

Combined effect of citric acid and ascorbic acid as chemical pretreatments to prevent enzymatic browning in fresh cut banana pseudo stem

Streemahalakshmi M B, Ajay shaji, Ahamed aniza M, Aravinth R, Gogul J

Department of food technology, Kalasalingam Academy of Research and Education, Virudhunagar, India

Abstract— As the banana pseudo stem has high health benefits and lower shelf life. The possible solution to overcome the problem is to market the edible portion after necessary minimal processing. But, the processes like washing, sorting, peeling and cutting enhances oxidative stress in pre-cut fruits and vegetables. It also has the ill effects on quality of pre-cut fruits and vegetables by increase in microbial contaminations, excessive tissue softening, and browning. Hence, this study was conducted as a solution to the above problem. Fresh cut banana pseudo stem was processed by using the independent parameters such as concentration of citric acid and ascorbic acid and treatment time and the response variables were Browning index (BI), colour change (ΔE), Firmness, Ash content and Overall acceptability after the treatment. From the response variables the best combination of independent variables was resulted. This research could be potentially beneficial for development of residential business sector through expanded infiltration on locally available under-utilized foods.

KEY WORDS—Minimal processing, Post-harvest loss, Citric acid, Ascorbic acid

I. INTRODUCTION

Banana plants, belongs to the family of (*musaceae*) are widely produced and abundant in natural resources in tropical and subtropical countries in the world. The banana plants are considered as one of the world's most health beneficial plants. Almost all the parts of this plant, for example, fruit, peel, leaf, pseudo-stem, and stalk can be utilized for many purposes. They are used in various applications, for example, as thickener, colorant and flavoring, macro and micro-nutrient source, livestock feed, fibers etc.

The nutrient content of banana stems varies according to the various variety. In Banana the dry matter content ranges from 3.60-9.80%, fiber ranges from 40.50-64.10%, nitrogen range from 31.60- 53.00%, protein ranges from 2.40-8.30%, ash ranges from 18.4-24.70%, cellulose ranges from 19.70-35.20%. Banana Pseudo stem has contained with nutrients and health benefits. Consuming the banana Pseudo Stem will provide proper digestion. The Pseudo Stem contains large amount of potassium and vitamins which is good for Kidney

Stone and overweight because of the presence of Fiber content present in Pseudo Stem. The fiber which is present in the Pseudo Stem helps in slows down in release of sugar and fats stored in the body's cells. It also improves metabolism, and contains very few calories. Due to rich in Vitamin B6 it helps in maintain the cholesterol and blood pressure. It also contains iron which helps in increasing the hemoglobin count in the blood. The Stem provides relief from heartburn and discomfort and burning in the tummy which helps in healing the acidity and gastric problems. (Debabandya Mohapatra, 2010).

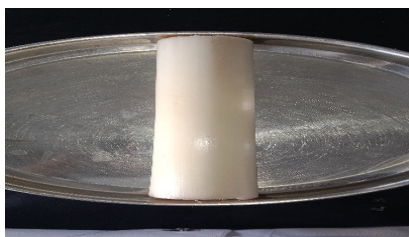
Now a days the consumers are more aware about the health and day by day the demand for ready to eat food products is increasing. The daily intake of fruits and vegetables helps in providing nutrition and minerals to our body which are essential for growth. The post-harvest loss of fruits and vegetables will lead to the nutritional loss and also by means of physical damage during transportation, longer storage duration and higher temperature. The Enzymatic Browning of the fruits and vegetables is due to the Polyphenol Oxidase. These reasons may lead to yield loss during harvesting and to prevent these issues is why we perform Minimal Processing of fruits and vegetables.

The minimal processing techniques of foods has widely increased and has a huge demand in markets among consumers. The minimal processing technique is done to provide the products with retained freshness, quality and increasing shelf life (Allende *et al.* 2006). By doing this process there has been a huge impact on the shelf life and nutritional retention of the food products. This action can be controlled by means of chemical pretreatments such as Antioxidants agents like Ascorbic Acid, Citric Acid. The Browning can also be stopped by using various packaging material such as using LDPE and PP for Vacuum Packaging. The objective of the paper is to study on optimization of minimal parameters using Response Surface Methodology and the characteristics of optimized banana stem.

II. MATERIALS AND METHODS

A. Raw Materials

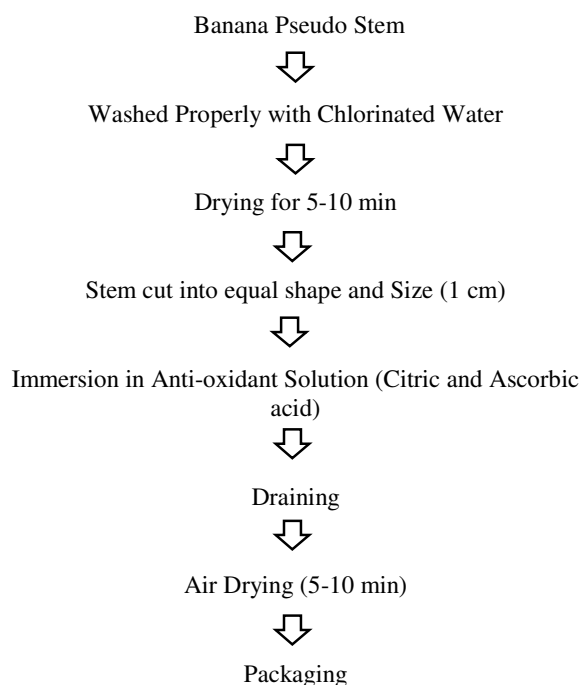
The study was carried out on the *poovan* variety of banana pseudo stem procured from the kalasalingam university srivilliputhur. The packaging material of LDPE (low density polypropylene) and PP (polypropylene) was obtained from the local market.



III. METHODOLOGY

A. Preparation of fresh-cut banana pseudo stem

Fresh good quality and uniformly matured banana pseudo stems (*var. poovan*) were cut in to round shape of approximately 5mm and immediately pre-treated with different anti-browning agents such as, ascorbic acid (0.1-1%) and citric acid (0.1-1%) with different treatment time (5-30 mins) to avoid browning. The treated stems were dried for 10-15 minutes to remove surface moisture and the samples were packaged in LDPE or PP packaging material. The test samples were stored under $8\pm 2^\circ\text{C}$, $27\pm 2^\circ\text{C}$ and analysed for colour value. Based on the colour value, the pre-treatments were optimized



Storage

The Ranges of the variables are tabulated below

Variables	Range	
	Minimum	Maximum
Ascorbic acid	0.1%	1%
Citric acid	0.1%	1%
Treatment time	5 min	30 min

B. Physical Characteristics

Colour

Hunter lab colour flex meter was used for the measurement of colour. It works on the principle of collecting the light and measures energy from the sample reflected across the entire visible spectrum. The meter uses filters and the mathematical models called Hunter model which rely on "standard observer curves" that define the amount of red, green, and blue (primary lights) required to match a series of colours across the visible spectrum. All the three standard CIE colour parameters 'L', 'a', 'b' was observed for daylight colour (Sachin N. Hajare et al, 2006).

$$\Delta F = \sqrt{(L^* - L^*_o)^2 + (a^* - a^*_o)^2 + (b^* - b^*_o)^2}$$

Where, "o" is the color value of fresh sample Yellowness Index (YI) of sample (b^*) and (L^*)

L^* - Perceptual lightness

a^* and b^* - Unique colors of human vision: red, yellow, blue, green.

Browning index

Browning index (BI) is measure to estimate the browning index. The procedure followed was, 5 g sample was extracted in 100 ml ethanol (67%) for 60 minute. Then the extract was filter by using filter paper (Whatman filter No.1). Then filtrate was used to determine browning index by using UV-visible spectrophotometer (wavelength at 420 nm) with blank as 67% ethanol (Saxena et al., 2009).

Firmness

The firmness of the Banana pseudo stem is a textural property. Firmness can be defined as the maximum force (N) recorded. Firmness of jackfruit Fruit were measured using fruit penetrometer. The resistance of the material to these force is measured by a calibrated load cell and results were shown in either grams or Newton. The sample was kept on the base round table for providing quick and easy height adjustment to accommodate (Chaiya Jantra et al, 2018).

$$\text{Firmness} = b/a$$

Where, "b" is referred as Endocarp Strength 'N' and "a" is referred as Deformation 'mm'.

C. Chemical Characteristics

Ash content

The Ash content is used to determine the amount and type of minerals found in food by burning the organic content and leaving inorganic minerals. Ash Content of the different sample was determined by the Muffle Furnace (O. Sipahioglu and S.A. Barringer, 2003)

FORMULA:

$$\text{Ash Content} = (W_2 - W) / (W_1 - W) \times 100$$

IV. RESULT AND DISCUSSION

Physical and Chemical Characteristics analysis are done in this study. In Physical Characteristics there are three main tests that has been conducted is that Colour Analysis, Browning Index and Firmness. For Chemical Characteristics Ash test and Crude fibre is conducted. These tests are conducted after the immersion of the anti-oxidants agents and packed in LDPE and PP packaging materials. The values are tabulated in table 1.1.

A. Effect on Physical Characteristics

Preetha P, 2015 undergone the study of colour analysis for banana pseudo stem by the hunter lab colour flex meter. This worked on the principle of collecting the light and measures energy from the sample reflected across the entire visible spectrum. The CIE colour parameters that is L, a, b values were observed and it is discussed that the initial L value for a banana pseudo stem decreased based on the treatment solution and it increased with the increase in storage period.

In this study the initial L, a, b values of the untreated fresh cut banana pseudo stem were 72.1, 1.5, 22.02. The L values for the treated samples with ascorbic acid and citric acid was 73.0 and 72.8. The values are 1.6 and 1.55. the b values are 23.1 and 22.90. The final calculated colour value ranges from 42.3-49.

Saxena et al, 2009 overviewed that the Browning Index for different sample was determined by the UV Spectrophotometer. For finding the browning index we must place the blank solution in the spectrophotometer in the absorbance range 520nm and after that the banana pseudo stem is crushed along with the ethanol and the sample is placed in the instrument and takes the readings according to the L, a, b value of the selected samples. Here the L, a, b values range from 20-50.

The Firmness for different sample was determined by the Fruit Penetrometer. Firmness is just to determine the strength of the banana pseudo stem after the immersion treatment of anti-oxidant solution (Chaiya Jantra et al, 2018). The initial firmness value of the fresh cut banana pseudo stem ranges from 0.1 -0.3.

B. Effect on Chemical Characteristics

O. Sipahioglu and S.A. Barringer (2003) said that the Ash content is used to determine the amount and type of minerals found in food by burning the organic content and

leaving inorganic minerals. Ash Content of the different sample was determined by using Muffle Furnace. This study analyzed that the ash content value ranges from 3 to 6%.

TR IA LS	AS CO RBI C ACI D	CIT RIC ACI D	TRE ATM ENT TIME	FIR MN ESS	CO LO UR	BRO WNI NG INDE X	ASH CONT ENT
1	1.0 0	1.0 0	5	0.1 855	42. 7	51.17	6
2	0.5 5	0.5 5	17.50	0.2 832	42. 93	47.05	3.75
3	0.5 5	1.4 7	17.50	0.1 991	48. 9	0	5
4	0.1 0	0.1 0	5	0.1 988	45. 5	48.5	4
5	1.0 0	1.0 0	30	0.1 885	43. 8	20.38	6
6	0.1 0	1.0 0	30	0.2 532	44. 5	5.29	8
7	1.0 0	0.1 0	30	0.1 568	43. 7	45.5	4
8	1.4 5	0.5 5	17.50	0.1 685	42. 8	43.7	5
9	0.5 5	0.5 5	17.50	0.1 875	45. 2	53.5	4
10	0.5 5	1.4 5	17.50	0.1 955	43. 7	42.2	3

1.1 Table shows the trials conducted during the Laboratory section.

V. CONCLUSION

The day to day increases in the popularity of minimally processed foods has provides a huge impact in Preserving the food and also helps in increasing the shelf life of the food material. There are various techniques has been followed for increasing the shelf life of the food products. With the introduction of the minimally process foods there has been a huge impact on preventing Post harvest loss and also helps in better Yields to the cultivators. This led to increase in quality and also helps in controlling microbial growth to ensure the product safety. The main reason for the post-harvest is the enzymatic browning of Fruits and Vegetables. This is because of the polyphenol oxidase enzyme present in the fruits and Vegetables.

So, to prevent this enzymatic browning we perform various treatments by means of antioxidant agents which will helps in preventing the enzymatic browning and helps to increase the shelf life of the products and retain the nutritional content of the product. During the process there are various parameters has to be checked life browning index, colour, firmness etc. has to be checked while performing the process. Minimal process has done in variety of fruits vegetables such as pineapple, apple, kiwifruit, potatoes, cabbage etc. By

performing this method, the shelf life can be extended up to 8 to 14 days and further study can take place.

REFERENCES

1. Preetha P, Varadharaju N, Gurumeenakshi G and Deepak J, 2010. Effect of pre-treatment on the quality of minimally processed fresh-cut banana pseudo stem. International Journal of Agriculture, Environment and Biotechnology. Pages 108-116.
2. Allende, A., Barberán, F.A.T. and Gil, I. 2006. Minimal processing for healthy traditional foods. Trends in Food Science and Technology. Volume 17: 513–519.
3. J. S. Ruthra Priya, Ravindra Naik and Dayanand Peter, 2014. Studies on Pre-treatment of Minimally Processed Banana Central Core. ScieXplore: International Journal of Research in Science, Vol 1(2): 110 – 116.
4. Lucimara Rogeria Antonioli, Benedito Carlos, Benedetti, Men de sa Moreira de souza filho, Deborados Santos Garruti, Maria de Fatima Borges, 2012. Shelf life of minimally processed Pineapples treated with Ascorbic and Citric acid. Post-harvest technology. Vol 71, n.3, Pages: 447-453.
5. Nilanthi wijewardana, Wasala 2015. Combined effect of Citric and Ascorbic acid as chemical pretreatments to prevent enzymatic browning in Fresh cut Ambul Banana (Musa spp.). Research gate. Proceedings of 8th International Research Conference KDV.
6. Sachin N. Hajare, Varsha S. Dhokane, R. Shashidhar, Sunil saroj, Arun sharma, and Jayant R. Bandekar, 2006. Radiation Processing of Minimally Processed Pineapple (*Ananas comosus* Merr.): Effect on Nutritional and Sensory Quality. Vol. 71, Nr. 6, Journal of food science.
7. Chaiya Jantraa , David C. Slaughterb , Jedediah Roachb , Siwalak Pathaveerata ,2018. Postharvest Biology and Technology. Volume 144, October 2018, Pages 1-8.
8. O. Sipahioglu and S.A. Barringer, 2003. Dielectric Properties of Vegetables and Fruits as a Function of Temperature, Ash, and Moisture Content. Journal of Food science—Vol. 68, Nr. 1.
9. Debabandya Mohapatra, Sabyasachi Mishra and Namrata sutar, 2010. Banana and its by-product utilization: an overview. Journal of Scientific and Industrial Research. Vol 69: pp 323-329 Industrial Research. Vol 69: pp 323-329.
10. Aloka Saxena A. S. Bawa & P. S. Raju, 2009. Effect of Minimally processin

Author's photo

(first **A. Author** and the other authors may include biographies at the end of regular papers. The first paragraph may contain a place and/or date of birth (list place, then date). Next, the author's educational background is listed. The degrees should be listed with type of degree in what field, which institution, city, state or country, and year degree was earned. The author's major field of study should be lower-cased.

Second Author personal profile with photo which contains their education details, their publications, research work, membership, achievements, with photo that will be maximum 200-400 words.

Third Author personal profile with photo which contains their education details, their publications, research work, membership, achievements, with photo that will be maximum 200-400 words.