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Optimization of Enzyme Assisted Juice Extraction from Banana

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ABSTRACT: 25.58% production of banana is contributed from India. 40-45 percent of fruits are detoriated due to improper post-harvest management. To rectify such problem we need to reduce convert the excess produce into value added products. The health conscious peoples are demanding much more for the juices. Pulpy nature of banana fruits makes the juice extraction difficult task because the pulp does not contain enough liquid to be converted into juice without the addition of more water, which changes the consistency of the juice from a sticky, lumpy mass to a free-flowing juicy nature. Adding enzymatic treatments to the banana pulp causes it to liquefy, resulting in free-flowing banana juice. The pectinase enzyme present in the banana variety 'Grand Naine' catalyses the breakdown of pectin found in the cell wall of the plant cell, speeding up the juice extraction process. It raised filterability and minimized viscosity. The goal is to assess the physicochemical and nutritional aspects of recovered juice, as well as the juice's durability and quality while stored at room temperature (RT). The impacts of factors like enzymatic concentrations (percent) 0.5, 1.0, 1.5, 2.0, incubation length of 60, 120 minutes at room temperature, and dependent variables like TSS, viscosity were studied using a completely randomised design (CRD). On the 60th day of room temperature storage, the chemical elements of fresh juice (0th day) showed a substantial increase in T_8 in TSS when treated to a 2 percent enzyme concentration for 120 minutes. During storage, the viscosity gradually decreased on the 60th day. The control treatment, T_9, had the maximum viscosity of the fresh juice, at 226.40cps.

Keywords: Banana, TSS, Viscosity, fresh juice, Enzyme.

INTRODUCTION

Juices are one of several processed foods with a variety of nutritional data, and juices are in high demand among customers. Juice is a beverage created by pressing or extracting the natural liquid inherent in fruit. Keeping in mind that the goal of my current research is to increase the potential of banana fruit juices. India is the world's top banana producer, accounting for 25.58 percent of global production (FAO, 2012). It contributes to the lives of millions of people by providing an additional source of income through production, processing, and marketing Singh *et al*., (2000). Juices are one of several processed foods with a variety of nutritional data, and juices are in high demand among customers. Juice is a beverage created by pressing or extracting the natural liquid inherent in fruit. Keeping in mind that the goal of my current research is to increase the potential of banana fruit juices. India is the world's top banana producer, accounting for 25.58 percent of global production. It contributes to the lives of millions of people by providing an additional source of income through production, processing, and marketing Singh *et al.,* (2000). For the experiment, a tissue cultivated cultivar called Grand-9 (G-9) was chosen, which is a superior selection of Giant Cavendish. In the current situation, prolonged fruit losses can be curtailed by converting overripe fruits into value-added products such as juices through processing. The banana is a perishable fruit. Because of the pulpy nature of banana fruits, juice extraction is difficult (Adao and Gloria, 2005), because the pulp does not have enough liquid to be extracted into a juice form without adding additional water, which changes the consistency of the juice from a sticky, lumpy mass to a free flowing juicy nature (Zulueta *et al.,* 2007). Not only is extraction difficult, but there have been a few issues with banana juice processing, such as excessive viscosity (Dupaine and Delnic, 1965; Viquez *et al*., 1981, 2007), As a result,

enzymes such as pectinase play an important role in the processing and synthesis of fruit juices, according to Albrecht *et al*., (1996). Pectinase enzyme is derived from bacteria and fungi and is a natural source. Pectinase isolated from Aspergillus niger fungus. Pectinase is a commonly utilised enzyme in the food business that catalyses the breakdown of pectin found in the cell walls of plants, speeding up the juice extraction process. Pectinases account for around a quarter of all food enzyme sales worldwide (Jayani *et al.,* 2005). Inhibition of banana polyphenoloxidase by citric acid and other compounds such as KMS has demonstrated to be somewhat more effective (Koffi *et al.,* 1991). This discovery will result in a holistic alteration of the current situation in possible areas where the use of enzymes could aid agro-industrial development and increase food product nutrition.

MATERIAL AND METHODS

Experimental site and Location: During the academic year 2019-20, the tests were carried out in the Laboratories of Food Science and Post-Harvest Technology at Bihar Agricultural University, Sabour, Bhagalpur.

Enzyme source: Kertesz published the first paper on the use of pectolytic enzymes for the clarification of fruit juices in 1930. Since then, a huge number of commercial pectic enzymes have been utilised to clarify juices with great effectiveness. This was isolated from the Aspergillus niger fungus.

Process of juice extraction: The matured bananas were carefully peeled. The banana pulp was then treated with pectinase, a commercial enzyme, in various quantities (0.5, 1.0, 1.5, 2.0) percent. The samples were incubated at room temperature for various time durations ranging from 60 to 120 minutes, depending on the treatment. The extracted juice was then clarified using a four-layered Muslin cloth. The filtered juice was then pasteurised for 5 minutes at 80-850°C in a thermostatically controlled water bath to suppress microorganisms and enzymatic reactions. For a period of 60 days, the pasteurised juices were kept at room temperature.

Experimental details: The Grand Naine banana cultivar was incubated at room temperature for 60 and 120 minutes after being treated with different doses of pectinase enzyme. As a control, untreated banana pulp was used. For a period of 60 days, the extracted juice was evaluated for physico-chemical characteristics as well as juice stability and quality at 15-day intervals. The experiment was conducted in CRD with 3 replication and 9 treatment viz; T_1-Pectinase (0.5 %) with incubation for 60 mins, T_2- Pectinase (1.0 %) with incubation for 60 mins, T_3- Pectinase (1.5 %) with incubation for 60 mins, T_4- Pectinase (2.0 %) with incubation for 60 mins, T_5- Pectinase (0.5 %) with incubation for 120 mins, T_6- Pectinase (1.0%) with incubation for 120 mins, T_7- Pectinase (1.5 %) with incubation for 120 mins, T_8- Pectinase (2.0 %) with incubation for 120 mins and T_9-Control(No enzyme added).

Physico-chemical analysis: The juices were examined to determine their chemical composition and production. The average juice yields were recorded as a function of enzymatic treatments. Standard procedures were used to determine and record total soluble solid and viscosity.

TSS: At room temperature, a digital refractometer was used to measure total soluble solids (Ranganna, 2010). A few drops of juice from each treatment were placed in a clean glass on the refractometer's prism base. After pressing the 'ON' button and then the 'READ' button, the TSS reading of the juice will appear on the digital refractometer screen.

Viscosity: Viscosity of the juice was determined using a digital viscometer (Brookfield, USA model LVTD) with spindle number 4 at 60 rpm for coarse pulp, spindle No. 18 at 60 rpm for fruit juice. The dial reading was multiplied by corresponding factor to get viscosity in centipoise. Capillary viscometer (U –tube viscometer) was used for determination of viscosity as per the method given by Ranganna, (1977).

Sensory evaluation: The sensory evaluation of banana juice was done by using 9-point hedonic scale. This sensory test was conducted with the help of a 5-member panel at the Department of Food Science and Postharvest Technology, Bihar Agricultural University Sabour, before storage (0 days) and after storage (60 days).

Main and interaction effects were examined in the data by used OPSTAT to help them.

RESULT AND DICUSSION

Physical Parameters of Fruit: Before juice extraction, the fully ripe Banana variety 'Grand Naine' was taken for experimental examination of physical parameters. The weight of a mature banana fruit, the weight of the peel, and the weight of the pulp were 118g, 39.3g, and 78.7g, respectively.

Effect of treatment on TSS during storage: Total Soluble Solid (°Brix): Table 1 shows the TSS of the obtained Banana Juice of the 'Grand Naine' variety as impacted by enzymatic treatment. At a 5% level of significance, the results demonstrated that therapy had a substantial influence on TSS. The TSS of the juice was very low at first, however it gradually increased during storage. TSS ranged from 20.720 (°Brix) to 22.480 (°Brix) on average. After 60 days of storage, the maximum TSS (Total Soluble Solid) of 22.480 °Brix was obtained in the eighth treatment (T8) when treated with 2% enzyme concentration incubated for 120 minutes, followed by T_4 at 20.720°Brix after 60 days of storage when treated with 2% enzyme concentration incubated for 60 minutes. Minimum TSS of 20.720°Brix was obtained in Treatment 9 (control) of fresh juice(0 days).Maximum TSS (Total Soluble Solid) was obtained in Treatment 8 (T_8) after 60 days of storage, i.e. 2 percent enzyme concentration incubated for 120 min or 2 hours (22.480 Brix), whereas Minimum TSS was obtained in Treatment 9 of fresh juice, i.e. control (20.720 Brix). Minh (2014) investigated the influence of enzyme concentration and

time on TSS in red rose apple juice and discovered that TSS increases from 12.7 to 14.3 Brix. Bhardwaj and Nandal (2014) investigated the effect of TSS on blended Kinnow juice during storage and discovered that the TSS of the juice increased during storage. Deka and Sethi (2001); Bhardwaj and Mukherjee (2001) both observed similar findings (1983).

Table 1: TSS (°Brix) as influenced by enzymatic treatment on storage.

Treatment	Storage (days)				
	0	15	30	45	60
T_1	20.803 ± 0.009	20.937 ± 0.022	21.347 ± 0.024	21.417 ± 0.013	21.497 ± 0.026
T_2	20.930 ± 0.012	20.95 ± 0.014	21.380 ± 0.012	21.470 ± 0.02	21.547 ± 0.012
T_3	21.130 ± 0.012	21.193 ± 0.021	21.433 ± 0.020	21.533 ± 0.015	21.597 ± 0.013
T_4	21.910 ± 0.017	21.963 ± 0.009	22.200 ± 0.009	22.277 ± 0.015	22.377 ± 0.016
T_5	20.837 ± 0.010	20.960 ± 0.010	20.960 ± 0.010	21.500 ± 0.006	21.540 ± 0.017
T_6	20.940 ± 0.006	21.020 ± 0.051	21.423 ± 0.017	21.507 ± 0.010	21.567 ± 0.013
T_7	21.140 ± 0.018	21.210 ± 0.018	21.473 ± 0.027	21.593 ± 0.015	21.657 ± 0.017
T_8	21.940 ± 0.006	21.977 ± 0.018	22.240 ± 0.023	22.343 ± 0.026	**22.480 ± 0.043**
T_9	**20.720 ± 0.006**	20.873 ± 0.000	20.907 ± 0.007	20.957 ± 0.014	21.030 ± 0.045
C.D.	0.033	0.067	0.054	0.048	0.076
SE(m)	0.011	0.022	0.018	0.016	0.026

Effect of treatment on Viscosity during storage: Table 2 shows the viscosity of 'Grand Naine' banana juice as a function of enzymatic treatment. At a 5% level of significance, it was discovered that treatment had a substantial effect on viscosity. The viscosity of the juice was at its highest during the first stage of storage and thereafter gradually decreased. The viscosity ranged from 119.990 to 471.833 cps on average. The maximum viscosity of fresh juice was 471.833 cps in T9 (control). T_8 after 60 days of storage, juice treated with 2% enzyme concentration and incubated for 120 minutes, yielding 119.990 cps, was followed by T_8 after 45 days of storage, yielding 121.280 cps, with the same treatment and incubation period. Due to the hydrolysis of pectin in the juice, the viscosity of the juice decreased during storage, resulting in the clearing of the liquid. Juices that are sparkling and translucent will appeal to the eye. After 60 days of storage, Maximum Viscosity was obtained in Treatment 9 (T_9) of fresh juice, i.e. control (471.833 cps), and Minimum Viscosity was obtained in Treatment 8 (T_8), i.e. 2 percent enzyme concentration incubated for 120 minutes or 2 hours (119.990 cps). Abdullah *et al.*, (2007) extracted carambola juice and discovered that 0.1 percent enzyme concentration for 20 minutes reduced viscosity. Joshi *et al.,* (1990) reported similar results

Table 2: Viscosity (cps) as influenced by enzymatic treatment on storage.

Treatment	Storage (days)				
	0	15	30	45	60
T_1	237.633 ± 1.529	236.587 ± 0.974	235.887 ± 0.863	235.687 ± 0.865	235.587 ± 0.915
T_2	227.200 ± 1.332	226.620 ± 0.834	226.553 ± 0.139	225.920 ± 0.881	224.320 ± 0.149
T_3	182.933 ± 1.618	181.720 ± 0.879	181.620 ± 0.881	181.577 ± 0.762	181.420 ± 0.881
T_4	144.067 ± 3.841	140.520 ± 0.879	139.987 ± 0.863	139.940 ± 0.990	139.920 ± 0.880
T_5	221.600 ± 0.851	220.953 ± 0.849	220.820 ± 0.881	220.587 ± 0.863	220.687 ± 0.865
T_6	202.067 ± 0.787	201.520 ± 0.879	200.920 ± 0.881	200.900 ± 0.899	200.880 ± 0.870
T_7	142.167 ± 0.786	141.420 ± 0.880	140.787 ± 0.864	140.753 ± 0.953	140.520 ± 0.774
T_8	122.733 ± 0.940	121.987 ± 0.770	121.687 ± 0.770	121.280 ± 0.240	**119.990 ± 0.719**
T_9	**471.833 ± 0.940**	472.420 ± 0.931	472.287 ± 0.918	471.720 ± 0.939	471.553 ± 0.829
C.D.	5.012	2.626	2.814	2.542	2.644
SE(m)	1.674	0.877	0.940	0.849	0.883

SUMMARY AND CONCLUSION

The current study's results were analysed using the Completely Randomized Design (CRD) statistical approach. The physicochemical quality parameters of the juices derived from the pectinase enzyme-treated banana pulp were investigated. The total soluble solid increased as the enzyme concentration and incubation time were increased. During storage for up to 60 days, total soluble solid (TSS) increased dramatically, although total viscosity dropped. In the control treatment, the juice had a high viscosity (T_9). During storage, the overall sensory quality deteriorated.

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Conflict of Interest. Nil.

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