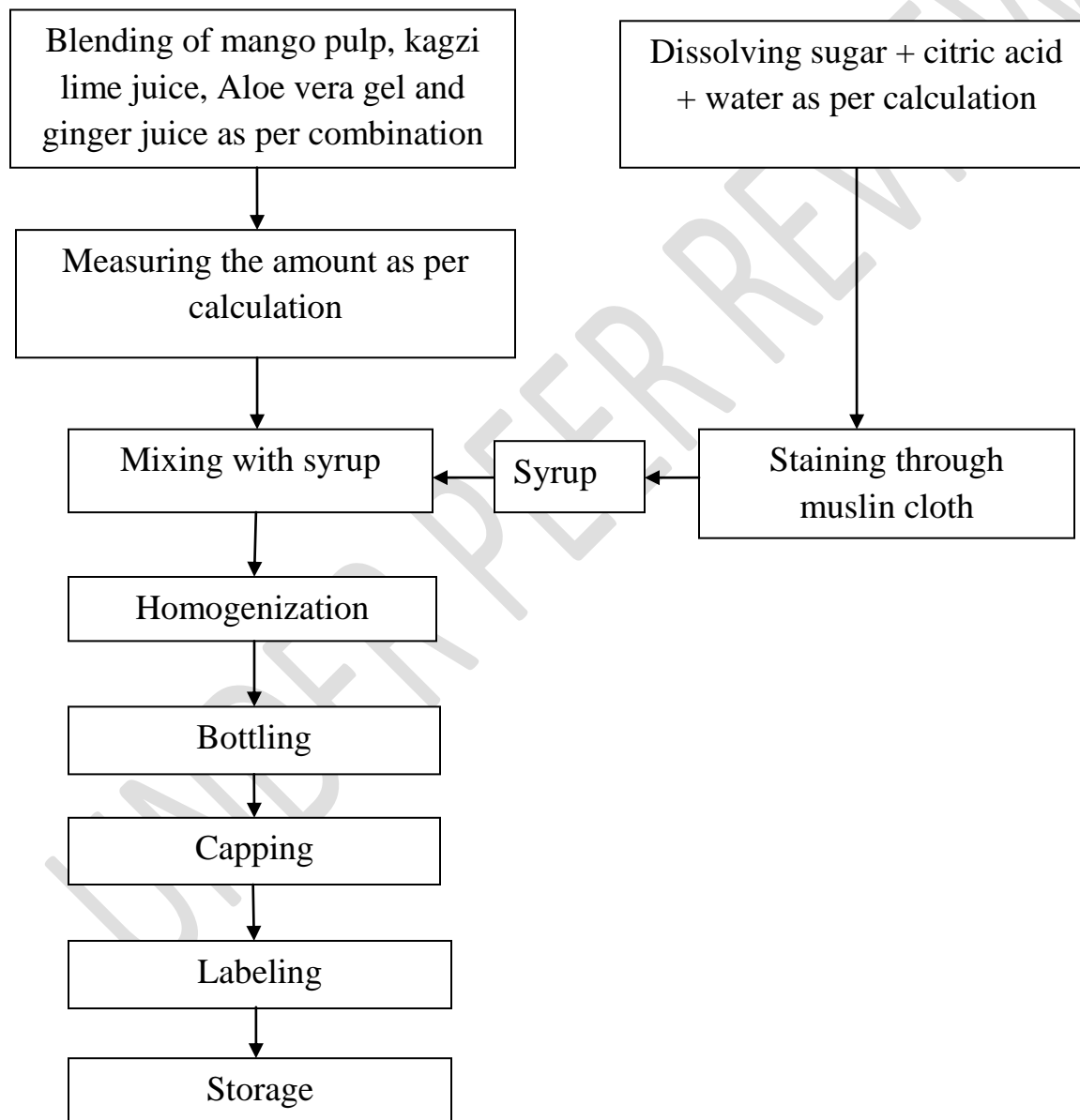


Fig.-5: Flow sheet for preparation of mango + kagzi lime + Aloe vera + ginger blended syrup.

## Storage studies

Finally 5 litres of syrup was prepared with best combination of blend, and filled into 750 ml glass bottles and polypet bottles of 750 ml capacity leaving 2 cm head space, capped and put for storage studies under ambient condition (20.1-29.4°C). During storage observation on changes in TSS, acidity, vitamin-A, vitamin-C, reducing sugars, non-reducing sugar, total sugars and organoleptic quality were recorded at monthly interval. Observations were recorded for changes in TSS, acidity and vitamin-C (**Rangana, 2010**), vitamin-A (**AOAC, 1970**), sugars (**Lane and Eynone, 1923**) and organoleptic quality (**Amerine *et al.*, 1965**) at monthly intervals during 5 months of storage period and are described as follows.

The Total Soluble Solids of sample was determined with the help of model (ERMA INC. TOKYO JAPAN) hand refractometer (58-92%) in terms of percentage. The value of TSS recorded at ambient temperature were corrected at 20°C with the help of reference table and the mean value was expressed as per cent TSS content of the sample whereas (**Rangana, 2010**). The acidity was determined by titrating known quantity of sample against 0.1 N sodium hydroxide solution using phenolphthalein indicator and expressed in percent anhydrous citric acid. Vitamin-A determined by preparing sample in acetone, then in petroleum ether and thereafter in sodium sulphate till the appearance of dark yellow-greenish colour and measured the optical density (OD) at 452 nm and 503 nm by Spectrophotometer whereas, Vitamin-C content was estimated by preparing sample in 3 percent metaphosphoric acid solution and titrating against 2, 6 dichlorophenol indophenols dye solution till the appearance of light pink colour. The reducing, non-reducing and total sugars were analysed by using Fehling's solution A and B and methylene blue indicator. A panel of 9 semi trained judges evaluated syrup for its colour, flavour, taste, appearance and overall acceptability on 9-point Hedonic scale.

## Statistical analysis

The experiments were conducted in 3 replications and the statistical analysis of the data was done by computer software as the method described by **Panse and Sukhatne (1985)** for CRD experiment.

## Results and Discussion

### Chemical attributes of fresh mango pulp, kagzi lime juice, Aloe vera gel and ginger juice

The data pertaining to chemical attributes of fresh mango pulp, kagzi lime juice, Aloe vera gel and ginger juice is presented in **Table-1** and revealed that the mango pulp used in syrup making contained 19.00 percent Total Soluble Solids, 1.36 percent acidity, 2650.17 I.U. vitamin-A, 17.33 mg/100g vitamin-C, 4.24 percent reducing sugars, 12.66 percent non-reducing sugar and 16.90 percent total sugars. Similarly **Chaudhary et al. (2017)** reported 23.10 percent total soluble solids, 0.31 percent acidity, 16.00 mg/100 g vitamin-C, 7.08 percent reducing sugars, 12.24 percent non reducing sugar, 19.32 percent total sugars and 14.30236mg/100g total carotene in mango pulp. Kagzi lime juice contained 5.00 percent Total Soluble Solids, 7.68 percent acidity, 2.78 I.U. vitamin-A, 59.80 mg/100ml vitamin-C, 1.43 percent reducing sugars, 1.08 percent non-reducing sugar and 2.51 percent total sugars whereas, **Hariharan and Mahendran (2016)** reported that 6.21<sup>0</sup>B TSS, 5.88 percent acidity, 38.91 mg/100ml vitamin-C and 1.43 percent total sugars in kagzi lime juice. Aloe vera gel contained 1.88 percent Total Soluble Solids, 0.24 percent acidity, 0.00 I.U. vitamin-A, 2.53 mg/100g vitamin-C, 0.53 percent reducing sugars, 1.18 percent non-reducing sugar and 1.71 percent total sugars whereas, **Sudhendra et al. (2012)** reported that Aloe vera gel contains 0.80-0.86<sup>0</sup>B TSS, 4.50-4.52 pH, 0.23-0.26 percent acidity, 3.76-3.86 mg/100g vitamin-C, 97.8-99.0 percent moisture, 0.026 percent reducing sugars, 1.894 percent non-reducing sugar, 1.92 percent total sugars, 8.86-9.00 mg/100g calcium and 0.92-0.94 mg/100g iron. Ginger contained 2.20 percent Total Soluble Solids, 0.26 percent acidity, 0.00 I.U. vitamin-A, 1.90 mg/100g vitamin-C, 0.63 percent reducing sugars, 1.12 percent non-reducing sugar and 1.75 percent total sugars similarly **Hegde et al. (2018)** observed 1.50<sup>0</sup>B TSS, 5.20 pH, 0.24 percent acidity, 2.70 mg/100g vitamin-C, 0.64 percent reducing sugars and 1.60 percent total sugars in ginger. The subtle difference in chemical attributes of raw materials might be due to variety, agroclimatic and cultural practices.

### Standardization of blends for syrup

A quality blended syrup with 25 per cent blend comprising 55 per cent mango pulp, 25 per cent kagzi lime juice, 10 per cent Aloe vera gel and 10 per cent ginger

juice with 70 per cent TSS and 1.20 per cent acidity was organoleptically found best for preparation of blend syrup (**Table-2**). Similarly **Tiwari and Deen (2016)** observed that syrup containing 50% bael pulp and 50% Aloe vera gel has secured highest organoleptic score. **Chaudhary *et al.* (2017)** reported that the syrup containing 75 per cent mango pulp and 25 per cent aloe vera gel has secured maximum organoleptic score which indicates that component of raw materials influenced the acceptability of the blend beverages.

### **Biochemical changes during storage**

Data pertaining to biochemical changes during storage of syrup into glass and polypet bottles are presented in **Table-3** and **Table-4**, respectively which indicates that the Total Soluble Solids of syrup increased gradually after 5 months of storage from 70.00 per cent to 71.42 per cent and from 70.00 per cent to 73.30 per cent into glass and polypet bottles, respectively. This change might be due to the conversion or hydrolysis of polysaccharides into simple sugars (monosaccharides and oligosaccharides). The conversion rate was comparatively higher in polypet container than glass bottles which might be due to container effects. Similarly an increasing trend in TSS during storage was reported in pummelo based blended syrup (**Bohra *et al.*, 2012**), mango-aloe vera blended syrup (**Chaudhary, 2014**), bael and aloe vera blended syrup (**Tiwari and Deen, 2016**), mango squash (**Pinkoo *et al.*, 2017**), mango, orange and pineapple mixed juice (**Begum *et al.*, 2018**), wood apple squash (**Kumar and Deen, 2018**) and phalsa-pear blended juice (**Pangotra *et al.*, 2018**), which are in agreement of present observations. The acidity of syrup increased gradually during storage period. Total acidity was increased from 1.20 per cent at initial day to 1.81 per cent at final day of storage into glass bottles while, from 1.20 per cent at initial day to 1.87 per cent into polypet bottles. Degradation of pectic substances and formation of organic acid have been reported to increase the acidity of fruit products (**Conn and Stumf, 1976**). Similarly an increasing trend in acidity during storage was observed by **Chaudhary, (2014)** in mango-aloe vera blended syrup, **Biswas *et al.* (2016)** in Aloe vera and pineapple blended beverage, **Tiwari and Deen (2016)** in bael and aloe vera blended syrup, **Begum *et al.* (2018)** in mango, orange and pineapple mixed juice and **Kumar and Deen (2018)** in wood apple squash. Vitamin-A content was continuously decreased from the first day (664.50 I.U.) to the end of storage (661.74 I.U.) throughout the storage period into glass bottles and

(664.50 I.U.) to (661.11 I.U.) into polypet bottles. This decrease in vitamin-A content might be due to the auto-oxidative degradation during storage and/or due to oxidative breakdown, isomerization or enzymatic destruction of the pigments. The loss of vitamin-A in syrup of different fruits based beverages during storage at ambient temperature was also reported in other studies (**Anju et al., 2017; Kumar et al., 2018; Avhad et al., 2019; Prabha et al., 2019 and Vignesh et al., 2019**). Vitamin-C content was continuously decreased from the first day (23.41 mg/100ml) to the end of storage (21.87 mg/100ml) into glass bottles and (23.41 mg/100ml) to (21.77 mg/100ml) into polypet bottles throughout the storage period. This decrease in vitamin-C content might be due to the oxidation of ascorbic acid into dehydro-ascorbic acid by oxygen. The loss of vitamin C in syrup of different fruits based beverages during storage at ambient temperature was also reported in previous studies (**Bohra et al., 2012; Chaudhary, 2014; Tiwari and Deen, 2016; Anju et al., 2017; Begum et al., 2018; Kumar and Deen, 2018; Kumar et al., 2018; Pangotra et al., 2018 and Thirukumar et al., 2018**). The reducing sugars and total sugars of blended syrup, increased gradually and it was increased from 1.65 per cent to 3.93 per cent and 69.75 per cent to 70.91 per cent, respectively in case of glass bottles whereas, from 1.65 per cent to 4.10 per cent and 69.75 per cent to 71.00 per cent, respectively in case of polypet bottles. The increase in reducing and total sugars of processed fruit products could be due to inversion of non-reducing sugar into reducing sugars. These finding were supported by **Bohra et al. (2012)** in pummelo based blended syrup, **Smitha et al. (2012)** in avocado based squash blended with sapota and Aloe vera, **Chaudhary (2014)** in blended syrup of mango and aloe vera, **Shahid et al. (2015)** in mango-mandarin squash, **Tiwari and Deen (2016)** in bael and aloe vera blended syrup, **Sherzed et al. (2017)** in strawberry based blended squash and **Kumar et al. (2018)** in mango squash. The non-reducing sugar of blended syrup, decreased continuously throughout the entire period of storage and it was decreased from 68.10 per cent to 66.98 per cent and from 68.10 per cent to 66.90 per cent into glass and polypet bottles, respectively. The decrease in non-reducing sugar of processed fruit products might be due to inversion of non-reducing sugar. This finding was supported by published works of **Tiwari and Deen (2016)** in bael and aloe vera blended syrup, **Mishra et al. (2017)** in mango-Aloe vera blend squash, **Kumar and Deen (2018)** in wood apple squash and **Noor uddin et al. (2019)** in blended mango-guava squash. Organoleptic score of blended syrup decreased gradually

with the storage period at room temperature (20.1-29.4<sup>0</sup>C) but the acceptability of syrup was maintained up to five months. The score was significantly decreased from 8.10 at first day to 7.08 at final day of storage into glass bottles and from 8.10 to 7.01 into polypet bottles. The loss in organoleptic quality of beverages after certain period is obvious because of undesirable changes in the products. Temperature plays an important role in biochemical changes that leads to development of off flavour as well as discolouration in the beverages. Reduction in organoleptic quality are also reported in pummelo based blended syrup (**Bohra *et al.*, 2012**), lime squash (**Papade *et al.*, 2015**), bael and Aloe vera blended syrup (**Tiwari and Deen, 2016**), concentrated orange juice (**Obasi *et al.*, 2017**) and guava-papaya blended bar (**Avhad *et al.*, 2019**). These reported observations are in the support of the present findings.

**Table-1: Chemical attributes of mango pulp, kagzi lime juice, Aloe vera gel and ginger juice.**

| S. No. | Chemical attributes      | Mean value |                  |               |              |
|--------|--------------------------|------------|------------------|---------------|--------------|
|        |                          | Mango pulp | Kagzi lime juice | Aloe vera gel | Ginger juice |
| 1.     | Total soluble solids (%) | 19.00      | 5.00             | 1.88          | 2.20         |
| 2.     | Acidity (%)              | 1.36       | 7.68             | 0.24          | 0.26         |
| 3.     | Vitamin-A ((I.U.)        | 2650.17    | 2.78             | 0.00          | 0.00         |
| 4.     | Vitamin-C (mg/100 g)     | 17.33      | 59.80            | 2.53          | 1.90         |
| 5.     | Reducing sugars (%)      | 4.24       | 1.43             | 0.53          | 0.63         |
| 6.     | Non-reducing sugar (%)   | 12.66      | 1.08             | 1.18          | 1.12         |
| 7.     | Total sugars (%)         | 16.90      | 2.51             | 1.71          | 1.75         |

**Table-2: Organoleptic quality of syrup prepared from different blends of mango pulp, kagzi lime juice, Aloe vera gel and ginger juice.**

| Treatments<br>(Recipe<br>No.) | Different combination of blends |                               |                         |                        | Organoleptic quality |                 |
|-------------------------------|---------------------------------|-------------------------------|-------------------------|------------------------|----------------------|-----------------|
|                               | Mango<br>pulp<br>(%)            | Kagzi<br>lime<br>juice<br>(%) | Aloe<br>vera gel<br>(%) | Ginger<br>juice<br>(%) | Score                | Rating          |
| T <sub>1</sub>                | 100                             | Nil                           | Nil                     | Nil                    | 7.56                 | Like moderately |
| T <sub>2</sub>                | Nil                             | 100                           | Nil                     | Nil                    | 6.56                 | Like slightly   |
| T <sub>3</sub>                | Nil                             | Nil                           | 100                     | Nil                    | 6.45                 | Like slightly   |
| T <sub>4</sub>                | Nil                             | Nil                           | Nil                     | 100                    | 6.05                 | Like slightly   |
| T <sub>5</sub>                | 25                              | 25                            | 25                      | 25                     | 7.10                 | Like moderately |
| T <sub>6</sub>                | 40                              | 20                            | 20                      | 20                     | 7.25                 | Like moderately |
| T <sub>7</sub>                | 70                              | 10                            | 10                      | 10                     | 7.95                 | Like moderately |
| T <sub>8</sub>                | 20                              | 40                            | 20                      | 20                     | 6.87                 | Like slightly   |
| T <sub>9</sub>                | 55                              | 25                            | 10                      | 10                     | 8.10                 | Like very much  |
| T <sub>10</sub>               | 50                              | 20                            | 15                      | 15                     | 7.44                 | Like moderately |
| SE.m±                         |                                 |                               |                         |                        | 0.03                 |                 |
| CD at 5%                      |                                 |                               |                         |                        | 0.08                 |                 |

**Table-3: Biochemical and organoleptic changes of syrup during storage into glass bottles.**

| Storage period (in months) | TSS (%) | Acidity (%) | Vitamin-A (I.U.) | Vitamin-C (mg/100 ml) | Reducing sugars (%) | Non-reducing sugars (%) | Total sugars (%) | Organoleptic |        |
|----------------------------|---------|-------------|------------------|-----------------------|---------------------|-------------------------|------------------|--------------|--------|
|                            |         |             |                  |                       |                     |                         |                  | Score        | Rating |
| 0                          | 70.00   | 1.20        | 664.50           | 23.41                 | 1.65                | 68.10                   | 69.75            | 8.10         | LVM    |
| 1                          | 70.24   | 1.28        | 663.95           | 23.16                 | 1.99                | 67.99                   | 69.98            | 8.00         | LVM    |
| 2                          | 70.46   | 1.39        | 663.04           | 22.93                 | 2.45                | 67.69                   | 70.14            | 7.85         | LM     |
| 3                          | 70.73   | 1.53        | 662.72           | 22.64                 | 2.82                | 67.50                   | 70.32            | 7.62         | LM     |
| 4                          | 71.00   | 1.70        | 661.94           | 22.15                 | 3.20                | 67.29                   | 70.49            | 7.33         | LM     |
| 5                          | 71.42   | 1.81        | 661.74           | 21.87                 | 3.93                | 66.98                   | 70.91            | 7.08         | LM     |
| SE.m±                      | 0.04    | 0.03        | 0.03             | 0.03                  | 0.03                | 0.04                    | 0.03             | 0.02         |        |
| CD at 5%                   | 0.12    | 0.09        | 0.10             | 0.08                  | 0.08                | 0.13                    | 0.10             | 0.07         |        |

LVM: Like very much, LM: Like moderately

**Table-4: Biochemical and organoleptic changes of syrup during storage into polypet bottles.**

| Storage period (in months) | TSS (%) | Acidity (%) | Vitamin-A (I.U.) | Vitamin-C (mg/100 ml) | Reducing sugars (%) | Non-reducing sugars (%) | Total sugars (%) | Organoleptic |        |
|----------------------------|---------|-------------|------------------|-----------------------|---------------------|-------------------------|------------------|--------------|--------|
|                            |         |             |                  |                       |                     |                         |                  | Score        | Rating |
| 0                          | 70.00   | 1.20        | 664.50           | 23.41                 | 1.65                | 68.10                   | 69.75            | 8.10         | LVM    |
| 1                          | 71.50   | 1.32        | 663.65           | 23.22                 | 2.04                | 67.91                   | 69.95            | 7.87         | LM     |
| 2                          | 72.46   | 1.43        | 663.00           | 22.92                 | 2.52                | 67.74                   | 70.26            | 7.60         | LM     |
| 3                          | 72.83   | 1.57        | 662.48           | 22.60                 | 2.94                | 67.44                   | 70.36            | 7.45         | LM     |
| 4                          | 73.00   | 1.72        | 661.74           | 22.07                 | 3.40                | 67.15                   | 70.55            | 7.25         | LM     |
| 5                          | 73.30   | 1.87        | 661.11           | 21.77                 | 4.10                | 66.90                   | 71.00            | 7.01         | LM     |
| SE.m±                      | 0.02    | 0.04        | 0.06             | 0.03                  | 0.04                | 0.03                    | 0.05             | 0.03         |        |
| CD at 5%                   | 0.07    | 0.11        | 0.17             | 0.10                  | 0.11                | 0.08                    | 0.16             | 0.08         |        |

LVM: Like very much, LM: Like moderately



## Conclusion:

It may be concluded from above findings that syrup prepared from 25 per cent blend comprising 55 % mango pulp, 25 % kagzi lime juice, 10 % Aloe vera gel and 10 % ginger juice containing 70 % TSS and 1.20 % acidity was best during organoleptic evaluation. The TSS, acidity, reducing sugars, total sugars was increased, whereas vitamin-A, vitamin-C, non-reducing and organoleptic quality was decreased during storage into both glass and polypet bottles. The syrup can be stored up to 5 months at ambient storage temperature (20.1-29.4<sup>0</sup>C) into both glass and polypet bottles with acceptable quality.

## REFERENCES

- Amerine, M.A.; Pangborn, R.M. and Roessler, E.B. (1965).** Principle of sensory evaluation of food. *Academic Press, London*.
- Anju, K. D.; Babu, G. N.; Surekha, A. and Preethi, R. (2017).** Development and standardization of ripe pumpkin based squash and its stability during storage. *Int.J.Curr.Microbiol.App.Sci.*, **6**(10): 821-831.
- Anonymous (1966).** *Speacial Report Series*, No. 4, I.C.M.R., New Delhi.
- AOAC (1970).** Official Methods of Analysis. 11<sup>th</sup> edn., Association of Official Analytical Chemists, Washington, D.C., p.769.
- Avhad, BA.; Kotecha, PM.; Lande, SB. and Chavan, UD. (2019).** Studies on preparation of fruit bar from papaya and guava. *J. Pharmacogn. Phytochem.*, **8**(4): 3219-3223.
- Begum, S.; Das, PC. and Karmoker, P. (2018).** Processing of mixed fruit juice from mango, orange and pineapple. *Fundam. Appl. Agric.*, **3**(2): 440-445.
- Biswas, S.; Masih, D.; Singh, M. and Sonkar, C. (2016).** Development and Quality Evaluation of Aloe vera and pineapple juice blended beverage. *Int. Res. J. Eng. Technol.*, **3**(10): 214-220.
- Bohra, P.; Sreenivas, K.N. and Shreeramu, B.S. (2012).** Development of a cost effective, palatable and shelf-stable blended beverage if pummelo (*Citrus grandis* Linn.). [www.fruits.journal.org](http://www.fruits.journal.org), Vol.-67: 249-256.

**Bozzi, A.; Perrin, C.; Austin, S. and Vera, FA. (2007).** Quality and authenticity of commercial Aloe vera gel powders. *Food Chem.*, **103**(1): 22-30.

**Chaudhary, M. (2014).** Studies on beverages from mango (*Mangifera indica* L.) and aloe vera (*Aloe barbadensis* Miller.) blends. M.Sc. Thesis, N. D. Univ. of Agric. & Tech., Faizabad, (U. P.).

**Chaudhary, M.; Deen, B.; Mishra, K. K. and Singh, J. P. (2017).** Studies on development of syrup from mango (*Mangifera indica* L.) pulp and Aloe vera (*Aloe barbadensis* Miller.) Gel Blend. *Int.J.Curr.Microbiol.App.Sci.*, **6**(7): 2247-2254.

**Conn, E. E. and Stumpf, P. K. (1976).** Outlines of Biochemistry, Wiley Eastern Ltd., New Delhi.

Drink-<https://en.m.wikipedia.org> (2019).

**Dubick and Michale, A. (1983).** Dietary supplements and health aids. A critical evaluation: Part 3: Natural Miscellaneous Products. *J. Nutr. Educ.*, (USA), **26**(6): 259- 265.

**Hariharan, G. and Mahendran, T. (2016).** Physico-Chemical, Sensory and Microbial Evaluation of Ginger-Lime Ready-To-Serve (RTS) Functional Beverage, Sweetened by Palmyra Sugar Candy. *Imp. J. Interdiscip. Res.*, **2**(5): 1545-1552.

**Hegde, P. P.; Sodananka, GK.; Sreenivas, KN.; Shankarappa, TH.; Chandan, K.; Manjula, GS.; Tayeebulla H, M. and Masoumi, A. (2018).** Conservation, cultivation and utilization of medicinal and aromatic plants. *J. Pharmacogn. Phytochem.*, SP3: 323-325.

**Kalra, SK.; Singh, H. and Chadha, KL. (1981).** Evaluation of some mango cultivars on the basis of their biochemical composition. *Indian J. Hortic.*, **38**(1 and 2): 70-73.

**Kalra, SK.; Tandon, DK.; Singh, H. and Chadha, KL. (1982).** Assessment of some mango cultivars for nectar preparation. *Progress. Hortic.*, **14**(4): 220- 224.

**Kumar, A. and Deen, B. (2018)** studies on post-harvest technology of *Limonia acidissima* L. fruits. Germany: *LAMBERT Academic Publishing*.

**Kumar, S.; Godara. R.K.; Kumar, S. and Singh, J. (2018).** Studies on Physico-chemical characteristics in squash prepared from different mango cultivars. *Int.J.Curr.Microbiol.App.Sci.*, **7**(1): 827-833.

**Lane and Eyenone L. (1923).** Determination of reducing sugars by means of Fehling solution with methylene blue indicator as an internal indicator. *Journal Soc. Chem. India*, **42**: 32.

**Malhotra, S. and Singh, P.S. (2003).** Medicinal properties of ginger (*Zingiber officinale*), *Natural product Radiance*. **2**(6).

**Mishra, K.K.; Pathak, S.; Chaudhary, M. and Singh, V. (2017).** Studies on preparation of squash from mango (*Mangifera indica* L.) pulp and Aloe vera (*Aloe barbadensis* Miller.) gel blends. *J. Pharmacogn. Phytochem.*, **6**(6): 2409-2412.

**Noor uddin, M.; Wahab, S.; Muhammad, A.; Bilal, H.; Din, M. U.; Nawaz, H.; Khan, S. A. and Sultan, Q. A. (2019).** Development and quality evaluation of mango and guava blended squash during storage. *Pure Appl. Biol.*, **8**(2): 1182-1190.

**Obasi, B.C.; Whong, C.M.Z. and Ameh, J.B. (2017).** Nutritional and sensory qualities of commercially and laboratory prepared orange juice. *Afr. J. Food Sci.*, **11**(7): 189-199.

**Pangotra, B. B.; Gupta, N.; Bandral, G. D.; Sood, M. and Singh, J. (2018).** Formulation and evaluation of phalsa-pear blended beverage. *The Pharma Innovation Journal*, **7**(10): 25-29.

**Panse, V.G. and Sukhatme, P.V. (1985).** Statistical Methods for Agricultural Workers. *Indian Council of Agricultural Research Publication*, 3rd rev. ed.

**Papade, J.N.; Chandan, P.M. and Sahoo, A.K. (2015).** Studies on preparation of acid lime squash. *J. Crop and Weed*, **11**(1): 138-143.

**Pinkoo, S.; Singh, G. R.; Kumar, T.; Singh, A. and Singh, Y. (2017).** Storage Effect on Physico-chemical and sensory attributes of mango squash beverage. *Chem.Sci.Rev.Lett.*, **6**(21): 177-183.

**Prabha, A.; Modgil, R. and Sandal, A. (2019).** Effect of blending and storage on the Physico-chemical composition of the papaya and mango squash. *Asian J. Dairy Food Res.*, **38**(2): 1-5.

**Ramachandra, C.T. and Rao, S .P. (2008).** Processing of Aloe Vera Leaf Gel. *Am. J. Agric. Biol. Sci.*, **3**(2): 502-510.

**Rameshwar, A.; Kulkarni, V.; Ahmed, MA.; Sultan, MA. and Shri Ramula, A. (1979).** Physico-chemical analysis and keeping quality of mango cultivars at Sangareddy. *Paper present at mango workers meeting at Panaji, Goa 2-5th May.*

**Ranganna, S. (2010).** Analysis and quality control for fruit and vegetable products, *Tata Mc Graw-Hill Ltd.*, New Delhi.

**Sadhu, MK. and Bose, TK. (1976).** Studies on mango cultivars part I: Morphological and physico- chemical studies of some promising mango cultivars of the district Mursidabad, West Bengal. *Indian Food Packer*, **30**(5): 24-32.

**Shahid, U.; Hussain, S.; Nadeem, M.; Jabbar, S.; Qureshi, T.M.; Nasir, M.U.; Zahira, S.M. and Rashid, F. (2015).** Quality assessment of the mango- mandarin (kinnow) squash during storage. *Sci. Lett.*, **3**(2): 115-121.

**Sherzad, R. A.; Sreenivas, K. N.; Krishna, H. C.; Tayeebullah, H. M. and Omari, M. G. (2017).** Valorization of strawberry (*fragaria ananassa*) based blended squash beverage with muskmelon, grape, ginger and lime. *Int. J. of Agri. Sci. and Res.*, **7**(1): 465-474.

**Smitha, N.K.; Sreeramu, B.S.; Chikkur, S.S.; Parmeshwar, A.S. and Kantharaj, K. (2012).** Standardization of processing technology and sensory evaluation of avocado squash blended with sapota and Aloe. *Int. J. Process. PostHarvest Technol.*, **3**(1): 94-97.

**Sudhindra, K.S.N.; Sreenivas, K.N.; Shankarappa, T.H. and Ravindra, V. (2012).** Standardization of recipe for value added nutraceutical beverages of guava blended with Aloe vera and Roselle. *Environment & Ecology*, **30**(3B): 995-1001.

**Thirukumar, S.; Vennila, P. and Kanchana, S. (2018).** Physico-chemical characteristics of noni fruit juice blended squashes during storage. *Int. J. Chem. Stud.*, **6**(1): 449-455.

**Tiwari, D.K. and Deen, B. (2016).** Effect of expansion and storage on value added bael (*Aegle marmelos*) syrup incorporated with Aloe vera (*Aloe barbadensis*). *The society of Agricultural Professionals*, **8**(2): 198-201.

**Vignesh, D.; Muthal, T.; Chidanand, D. V. and Sunil, C. K. (2019).** Study of sensory and storage quality of the RTS juice enriched with papaya leaf flavonoid. *Ind. J. Pure App. Biosci.*, **7**(4): 422-430.