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Processing Effect on Sweet Cherry into Sweet Cherry Juice Concentrate with Special Reference to its Quality Characteristics

Bharty Kumar[1], S. D. Singh[2]

[1]Assistant Professor M.V.M College Bhopal (M.P), India

[2]Professor M.V.M College Bhopal (M.P), India

Abstract: ***Sweet cherry (Prunus avium* L.) *is widely cultivated in Shopian district of Jammu and Kashmir and the fruits are harvested at immature stage to prevent spoilage. The immature sweet cheery fruits with less commercial value were used for processing into sweet cherry juice concentrate. Immature sweet cherry were crushed and treated with 0.1% pectinase enzyme for 120 min to obtain maximum juice. Sweet cherry juice was found to be rich in reducing sugars (13.4%) and total sugars (13-18%). Juice was pasteurized at 85°C to inactivate the enzyme, cooled and centrifuged at 3000 rpm to get clear juice. The juice was concentrated in a thin film evaporator to total soluble solids (TSS) of 0-32°Brix in 2 passes. Chemical composition of sweet cherry juice during different stages of concentration was determined. Sweet cherry juice concentrate was packed in low density polyethylene bags of size (22 cm × 14 cm) and frozen in blast freezer at –40°C and stored at –20°C. Storage of sweet cherry juice concentrate at –20°C for 6 months indicated no significant changes in TSS, acidity, ascorbic acid, total sugars and pH. Hunter colour lightness L, and redness a values of sweet cherry juice concentrate decreased whereas b values increased during storage. Sweet cherry juice concentrate was stable during 6 months storage could be reconstituted for preparing ready-to-serve beverages with acceptable sensory quality.***

Keywords: Sweet cherry juice, Juice concentrate, Enzyme clarification, Sweet cherry beverage

1. Introduction

Sweet Cherry (*Prunus avium* L.) belonging to family Rosaceae is one of the most important fruit crops of temperate region of the world. In India, Jammu and Kashmir is the main cherry growing state having 3106 hectares under this crop with the annual production of metric tones (Anonymous, 2005-06). Cherries have high calorific value than apple as they are rich in protein and sugars. Besides, carotene and folic acid contents are fairly high. The fruit is also rich source of minerals like potassium, calcium, magnesium, iron and zinc (Randhawa, 1991). Shelf life of cherry fruit is very less and large quantities get wasted. Also there is lack of efficient post-harvest management of cherries, which leads to the rapid quality deterioration and sudden glut in the market. This crop can be saved from wastage and at the same time, can be converted into more valuable and priced commodity by processing into various products (Maini and Anand, 1996). Various products prepared from cherries are juice, frozen cherries, dehydrated cherries, canned products, cherry jam, cherry juice concentrate, cherry juice powder, cherry bars and cherry candies

Fruits are among the most important foodsof mankind as they are both nutritive and indispensable for maintenance of health. Being rich source of carbohydrates, minerals, vitamins and dietary fibres, these constitute an important part of our daily diet. Moreover, they add flavour and diversity to diet. In recent times, fruits have received more attention on their beneficial role in human diet than any other food group. They hold an immense value in formulating a balanced diet (Goyal, 2000). Due to their high nutritive value, fruits make a significant nutritional contribution to human well being. They are cheaper and better sources of protective foods. If they can be supplied in fresh or preserved form throughout the year for human consumption, the national picture of its contribution to GDP will improve greatly.

2. Materials and Methods

The Freshly harvested immature Sweet cherry (*Prunus avium* L.)Clusters were procured from Shopian district of Jammu and Kashmir. The sweet cherry fruits weighing 20 kg were packed in ventilated corrugated fiberboard boxes and transported by air for the experimental studies. The date fruits were separated from clusters, sorted, washed and used for the preparation of juice concentrate. Commercially manufactured pectinase enzyme (bio pectinase) was procured from M/s BioconIndia Ltd, Bangalore.

2.1 Extraction of Sweet cherry juice

The Fresh and firm sweet cherry werewashed and crushed in a fruit mill. The pulp was preheatedto 45°C and divided into different parts for enzyme treatment. The pectinase enzyme was pipetted (0.05 and 0.1ml /100 g pulp) into the sweet cherry pulp. The enzyme treated pulp wasincubated at 45°C for 30–150 min. After clarification, treated sweet cherry pulp was pressed in a hydraulic press for extractingthe juice. The date juice yield was measured and recordedas weight/weight of pulp. The juice was heated to 85°C for60 sec to inactivate the added enzyme and cooled.

3. Analysis

Juice extracted from immature sweet cherry and sweet cherry juice concentrate (SCJC) were analyzed for total soluble solids (TSS) using a digital refractometer (Model

RX 5000, ATAGO, Japan). The titratable acidity, reducing sugars, total sugars, ascorbic acid and tannins were determined by AOAC (2000) methods. Pectin content in juice was determined according to the method described by Rangana (1986). The non-enzymatic browning (NEB) was determined by measuring the absorbance of the alcoholic extract at 440 nm. Twenty g of sweet cherry juice was mixed with 100 ml of 60 % alcohol, held overnight at 27±1°C and the extract was filtered through Whatman Nr 41 filter paper. The optical density (OD) of the filtrate was measured at 440 nm inUV–visible spectrophotometer (Model Cintra–GBC-10, Australia) as also transmitanance of enzyme treated and clarified juice at 660 nm. The enzyme treated sweet cherry juice was centrifuged at 3000 rpm at room temperature (27±1°C) to remove the suspended materials in the clarified juice using nozzle type of centrifuge. The clarified date juice was concentrated in a vacuum evaporator. The clarified date juice was passed through evaporator (thin film evaporator, Turba film model 04012) at 50°C and vacuum of 24 inches of Hg. Juice was concentrated in two passes. The concentrate was collected during different stages of concentration for analysis.Hunter colour values of fresh sweet cherry juice and DJC were measured using Shimadzu colour measuring system (Model Nr UV– 2100) at wave lengths ranging from 360 to 800 nm and expressed as L, a, b, where L = lightness, a (+) = redness, b (+) = yellowness (Hunter 1975).

4. Storage studies of Sweet Cherry Juice Concentrate

The SCJC (500 g) was filled in low density polyethylene pouches of 50 micron thickness, sealed and frozen in blast freezer at –40°C (Foster BOP-50, England) and stored at –20°C in a deep freezer. The pouches were periodically removed for analysis up to 6 months.

5. Preparation of beverages

The stored SCJC was used to prepare ready-to-serve beverage by adding water and citric acid. The beverage was adjusted to 14°Brix and 0.28% acidity. The blended juice was heated to 90°C for 2 min and fi lled in sterilized ready-to-serve beverage of 200 ml capacity bottles and sealed by crown corking. The sealed bottles were allowed to cool overnight at room temperature.

6. Sensory Evaluation

Ready-to-serve beverage prepared from SCJC was evaluated for sensory colour, taste, flavour and overall quality by a panel of 9 judges using Hedonic scale (where 1–2 = poor, 3–4 = fair, 5–6 = good, 7–8 = very good and 9–10 = excellent) (Amerine et al. 1965). Samples receiving an overall quality score of 7 or above were considered acceptable.

7. Statistical Analysis

Analysis was carried in 3 replicates (Microsoft Excel 2010). The sensory data was analyzed by 2-way analysis of variance and the significance was determined (Steel and Torrie 1980).

8. Results and Discussion

8.1 Chemical composition of sweet cherry juice

The Freshly extracted sweet cherry juice contained TSS 19.5%, reducing sugars 16.1%, total sugars 18.3%, ascorbic acid 13.2 mg /100 g, titratable acidity (as citric acid) 0.09%, tannin 0.38% and pectin 3.6% and its pH was 5.1.

8.2 Effect of enzyme treatment on yield and juiceclarity

Juice yield was 53.1% in control sample with high turbidity. Higher juice yield of 69.8% and clarity of juice (84.3% transmission at 660 nm) was observed with 0.1 ml pectinase enzyme per 100 g sweet cherry juice as compared to control (Fig. 1). Juice yield and clarity increased with time initially up to 120 min and thereafter remained constant. Further, yield and clarity of juice increased with increase in enzyme concentration (Fig. 1). Floribeth et al. (1981) reported that of pectinolytic enzyme treatment increased yield and clarity of juice from ripe banana pulp.

8.3 Effect of vacuum concentration of sweet cherry juice

The TSS increased from 19.5 to 76.0% and acidity from 0.09% to 0.3% during concentration of sweet cherry juice in 2 passes (Fig. 2). Significant increase in reducing sugars (63%) and total sugars (67%) was observed during the concentration of sweet cherry juice. Ascorbic acid content also showed similar trend and increased to 13.9 mg/100 g. Tannin content and NEB of SCJC increased slightly during concentration. The colour of the SCJC after 2 passes was light brown and Hunter colour values of the concentrate were L (20.0), a (0.65) and b (1.76) (Fig. 3). Hunter colour values during vacuum evaporation process of pomegranate juice were reported by MedeniMaskan (2006).

8.4 Effect of frozen storage

Results in Table 1 indicate that no significant changes were observed in TSS, acidity, ascorbic acid, total sugars and pH. There was an increase in NEB, reducing sugars and tannin and decrease in non-reducing sugars during 6 months storage. The increase reducing sugars may be due to inversion of non reducing sugars. Similar observations were reported on the effect of storage conditions on pineapple juice concentrate (Sandhu et al. 1985) and debitteredkinnow mandarin juice concentrate (Thakur et al. 2000). Hunter value lightness (L), and redness (a) values of date juice concentrate were decreased and yellowness (b) increased significantly during storage.

9. Quality Characteristics of ready-to-serve Beverages Prepared from Sweet Cherry Juice Concentrate

The OD at 440 nm of beverages increased from 0.04 to 0.13 and tannin content decreased from 0.12 to 0.05% during 6 months storage and other parameters remained almost unchanged (Table 2). The RTS beverages prepared from DJC stored at 20°C was sensorilyacceptable even after 6

months storage at –20°C as indicated by score of >7.0 for all attributes

Table 1: Changes in chemical quality characteristics of date juice concentrate during frozen (–20°C) storage

	Storage period, months			
	0 (Initial)	***2***	***4***	***6***
pH	4.6 ± 0.05 a	4.5 ± 0.05a	4.6 ± 0.05a	4.5 ± 0.05a
Acidity, % citric acid	0.33 ± 0.01a	0.35 ± 0.01a	0.34 ± 0.01a	0.34 ± 0.01a
TSS %	76.0 ± 0.32a	76.2 ± 0.32a	75.8 ± 0.32a	76.6 ± 0.32a
Reducing sugars, %	63.0 ± 0.20a	63.3 ± 0.20a	63.6 ± 0.20ab	64.0 ± 0.20b
Total sugars, %	67.0 ± 0.30a	67.0 ± 0.30a	66.7 ± 0.30a	66.5 ± 0.30a
Non-reducing sugars %	3.8 ± 0.02a	3.5 ± 0.02a	3.0 ± 0.02b	2.4 ± 0.02c
Ascorbic acid, mg/100g	13.0 ± 0.14a	12.95 ± 0.14 a	12.7 ± 0.14 a	12.6 ± 0.14 a
Tannins %	1.16 ± 0.03a	1.24 ± 0.03a	1.26 ± 0.03ab	1.36 ± 0.03b
NEB OD at 440 nm	0.17 ± 0.02a	0.35 ± 0.02b	0.38 ± 0.02bc	0.42 ± 0.02c
Hunter colour L	19.9 ± 0.05a	17.7 ± 0.05b	15.8 ± 0.05c	12.4 ± 0.05d
a	0.65 ± 0.02a	0.42 ± 0.02b	0.34 ± 0.02c	0.40 ± 0.02d
b	176 ± 0.02a	2.5 ± 0.02b	3.2 ± 0.02c	4.1 ± 0.02d

TSS= Total soluble solids, NEB= Non enzymatic browning
Means followed by same superscripts within a row do not differ significantly ($p < 0.05$) (n=3)

Table 2: Chemical and sensory quality characteristic of ready-to-serve beverage prepared from stored date juice concentrate

	Storage (27–33°C) period, months			
	0 (Initial)	***2***	***4***	***6***
Chemical (n = 3)				
TSS, %	14.0 ± 0.04a	14.1 ± 0.03a	14.0 ± 0.04a	14.2 ± 0.04a
pH	3.3 ± 0.02a	3.3 ± 0.01a	3.3 ± 0.02a	3.3 ± 0.02a
Total acidity, %	0.29 ± 0.02a	0.30 ± 0.02a	0.28 ± 0.03a	0.29 ± 0.03a
Reducing sugars, %	11.1 ± 0.04 a	11.3 ± 0.03 a	11.5 ± 0.03b	11.8 ± 0.04c
Total sugars, %	12.9 ± 0.04a	13.0 ± 0.2 a	13.1 ± 0.04a	12.9 ± 0.05a
Tannins, %	0.12 ± 0.03a	0.10 ± 0.05b	0.07 ± 0.02c	0.05 ± 0.03d
NEB, O.D at 440 nm	0.04 ± 0.02a	0.06 ± 0.05b	0.09 ± 0.03c	0.13 ± 0.04d
Sensory quality (n= 9 panelists)				
Colour	8.8 ± 0.03 a	8.0 ± 0.0b	7.7 ± 0.02c	7.2 ± 0.03d
Taste	8.0 ± 0.02a	7.8 ± 0.02a	7.5 ± 0.03b	7.0 ± 0.0c
Flavour	8.9 ± 0.05a	8.5 ± 0.04b	8.0 ± 0.03c	7.6 ± 0.03d
Overall quality	8.5 ± 0.02a	8.2 ± 0.03a	7.4 ± 0.05b	7.0 ± 0.04a

TSS= Total soluble solids, NEB= Non enzymatic browning
Means followed by same superscripts within a row do not differ significantly ($p < 0.5$) (n=3)

10. Conclusion

Immature sweet cherry could be used for the production of CJC. The CJC is also good source of sugars, tannins and ascorbic acid as it contained 76% TSS, 0.33% acidity, 63% reducing sugars, 67% total sugars, 1.16% tannins and its NEB at 440 nm was 0.17. The CJC packed in low density polyethylene pouches of 50 micron thickness, frozen in a blast freezer at –40°C and stored at –20°C was stable for 6 months and could be used for the preparation of ready-to-serve beverages with sensorily acceptable quality characteristics.

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Author Profile

Dr. Baharty Kumar is a Assistant Professor of Botany in Government M.V.M College, Bhopal, Madhya Pradesh. Her area of specialization is Plant Pathology. She has teaching experience of 20 years at UG and PG level. She had attended national and international workshops, seminar and conferences.