

## **Effect of different preservatives on the storage of ber pulp**

**MUKESH KUMAR, RK GODARA\*, DEVI SINGH\*\*, DV PATHAK\*\*\*  
and SURENDER SINGH\*\*\*\*\***

**Krishi Vigyan Kendra, Bawal, Rewari 123501 Haryana, India**

**\*Department of Horticulture**

**\*\*College of Agriculture, Kaul 136021 Haryana, India**

**\*\*\*Regional Research Station, Bawal, Rewari 123501 Haryana, India**

**\*\*\*\*Saina Nehwal Institute of Agricultural Technology, Training and Education  
CCS Haryana Agricultural University, Hisar 125004 Haryana, India**

Email for correspondence: sabharwalmk@gmail.com

### **ABSTRACT**

The pulp of ber cv Kaithali was pasteurized and stored with addition of preservatives viz KMS (potassium metabisulphite) @ 2000 ppm SO<sub>2</sub>, SB (sodium benzoate) @ 2000 ppm SO<sub>2</sub>, KMS + SB @ 1000 ppm SO<sub>2</sub> each and sugar equivalent to 70°B. Initial acidity of pulp was maintained at 0.2 per cent by adding citric acid and it was stored in glass bottles for three months at ambient temperature. Observations on TSS, acidity, sugars (reducing and non-reducing), ascorbic acid and non-enzymatic browning were recorded in each treatment at monthly intervals. After the storage of three months sugar equivalent to 70°B resulted in maximum TSS, total sugars, reducing sugars, non-reducing sugars and non-enzymatic browning whereas minimum ascorbic acid. Among the chemical treatments KMS had highest TSS, ascorbic acid and reducing sugars followed by KMS + SB and sugar equivalent to 70°B. Reverse trend was observed in non-reducing sugars and non-enzymatic browning. Total soluble solids, total sugars, reducing sugars and non-enzymatic browning increased with increase in storage period whereas acidity, ascorbic acid and non-reducing sugars decreased with increase in storage period of pulp.

**Keywords:** Ber pulp; Kaithali; storage, preservatives

### **INTRODUCTION**

Ber is an important commercial fruit of arid region of India. In India ber is growing in an area of 48.45 thousand hectares which produces 662.96 thousand MT fruit yield (Anon 2014). Ber fruit is

having excellent digestive and nutritive value, pleasant flavour, high palatability and availability in abundance at moderate price. Processed products have good palatability, acceptability and shelf-life. The estimated market potential of processed food in 2015 is reported to be 11 times in fruits and

vegetables compared to figures for 2003-04 (Ghosh 2012). India's present share in processed food in the world trade amounts to 1.6 per cent. The processing technique should not lead to nutrient losses and those which are lost need to be fortified. Several fruits are processed in India in the form of different products. The ber fruit is generally consumed fresh. Very little information is available on processing of this fruit. The estimates show that about 76 per cent of fruits and vegetables are consumed fresh whereas 22 per cent are lost or get wasted in the market channel (Acharya 2007). The current trends show that dietary habit has been changing with increasing income from cereal-based diet to nutritious one (Singh and Malhotra 2011). Hence the demand for food processing sector is growing throughout the globe and in India as well. Most common processed products are preserved as dehydrated fruits, canned fruits, juice, pulp, squash, wine, fruit candy etc. Among the products some juicy varieties of ber can be converted into ber pulp which can be preserved by thermal processing or with chemical preservatives. These processed products help to ease out fluctuation in the market price; farmers may get better returns and consumers the value added products. Processed products of ber also have good acceptability and can fetch good prices in the market. The present investigation was carried out to standardize the technique for storage of ber pulp using some preservatives.

## MATERIAL and METHODS

The experiment was conducted in post-harvest technology laboratory of CCS Haryana Agricultural University, Hisar, Haryana. Ripe fruits of ber cv Kaithali were procured from the orchard of Department of Horticulture of the university when fruit colour changed from yellowish to brownish. The fruits were washed in water, blanched for two minutes, de-stoned, macerated in pulper with about 10-15 per cent water and passed through a paddle type baby pulper with stainless steel sieve to obtain a fine fruit pulp devoid of peel portions. The pulp was heated to a temperature of 68°C and acidity was raised to 0.2 per cent with the addition of citric acid. Chemical preservatives including potassium metabisulphite (KMS) equivalent to 2000 ppm  $\text{SO}_2$  ( $T_1$ ), sodium benzoate (SB) equivalent to 2000 ppm  $\text{SO}_2$  ( $T_2$ ), KMS + SB equivalent to 1000 ppm  $\text{SO}_2$  each ( $T_3$ ) and sugar equivalent to 70°B TSS ( $T_4$ ) were used. The treated pulp was stored at ambient temperature ( $25 \pm 2^\circ\text{C}$ ) and evaluated for its various quality parameters viz TSS, acidity, ascorbic acid (Anon 2012); total sugars, reducing sugars, non-reducing sugars by ferric chloride methods (Humble and Narain 1931) and non-enzymatic browning (optical density x dilution factor) (Ranganna 1977) at monthly intervals up to three months of storage in three replications. The data were analyzed using completely randomized design (CRD).

## RESULTS and DISCUSSION

**Total soluble solids:** The total soluble solids of pulp increased significantly from 15.80 to 16.37°B with increase in storage period in  $T_1$  which was at par with  $T_2$  and  $T_3$  (Table 1b). This could be due to conversion of polysaccharides into sugars and partly due to loss of moisture during heating. The similar trend was recorded in total soluble solids of mango pulp by Desai et al (2012) during storage. Gomez and Khurdiya (2005) also recorded an increase in TSS of aonla pulp during 6 months of storage.

**Acidity:** The acidity of ber pulp was adjusted initially at 0.2 per cent before storage. It decreased from 0.2 per cent to 0.179 per cent with increase in storage period irrespective of pulp treatments (Table 1a). Similar trend of decrease in acidity was observed during storage of pomegranate juice (Waskar and Deshmukh 1995). The reduction in acidity might be due to the chemical interaction between the organic constituents of the fruit pulp induced by the action of enzymes and storage temperature (Kaushik 1997) or by reaction involving the reversal of glycolytic pathway (Ruffner et al 1975).

**Ascorbic acid:** The ascorbic acid in ber pulp decreased with the advancement of the storage period. It decreased from 79.95 to 51.30 mg/100 g with increase in storage

period irrespective of pulp treatments (Table 1b). Ascorbic acid is more sensitive to oxidation and gets destroyed very quickly in the presence of oxygen. It might have been destroyed during processing and subsequently during storage of ber pulp. Slight reduction in ascorbic acid could be due to oxidation by trapped oxygen in the container. The other possible factor responsible for loss in ascorbic acid is through its oxidation into dehydro-ascorbic acid or furfural or hydroxyl methyl furfural (brown pigment) at ambient temperature because of its sensitive nature. Minimum ascorbic acid was recorded in  $T_4$ . Low proportion of pulp ( $T_4$ ) and more browning in  $T_4$  were responsible for less ascorbic acid. Among the pulp treatments maximum ascorbic acid was recorded in  $T_1$  (81.08 mg/100 g) whereas it was recorded minimum (23.63 mg/100 g) in  $T_4$  irrespective of storage period (Table 1a). Less ascorbic acid in  $T_2$  could be due to more non-enzymatic browning which might have destroyed it. Similar observations of decrease in ascorbic acid were made by Gomez and Khurdiya (2005) in aonla pulp.

In interaction of different pulp treatments with storage period maximum (97.20 mg/100 g) ascorbic acid was recorded in chemical treatments  $T_1$ ,  $T_3$  and  $T_2$  at the initiation of storage whereas minimum (19.80 mg/100 g) ascorbic acid was recorded in  $T_4$  after 90 days of storage (Table 1b).

Table 1a. Effect of preservatives on different parameters of ber pulp during storage

| Treatment          | TSS<br>(°B) | Acidity<br>(%) | Ascorbic acid<br>(mg/100 g pulp) | Total<br>sugars (%) | Reducing<br>sugars (%) | Non-<br>reducing<br>sugars (%) | Non-enzymatic<br>browning (optical<br>density x dilution factor) |
|--------------------|-------------|----------------|----------------------------------|---------------------|------------------------|--------------------------------|------------------------------------------------------------------|
| T <sub>1</sub>     | 16.14       | 0.191          | 81.08                            | 10.97               | 7.27                   | 3.71                           | 0.97                                                             |
| T <sub>2</sub>     | 15.96       | 0.184          | 72.30                            | 10.84               | 6.95                   | 3.89                           | 2.01                                                             |
| T <sub>3</sub>     | 16.07       | 0.186          | 74.45                            | 10.87               | 7.01                   | 3.86                           | 1.68                                                             |
| T <sub>4</sub>     | 71.13       | 0.186          | 23.63                            | 60.42               | 14.09                  | 46.32                          | 2.65                                                             |
| CD <sub>0.05</sub> | 0.17        | NS             | 3.43                             | 0.42                | 0.06                   | 0.44                           | 0.31                                                             |
| T <sub>1</sub>     | 29.35       | 0.200          | 79.95                            | 22.84               | 6.92                   | 15.92                          | 1.41                                                             |
| T <sub>2</sub>     | 29.77       | 0.186          | 63.37                            | 23.19               | 8.33                   | 14.86                          | 1.63                                                             |
| T <sub>3</sub>     | 30.00       | 0.182          | 56.82                            | 25.49               | 9.43                   | 14.06                          | 2.01                                                             |
| T <sub>4</sub>     | 30.18       | 0.179          | 51.30                            | 26.57               | 10.64                  | 12.93                          | 2.26                                                             |
| CD <sub>0.05</sub> | 0.17        | 0.005          | 3.43                             | 0.42                | 0.06                   | 0.44                           | 0.31                                                             |

Preservatives effect on ber pulp storage

Table 1b. Effect of preservatives on different parameters of ber pulp during storage (treatments x storage period)

| Storage period (days)                                                                   | TSS (°B) | Acidity (%) | Ascorbic acid (mg/100 g pulp) | Total sugars (%) | Reducing sugars (%) | Non-reducing sugars (%) | Non-enzymatic browning (optical density x dilution factor) |
|-----------------------------------------------------------------------------------------|----------|-------------|-------------------------------|------------------|---------------------|-------------------------|------------------------------------------------------------|
| KMS (potassium metabisulphite) equivalent to 2000 ppm SO <sub>2</sub> (T <sub>1</sub> ) |          |             |                               |                  |                     |                         |                                                            |
| 0                                                                                       | 15.80    | 0.200       | 97.20                         | 10.74            | 6.82                | 3.92                    | 0.71                                                       |
| 30                                                                                      | 16.13    | 0.193       | 81.40                         | 10.97            | 7.28                | 3.69                    | 0.85                                                       |
| 60                                                                                      | 16.27    | 0.187       | 76.20                         | 11.05            | 7.41                | 3.64                    | 1.00                                                       |
| 90                                                                                      | 16.37    | 0.182       | 69.50                         | 11.13            | 7.55                | 3.58                    | 1.30                                                       |
| SB (sodium benzoate) equivalent to 2000 ppm SO <sub>2</sub> (T <sub>2</sub> )           |          |             |                               |                  |                     |                         |                                                            |
| 0                                                                                       | 15.80    | 0.200       | 97.20                         | 10.74            | 6.82                | 3.92                    | 1.45                                                       |
| 30                                                                                      | 15.90    | 0.181       | 71.20                         | 10.81            | 6.91                | 3.90                    | 1.85                                                       |
| 60                                                                                      | 16.03    | 0.179       | 63.50                         | 10.87            | 6.98                | 3.89                    | 2.15                                                       |
| 90                                                                                      | 16.10    | 0.175       | 57.30                         | 10.92            | 7.09                | 3.83                    | 2.60                                                       |
| KMS + SB equivalent to 1000 ppm SO <sub>2</sub> each (T <sub>3</sub> )                  |          |             |                               |                  |                     |                         |                                                            |
| 0                                                                                       | 15.80    | 0.200       | 97.20                         | 10.74            | 6.82                | 3.92                    | 1.26                                                       |
| 30                                                                                      | 16.03    | 0.185       | 76.30                         | 10.83            | 6.97                | 3.86                    | 1.47                                                       |
| 60                                                                                      | 16.20    | 0.181       | 65.70                         | 10.93            | 7.10                | 3.83                    | 1.97                                                       |
| 90                                                                                      | 16.23    | 0.178       | 58.60                         | 10.97            | 7.16                | 3.81                    | 2.03                                                       |
| Sugar equivalent to 70°B (T <sub>4</sub> )                                              |          |             |                               |                  |                     |                         |                                                            |
| 0                                                                                       | 70.00    | 0.200       | 28.20                         | 59.13            | 7.23                | 51.90                   | 2.22                                                       |
| 30                                                                                      | 71.00    | 0.183       | 26.60                         | 60.17            | 12.17               | 48.00                   | 2.36                                                       |
| 60                                                                                      | 71.50    | 0.181       | 21.90                         | 61.12            | 16.23               | 44.89                   | 2.90                                                       |
| 90                                                                                      | 72.00    | 0.179       | 19.80                         | 61.24            | 20.74               | 40.50                   | 3.10                                                       |
| CD <sub>0.05</sub>                                                                      | 0.33     | NS          | 6.86                          | 0.83             | 0.11                | 0.88                    | NS                                                         |

**Total sugars:** Total sugars of pulp increased from 22.84 to 26.57 per cent with increase in storage period irrespective of pulp treatments (Table 1a). This could be due to hydrolysis of polysaccharides like pectin, starch and their conversion into simple sugars and partly due to loss of moisture. Total sugars in mango pulp increased significantly during storage period at ambient temperature (Desai et al 2012). The total sugars of ber pulp were recorded higher (60.42%) in  $T_4$  irrespective of storage period (Table 1a) whereas the values of total sugars in chemical treatment of pulp were at par with each other. Increase in total sugars and reducing sugars of guava-mango RTS drink and squash beverages has been reported with the advancement of storage duration (Snehlata et al 2014).

In interaction of pulp treatments with storage  $T_4$  recorded maximum (61.24%) total sugars after 90 days of storage (Table 1b) whereas in chemical treatments the values of total sugars were observed at par with each other.

**Reducing sugars:** The reducing sugars of ber pulp increased from 6.92 to 10.64 per cent during storage of pulp irrespective of pulp treatments (Table 1a). It also increased in chemicals and  $T_4$ . Among different pulp treatments maximum reducing sugars (14.09%) were observed in  $T_4$  whereas minimum (6.95%) were recorded in  $T_2$  irrespective of storage period. Desai et al (2012) also reported the increase in

reducing sugars of mango pulp during storage. Increase in reducing sugars was also recorded in sulphur dioxide treated guava pulp. It might be due to breakdown of some of the hemicelluloses and other saccharides into simple soluble sugars. Among chemical treatments  $T_1$  observed more reducing sugars as compared to others and it could be due to more preservative action of KMS.

In interaction of storage period with pulp treatments maximum reducing sugars (20.74%) were observed in  $T_4$  after 90 days of storage whereas minimum (6.82%) were recorded at the beginning of storage in all the chemical treatments of pulp (Table 1b).

**Non-reducing sugars:** The non-reducing sugars decreased significantly from 15.92 to 12.93 per cent with increase in storage period irrespective of treatments (Table 1a). This could be due to increase in reducing sugars. The reducing sugars could have increased at the cost of non-reducing sugars. In different treatments maximum non-reducing sugars (46.32%) were observed in  $T_4$  however the values of non-reducing sugars in chemical treatments of pulp were at par with each other irrespective of storage period.

In the interaction of different treatments with storage, non-reducing sugars were recorded higher (51.90%) in  $T_4$  at the initiation of storage (Table 1b)

whereas the values in chemical treatments of pulp were at par with each other.

**Non-enzymatic browning:** The non-enzymatic browning of pulp increased from 1.41 to 2.26 with increase in storage period irrespective of pulp treatments (Table 1a). It might be due formation of furfural and its derivatives at high temperature formed by reaction of ascorbic acid with citric acid. These derivatives could have contributed to non-enzymatic browning which were higher at high temperature. In different treatments maximum non-enzymatic browning (2.65) was recorded in  $T_4$  whereas minimum (0.97) was recorded in  $T_1$  irrespective of storage period. Minimum non-enzymatic browning (0.97) in  $T_1$  might be due to better antioxidant action of KMS and more non-enzymatic browning in  $T_4$  could be due to Millard and Caramelization (during heating) reactions. The reaction of organic acids with sugar or oxidation of phenols leads to the formation of brown pigment. In case of interaction of different pulp treatments with storage period the non-enzymatic browning was found non-significant.

## REFERENCES

- Acharya SS 2007. India's current agrarian distress: intensity and causes. NAAS News, July-Sept 2007, pp 7.
- Anonymous 2012. Methods of analysis. 13<sup>th</sup> edn. Association of Official Agricultural Chemists. Washington DC.
- Anonymous 2014. Database. National Horticulture Board, Gurgaon, Haryana, India.
- Desai CS, Naik AK and Patil JM 2012. Study on physiochemical properties of some early mango (*Mangifera indica* L) varieties for pulp processing. Beverages and Food World **39(2)**: 55-57.
- Ghosh SP 2012. Carrying capacity in Indian horticulture. Current Science **107(6)**: 889-893.
- Gomez S and Khurdiya DS 2005. Quality changes in aonla pulp under different storage conditions. Indian Food Packer **59(4)**: 54-57.
- Humle AC and Narain R 1931. The ferricyanide method for determination of reducing sugars: a modification of Hagedorn-Jenson-Hanes technique. Biochemistry Journal **25**: 1051-1056.
- Kaushik RA 1997. Studies on maturity indices and medicinal value of fresh and preserved bael (*Aegle marmelos* Correa) fruit. PhD thesis, CCS Haryana Agricultural University, Hisar, Haryana, India.
- Ranganna S 1977. Manual of analysis of fruit and vegetable products. 1<sup>st</sup> edn. Tata McGraw Hill, New Delhi, India, pp 197-198.
- Ruffner HP, Kablet W and Rast D 1975. Galacogenesis in the ripening berries of grape (*Vitis vinifera* L). Vitis **13(4)**: 319-328.
- Singh HP and Malhotra SK 2011. Horticulture for food, nutrition and health care- a new paradigm. Indian Horticulture **56(2)**: 3-11.
- Snehlata, Gahlot R, Siddiqui S and Grewal RB 2014. Changes in chemical constituents and overall acceptability of guava-mango RTS drink and squash during storage. In: National Seminar on Reorientation of Agricultural Research to Ensure National Food Security, 6-7 Jan 2014, CCS Haryana Agricultural University, Hisar, Haryana, India.
- Waskar DP and Deshmukh AN 1995. Effect of packaging containers on the retention of anthocyanins of pomegranate juice. Indian Food Packer **41(1)**: 5-8.

**Received: 7.2.2015**

**Accepted: 18.5.2015**