Development of mixed fruit jam from Ber and Guava fruits and its sensory and physico-chemical evaluation

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Abstract: The production and processing of mixed fruit jam from ber and guava was the main focus of the current investigation. Evaluation of mixed fruit jam in terms of sensory and physicochemical assessment with storage trials was also conducted. To make mixed fruit jam, fresh and completely ripe ber and guava fruits were used. The Mixed fruit jam prepared by using treatment (T1) having pulp 50 + 50 gm (Ber and Guava) pulp, 72g sugar, and 0.8 gm citric acid was found to be superior in colour, appearance, texture, taste, flavour and overall acceptability to those prepared by using other combinations. The physicochemical properties of mixed fruit jam were assessed using a variety of criteria, including total sugar, reducing sugar, acidity, pH, moisture, ash, and total soluble solids (TSS). During the storage of mixed jam at ambient temperature for 180 days, the Acidity %, TSS ºBrix, Total sugar %, Reducing sugar % and Microbial load (cfu/ml) increased, whereas Moisture %, Ash%, pH and Protein % decreased with the time. Because of the high acidity and appropriate preservation of the produced samples, the microbial load (cfu/ml) in the jam was determined to be quite low. In all of the jam samples, there was very little microbiological contamination.

Key words- Mixed fruit jam, Ber fruit, Guava fruit, physico-chemical evaluation

INTRODUCTION

India is an agriculturally advanced country that produces a lot of food due to its rich and fertile geography. There is a vast array of fruits found in Indian forests. Presently, India stands as the world's second biggest fruit producer (Patil et al., 2013). During the rainy season, a variety of fruits are harvested in large quantities, mostly for retail consumption. Fruits are a vital and essential source of many different vitamins and minerals, including calcium, phosphorus, iron, and many more (Kowalski et al., 2013).

In India, less than 2% of fruits produced are processed against 65% in the United States (Patil et al., 2013). In developing nations like India, post-harvest fruit losses are more common and may reach 30-40% of total losses from harvest to consumer point, contributing to millions of billions of rupees. Fruit processing is necessary where it ensures fair returns to the processors/growers to improve their economic condition. It also helps to mitigate the problem of under employment. The perishable fruits are available as seasonal surplus during certain parts of the year and are wasted in large quantities due to absence of facilities and know-how for proper handling, marketing and storage. Furthermore, massive amount of the perishable fruits produced during particular season results in a glut in the market and became scare during other seasons (Ravani & Joshi, 2014).

Jam is a substance that is produced from entire fruits, fruits that have been chopped or mashed. Fruit is cooked with water and sugar to release the fruit's pectin (Usman et al., 2009). Jam is often made by boiling chopped or mashed fruit or vegetable pulp with sugar and water until the desired consistency is reached (Ihekoronye, 1999). The nutritional and organoleptic characteristics of jam vary depending on the manufacturing method and fruit and vegetable varieties used (Usman et al., 2009). Because jam is neither a solid nor a liquid, it should have a uniform viscosity lacking noticeable fruit bits, excellent fruit taste, vibrant color, semi-jelled texture, ease of spreading, and no loose liquid (Berolzheimer, 1969). Some jams, nevertheless, include discrete fragments of entire fruits. There are several tropical fruits that may be utilized to make jam (Ihekoronye, 1999). Therefore, there is a great scope for fruit processing &

value addition to the underutilized fruits into various products like Jam, Jelly, Fruit Bars and Fruit Toffee.

Ber (Ziziphus mauritiana) belongs to the family Rhamnaceae. Ber trees grow well in semi-arid and desert areas. The tree may be grown in areas with little rainfall since it is hardy and resilient to harsh environments. India is home to Ber trees, which are widely cultivated and found in many regions. Considerable Ber cultivation is well-known in states like Maharashtra, Andhra Pradesh, Uttar Pradesh, Gujarat, and Rajasthan.

It is also known as the Indian Jujube and poor men's apple. The fruits are rich in phytochemicals, particularly polysaccharides, which are regarded as beneficial substances. Jujube has long been used as a traditional medicine or as an essential ailment. The jujube plant is utilized for pharmaceutical purposes in a variety of ways, including its roots, stem, leaves, flowers, and fruits (Rashwan et al., 2020). Ber fruit has a high nutritional value since it is a great source of provitamin A, vitamin C, vitamin B complex, calcium, potassium, and zinc. The three main sugars in Ber fruit are galactose, fructose, and glucose (Pareek & Yahia, 2013). As a result, jelly and jam made from Ber are seen as potential processed foods. Ber fruit has an extremely limited shelf life and is highly perishable. A shelf life of two to four days is typical at room temperature (15 to 25^{o}C). A significant amount of fruit is lost as a result of the abundance of fruits in the local markets during peak season, which causes significant postharvest losses (Pareek et al., 2009). Keeping these aspects in mind for present study, forest based fruit like Ber has been selected for formulation and development of fruit product like jam, which would promote forest, based micro enterprises for uplifting socioeconomic conditions of forest dwellers.

MATERIAL AND METHODS

A. COLLECTION AND PREPARATION OF FRUITS

The fully developed, somewhat yellow small Ber fruits (Ziziphus mauritiana Lam.) were harvested from Nanded farms and used in the present study.

B. EXTRACTION OF FRUIT PULP

Ber (Ziziphus mauritiana Lam.) Pulp was made from fully ripe, slightly yellow Ber fruits. Fruits were peeled and sliced into little pieces. After boiling the fruit pieces in water for a short while, the pulp was ground up and sieved through stainless steel. Additional value-added products were prepared using this pulp.

C. VALUE ADDED PRODUCT DEVELOPMENT

PREPARATION OF JAM

To make jam, nutritious fresh fruits were chosen, and the pulp was prepared as previously indicated. After combining the pulp and sugar, the mixture was heated to 68.5^{o}Brix, adding citric acid, and edible colours. After that, it was put into the bottle for further investigation.

Fruit
↓
Washing
↓
Cutting
↓
Grinding
↓
Pulp
↓
Addition of sugar
↓
Heating
↓
Addition of citric acid / Colour
↓
(End point 68.5 ^{o}Brix)
↓
Addition of preservative
↓
Hot filling in bottle and sealing
↓
Storage

Flow sheet: Flow Chart for Mixed jam.

D. SHEET (OR) FLAKE TEST

Using a spoon or wooden ladle, a tiny amount of jam is removed after boiling pan and allowed to cool gradually for few seconds. After that, let it drop into water. The product is ready when it slips off in the shape of a sheet (or) flakes rather than running in a continuous stream of syrup. This indicates that the end point has been achieved. If not, boiling is kept on until the sheet test comes out positive.

E. DROP TEST

A drop of the concentrated substance is added to a water-filled glass. The end point was indicated by the drop settling down without disintegrating.

F. PHYSICOCHEMICAL CHARACTERISTICS OF VALUE-ADDED PRODUCTS

The value-added goods' total soluble content was determined using a digital handheld refractometer. Using phenolphthalein indicator, the acidity was measured by titrating against a standard alkaline solution and represented as a percentage in citric acid (AOAC table). Fehling's solution (Copper reduction) was used to determine the total amount of sugars. A pH meter was used to test the pH. Proteins in value-added products were determined by micro- Kjeldhal method. Crude fibre was determined by AOAC, (1990). Reducing sugar was determined by standard method.

G. SENSORY EVALUATION

A panel of five judges conducted a sensory assessment in order to rate the overall acceptability on a 9-point hedonic scale, as described by (Amerine et al., 1965). The processed items' end of storage was largely decided by their sensory quality (a sensory value of seven or above was deemed satisfactory). Using the dilution plate approach, the microbiological examination of processed items was conducted by counting colony forming units (cfu/g or ml) of yeast and bacteria. (A sequence of tenfold dilutions in cold water).

Sr. No	Scale	Liking score
1	Like extremely	9
2	Like very much	8
3	Like moderately	7
4	Like slightly	6
5	Neither like nor	5
6	Dislike slightly	4
7	Dislike moderately	3
8	Dislike very much	2
9	Dislike extremely	1

RESULTS AND DISCUSSION

The results of recipe of value-added product-mixed jam from Ber and Guava are shown in Table 1. The fruit jam was formulated by using different treatments of pulp of two fruits, sugar and citric acid. In treatment (T1), mixed jam was prepared by using 50 + 50 gm (Ber and Guava) pulp, 72 gm sugar, and 0.8 gm citric acid.

Table 1. Recipe of value-added product -Mixed jam from Ber and Guava

Sr. No	Ingredients	Treatment				
		T1	T2	T3	T4	T5
1	Pulp Mixed (Ber and Guava)	50 + 50	55 + 45	60 + 40	65+ 35	70 + 30
2	Sugar (gm)	72	75	80	82	60
3	Citric acid (gm)	0.8	0.8	0.8	0.8	0.8
4	Sodium Benzoate	100 PPM	100 PPM	100 PPM	100 PPM	100 PPM

In treatment (T2), mixed jam was prepared by using 55 + 45 gm (Ber and Guava) pulp, 75 gm sugar, and 0.8 gm citric acid. In treatment (T3), mixed jam was prepared by using 60 + 40 gm (Ber and Guava) pulp, 80gm sugar, and 0.8 gm citric acid. In treatment (T4), mixed jam was prepared by using 65+35 gm (Ber and Guava) pulp, 82 gm sugar, and 0.8 gm citric acid. In treatment (T5), mixed jam was prepared by using 70 + 30 gm (Ber and Guava) pulp, 60 gm sugar, and 0.8 gm citric acid.

The Mixed fruit jam prepared by using treatment (T1) having pulp 50 + 50 gm (Ber and Guava) pulp, 72g sugar, and 0.8 gm citric acid was found to be superior in colour, appearance, texture, taste, Flavor and overall acceptability to those prepared by using other combinations.

The Mixed fruit jam prepared by using treatment (T1) having pulp 50 + 50 gm (Ber and Guava) pulp, 72g sugar, and 0.8 gm citric acid was found to be superior than other combinations.

SENSORY EVALUATIONS

A semi-trained panel of five judges assessed the quality of ber mixed jam using a nine-point hedonic scale, taking into account factors such as colour, appearance, texture, taste, and general acceptability (Amrineet al.,1965). The sensory development was carried out in storage at room temperature for six months. The sensory details of evaluation shown in Table 2.

The Mixed fruit jam prepared by using treatment (T1) having pulp 50 + 50 gm (Ber and Guava) pulp, 72g sugar, and 0.8 gm citric acid was found to be superior in colour, appearance, texture, taste, Flavour and overall acceptability to those prepared by using other combinations.

Table 2. Sensory evaluations

Sensory Evaluation								
Ber and Guava Mixed Jam	Storage	Fresh	30	60	90	120	150	180
	Colour	8.4	8.2	8.4	8.8	8	8.4	8.4
	Taste	8.4	8.2	8.8	8.4	8.2	8.4	8.4
	Flavors	8.4	8	8.4	8.6	8.4	8.5	8.5
	Texture	8.4	8.4	8.6	8	8.6	8.1	8.3
Over all Acceptability		8.4	8.2	8.55	8.45	8.3	8.35	8.4

PHYSICO CHEMICAL ANALYSIS

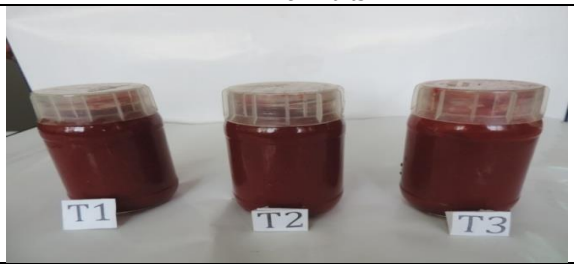
Physicochemical measures such as acidity %, moisture %, ash %, TSS, total sugar %, reducing sugar %, protein %, crude fiber %, pH, and microbial load (cfu/ml) were used to assess the ber mixed jam during the course of 180 days of storage at room temperature. During the storage of mixed jam at ambient temperature for 180 days, the Acidity%, TSS°Brix, Total sugar%, Reducing sugar %and Microbial load (cfu/ml) increased, whereas Moisture %, Ash%, pH and Protein % decreased with the time. Because of the high acidity and appropriate preservation of the produced samples, the microbial load (cfu/ml) in the jam was determined to be quite low. In all jam samples, there was very little microbiological contamination. The detailed summary of physico chemical analysis is shown in Table 3.

PHOTOPLATE-1

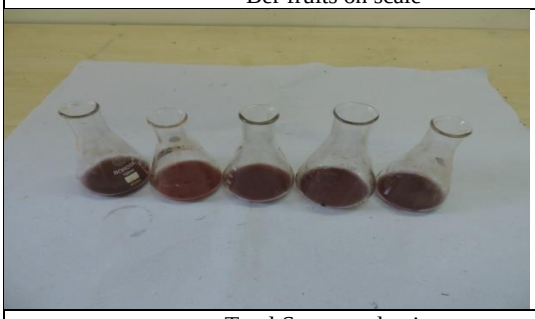
Ber tree with fruits

Ber Fruits

Ber fruits on scale



Mixed jam



Total Sugar evaluation

Sensory workers

In present research work, efforts have been made to standardize ber and guava fruit processing techniques for mixed jam, in accordance with the Food Safety Standards Authority of India's current food laws.

The fruit jam was formulated by using different treatments of pulp of two fruits, sugar and citric acid. In treatment (T1), mixed jam was prepared by using 50 + 50 gm (Ber and Guava) pulp, 72g sugar, and 0.8 gm citric acid. In treatment (T2), mixed jam was prepared by using 55 + 45 gm (Ber and Guava) pulp, 75g sugar, and 0.8 gm citric acid. In treatment (T3), mixed jam was prepared by using 60 + 40 gm (Ber and Guava) pulp, 80g sugar, and 0.8 gm citric acid. In treatment (T4), mixed jam was prepared by using 65+35 gm (Ber and Guava) pulp, 82g sugar, and 0.8 gm citric acid. In treatment (T5), mixed jam was prepared by using 70 + 30 gm (Ber and Guava) pulp, 60 g sugar, and 0.8 gm citric acid.

The Mixed fruit jam prepared by using treatment (T1) having pulp 50 + 50 gm (Ber and Guava) pulp, 72g sugar, and 0.8 gm citric acid was found to be superior to other combinations. Similar type of results were reported in mango mixed toffee by (Sakhale et al., 2012) and in guava and strawberry toffee by (Chavan et al., 2015). All value products had nutritional profiles that were appropriate for their intended use. Additionally, a physicochemical study of the developed product revealed a figure that was within range. During the storage of mixed jam at ambient temperature for 180 days, the Acidity %, TSS^{o}Brix, Total sugar%, Reducing sugar %and Microbial load (cfu/ml) increased, whereas Moisture %, Ash %, pH and Protein %, decreased with time. A 9-point hedonic score indicated that all items' sensory evaluations and shelf lives were generally accepted. All processed items had a four to six months shelf life. Comparable outcomes were attained in accordance with the information disclosed by (Sakhale et al., 2012).

The most important enzyme in fruit jam is pectinase and invertase. Pectin is broken down by pectinase into galacturonic acid and carbohydrates. The fruit juice's color and scent are enhanced by the presence of pectinase. Fruit juice becomes more voluminous and simpler to pour when the pectin is broken down by the pectinase enzyme, which also eliminates any cloudiness that may have been present. Pectinase is an enzyme that breaks down the starches in fruit juice, removing any remaining plant matter from the liquid (Akintunde et al., 2004). Plant cell wall construction is broken down by pectinase, which also catalyzes the random hydrolysis of 1, 4-α-Dgalactosiduronic links in pectate and other galacturonans. Consequently, the quickening of juice discharge likewise saves time and money for the industries. The other important enzyme invertase breaks down sucrose into glucose and fructose by cleaving the α-1, β-2-glycosidic bond. It is an enzyme that breaks down carbohydrates. When sugar and water are combined to prepare fruit products, the invertase enzyme activates and splits the sucrose. Fruit jam quality is improved by this chemical reaction in the combination, which also prevents crystallization and enhances the fruit's brightness and taste (Chaudhary et al., 2007).

During the processing of jam, role of pectin has important role. Water is drawn to and retained by the sugar during the gelling process. Depending on the kind of fruit wild/cultivated, the pectin concentration may range from 0.5 to 1.5% by weight, which determines the gel's consistency (Kumar & Deen, 2017). In fruit jam products, adding sugar is necessary to get the right consistency and hardness. Only when both acid and sugars are present, pectin has the potential to gel.

CONCLUSION

The Mixed fruit jam prepared by using treatment (T1) having pulp 50 + 50 gm (Ber and Guava) pulp, 72g sugar, and 0.8 gm citric acid was found to be superior in colour, appearance, texture, taste, flavour and overall acceptability to those prepared by using other combinations. During the storage of mixed jam at ambient temperature for 180 days, the Acidity%,, TSS^{o}Brix, Total sugar%, Reducing sugar %and Microbial load (cfu/ml)increased, whereas Moisture %, Ash%, pH and Protein %, decreased with the time. Because of the high acidity and appropriate preservation of the produced samples, the microbial load (cfu/ml) in the jam was determined to be quite low. In all of the jam samples, there was very little microbiological contamination. The aforementioned information leads to the conclusion that this standardized procedure may be used to prepare mixed jam from the chosen wild fruit in order to provide local communities with an extra source of revenue. This would be helpful for launching fresh ventures as well. This study is useful to common people and food biotech companies. Indian government will also get benefits from this research work.

Table 3. Results of Physico-chemical evaluation

Ber Mixed Jam									
Sr. No	Sample	Storage Duration (Days)							
		Fresh	15	30	60	90	120	150	180
		1. Acidity (%)							
1	T1	00.62 ± 00.04	00.77 ± 00.04	00.97 ± 0.04	01.17 ± 0.06	01.17 ± 0.06	01.27 ± 0.02	01.27 ± 0.02	01.30 ± 00.00
2	T2	00.70 ± 00.07	00.94 ± 00.20	01.14 ± 0.02	01.20 ± 0.04	01.37 ± 0.06	01.40 ± 0.04	01.55 ± 0.10	01.68 ±00.09
3	T3	00.46 ± 00.02	00.74 ± 00.04	00.97 ± 0.14	01.00 ± 0.00	01.40 ± 0.04	01.47 ± 0.04	01.57 ± 0.04	01.57 ± 00.04
4	T4	00.76 ± 00.02	00.97 ± 00.02	01.04 ± 0.09	01.14 ± 0.02	01.15 ± 0.01	01.17 ± 0.09	01.47 ± 0.07	01.54 ± 00.07
5	T5	00.64 ± 00.06	00.64 ± 00.06	00.77 ± 0.02	00.90 ± 0.04	01.03 ± 0.06	01.34 ± 0.06	01.54 ± 0.09	01.56 ± 00.09
		2. TSS°Brix,							
1	T1	70.34 ± 00.58	71.34 ± 00.58	71.50 ± 00.50	72.34 ± 00.58	73.34 ± 00.58	74.40 ± 00.36	75.34 ± 00.58	76.34 ± 00.58
2	T2	70.00 ± 00.00	70.67 ± 01.16	71.34 ± 00.29	71.73 ± 00.26	72.85 ± 00.97	73.65 ± 00.30	74.34 ± 00.58	75.00 ± 00.00
3	T3	69.34 ± 00.58	70.50 ± 01.33	71.68 ± 00.58	72.34 ± 00.58	73.32 ± 00.28	73.63 ± 00.66	74.80 ± 00.73	75.71 ± 00.25
4	T4	68.34 ± 00.58	69.17 ± 00.28	70.50 ± 00.50	71.34 ± 00.24	72.34 ± 00.34	73.74 ± 00.24	74.75 ± 00.26	75.67 ± 00.58
5	T5	67.67 ± 00.58	68.84 ±00.77	69.00 ± 00.01	71.68 ± 01.15	72.40 ± 00.43	73.20 ± 00.20	74.34 ± 00.58	74.67 ± 00.58
		3. ASH (%)							
1	T1	24.47 ± 00.02	23.94 ± 00.30	23.80 ± 00.20	23.07 ± 00.16	22.27 ± 00.04	21.94 ± 00.06	20.26 ± 00.04	19.34 ± 00.05
2	T2	27.40 ± 00.03	26.34 ± 00.05	25.20 ± 00.27	24.94 ± 00.25	23.60 ± 00.05	23.27 ± 00.05	22.53 ± 00.04	21.86 ± 00.03
3	T3	30.84 ± 00.25	29.74 ± 00.20	28.54 ± 00.27	28.27 ± 00.39	27.60 ± 00.13	27.13 ± 00.05	26.54 ± 00.03	25.74 ± 00.07
4	T4	30.60 ± 00.17	30.27 ± 00.30	29.73 ± 00.35	29.26 ± 00.27	28.93 ± 00.09	27.40 ± 00.06	26.26 ± 00.06	25.53 ± 00.05
5	T5	27.20 ± 00.25	26.54 ± 00.09	25.33 ± 00.17	24.27 ± 00.12	23.80 ± 00.06	22.40 ± 00.04	21.20 ± 00.05	20.00 ± 00.05
		4. MOISTURE (%)							
1	T1	31.34 ± 00.08	30.50 ± 00.08	29.84 ± 00.12	29.00 ± 00.24	28.16 ± 00.17	27.84 ± 00.15	26.16 ± 00.16	25.83 ± 00.08
2	T2	31.17 ± 00.12	30.84 ± 00.09	30.50 ± 00.10	29.83 ± 00.24	29.17 ± 00.11	28.00 ± 00.16	27.34 ± 00.20	26.17 ± 00.16
3	T3	32.34 ± 00.05	31.84 ± 00.05	30.50 ± 00.13	29.34 ± 00.04	28.50 ± 00.09	28.00 ± 00.10	27.50 ± 00.08	26.20 ± 00.09
4	T4	30.67 ± 00.06	29.67 ± 00.14	29.00 ± 00.06	28.84 ± 00.03	27.34 ± 00.03	26.34 ± 00.08	25.46± 00.07	24.46 ± 00.01
5	T5	32.17 ± 00.08	31.67 ± 00.09	30.00 ± 00.08	29.16 ± 00.04	28.34 ± 00.04	27.66 ± 00.06	26.11± 00.23	25.46 ± 00.21
		5. PROTEIN (%)							
1	T1	10.95 ± 0.43	10.18 ± 0.04	09.08 ± 0.61	08.15 ± 0.37	06.99 ± 0.15	06.37 ± 0.36	05.59 ± 0.12	04.30 ± 0.76
2	T2	10.75 ± 0.28	10.01 ± 0.28	09.67 ± 1.12	08.23 ± 0.34	06.94 ± 0.10	06.30 ± 0.47	05.62 ± 0.92	04.31 ± 0.17
3	T3	10.75 ± 0.49	10.09 ± 0.47	09.03 ± 0.59	08.00 ± 0.17	06.86± 0.15	06.17± 0.15	05.98 ± 1.43	04.30 ± 0.35
4	T4	10.71 ± 0.56	10.12 ± 0.14	09.17 ± 0.42	08.03 ± 0.05	06.74 ± 0.52	06.20 ± 0.18	05.42 ± 0.16	04.06 ± 0.14
5	T5	10.74 ± 0.22	10.02 ± 0.26	09.35 ± 0.22	08.08 ± 0.44	06.48 ± 0.76	06.07 ± 0.03	05.09 ± 0.24	04.13 ± 0.73
		6. pH							
1	T1	02.96 ± 00.05	03.04 ± 00.05	03.93 ± 00.11	04.09 ± 00.11	04.71 ± 00.30	05.09 ± 00.10	05.73 ± 00.10	06.03 ± 00.07
2	T2	03.06 ± 00.05	03.14 ± 00.03	04.00 ± 00.01	04.36 ± 00.20	04.72 ± 00.10	05.09 ± 00.09	05.73 ± 00.25	06.04 ± 00.10
3	T3	02.96 ± 00.05	03.00 ± 00.01	04.03 ± 00.07	04.41 ± 00.07	04.87 ± 00.08	05.04 ± 00.08	05.58 ± 00.25	06.18 ± 00.07
4	T4	02.98 ± 00.02	03.08 ± 00.05	04.04 ± 00.08	04.73 ± 00.15	04.99 ± 00.00	05.19 ± 00.03	05.63 ± 00.21	06.25 ± 00.07
5	T5	02.97 ± 00.02	03.01 ± 00.01	03.96 ± 00.05	04.42 ± 00.05	04.94 ± 00.02	05.18 ± 00.02	05.61 ± 00.22	06.06 ± 00.22
		7. TOTAL SUGAR (%)							
1	T1	28.11 ± 00.90	29.21 ± 00.96	30.320 ± 00.99	30.40 ± 02.05	31.25 ± 01.52	32.43 ± 00.56	32.75 ± 00.56	33.83 ± 01.59
2	T2	27.26 ± 00.64	28.88 ± 00.61	29.40 ± 00.11	30.19 ± 00.50	31.19 ± 00.32	32.82 ± 00.53	33.00 ± 00.74	34.13 ± 01.34
3	T3	28.32 ± 01.45	29.10 ± 00.09	30.70 ± 01.35	31.33 ± 01.27	32.15 ± 01.63	32.62 ± 01.45	33.85 ± 01.41	34.20 ± 00.58
4	T4	27.78 ± 00.47	28.79 ± 01.08	29.32 ± 00.68	30.64 ± 00.89	31.40 ± 00.97	32.37 ± 00.88	32.94 ± 01.01	33.63 ± 01.11
5	T5	27.59 ± 00.78	28.65 ± 00.92	29.16 ± 01.15	30.82 ± 01.04	31.59 ± 00.12	32.38 ± 00.07	33.01 ± 00.35	34.26 ± 00.60
		8. REDUCING SUGAR (%)							
1	T1	26.23 ± 00.53	25.69 ± 00.13	23.48 ± 00.39	22.46 ± 00.61	21.27 ± 00.49	20.03 ± 00.31	19.00 ± 00.64	18.13 ± 00.56
2	T2	24.29 ± 00.74	22.70 ± 00.56	21.00 ± 00.51	19.95 ± 00.51	18.89 ± 00.45	17.93 ± 00.35	16.64 ± 00.50	15.87 ± 00.49
3	T3	22.35 ± 00.62	21.59 ± 00.87	20.52 ± 00.95	19.80 ± 00.93	18.36 ± 00.82	17.31 ± 00.96	16.45 ± 00.86	15.43 ± 01.02
4	T4	25.26 ± 01.60	24.05 ± 00.98	22.14 ± 00.80	20.48 ± 00.33	19.81 ± 00.83	18.78 ± 1.02	17.66 ± 01.08	16.63 ± 00.93
5	T5	23.19 ± 00.50	22.54 ± 00.57	21.01 ± 00.67	19.85 ± 00.73	18.83 ± 00.29	17.79 ± 00.48	16.82 ± 00.60	15.62 ± 00.43
		10. MICROBIAL LOAD (10^1 Log value)							
1	T1	5.325679827	5.583278142	5.698300675	5.724824537	5.805826966	5.908572584	6.033103278	6.147368139
2	T2	5.395204039	5.652210874	5.807807786	5.857784651	5.912089143	6.003604124	6.109061946	6.249524466
3	T3	5.485764002	5.698300675	5.752673177	5.857784651	5.912089143	5.994076545	6.187896571	6.267191291
4	T4	5.578138547	5.77555948	5.836990451	5.90504173	5.953213461	6.13115761	6.294731425	6.353678416
5	T5	5.315277439	5.742067564	5.93460617	5.954885433	6.009898275	6.100628977	6.186618294	6.269519949

ACKNOWLEDGMENT

The authors are thankful to Rajiv Gandhi Science and Technology Commission, Govt. of Maharashtra, Mumbai for providing necessary funding for this research work.

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