

# Effect of Amylolytic Enzyme Treatment on Banana Juice Preparation, Yield and Clarification: A Preliminary Approach

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**Abstract:** The enzymatic clarification of banana juices from three cultivars (HPEE GYAN, THEE HMWE, NGET PYAW CHIN) of Myanmar origin was studied as a preliminary lab scale. Full ripe bananas of maturity stage 7 (completely yellow and speckled with brown spots) were treated with commercial  $\alpha$ -amylase. As a result of the enzymatic treatment (0.1, 0.2, 0.4ml), it was found that no extracted juice volume in HPEE GYAN and THEE HMWE, except NGET PYAW CHIN gave 26.7 (v/w%), respectively. This study revealed that the role of  $\alpha$ -amylase during clarification, NGET PYAW CHIN gave a little more yield among others. Depending on maturity, the effect on clarity, viscosity, pH and Brix on all three types of banana shows no significant changes in the experiments.

**Keywords:** enzyme; clarification; banana; liquefaction;  $\alpha$ -amylase

## 1. INTRODUCTION

Banana (*Musa* spp.) juice is nutritionally important beverage in the tropical and subtropical world and is rich in calories and minerals such as potassium, magnesium, phosphorus, etc. Clear banana juice, with its widely appreciated flavour and aroma can be used in various foods and drinks.

Generally, fruit juices are extracted by simple crushing and or grinding of fruits. However, in case of banana this process results in a sticky, lumpy mass with no juice. Bananas are usually too pulpy and pectinaceous to yield juice by simple pressing or centrifugation. Of the problems associated with banana pulp processing, a high viscosity seems to be the most severe. The turbidity and viscosity of banana juice are caused mainly by the polysaccharides in the juice such as pectin and starch [1].

Pectin makes the clarification process harder because of its fibre-like molecular structure. Starch is also a common problem for juice processors. Polymeric carbohydrates like starch may make filtration difficult and cause post process cloudiness. Application of enzymes such as pectinase and amylase improved the clarification process for banana fruit juice [2] [3].

Enzymatic treatment for juice extraction and clarification is most common nowadays. Enzymatic liquefaction of banana juice increases soluble components, which offer a number of advantages in producing juice, such as aroma, flavour, viscosity, turbidity, quality and yield [4].

Enzymatic hydrolysis of the cell walls increases the extraction yield, reducing sugars, soluble dry matter content, galacturonic acid content and titratable acidity of the products. The resultant pulp has a lower viscosity and the quantity of waste is reduced. Enzymatic degradation of the biomaterial depends upon the type of enzyme, incubation time, incubation temperature, enzyme concentration, agitation, pH and use of different enzyme combinations [5] [6].

Banana juices have been produced locally for several years in the banana-producing areas. Though not yet commonly available on

the market, clarified banana juice has been studied by different researchers using various approaches [7].

In Myanmar, at least 25 species of banana varieties are grown though 150 species in the banana family. The popular strains are Hpee gyan, Hnget pyar, Byat pyeith, Thange zar, Rakhine ngapyaw, Thee hmwe, Nget, pyaw chin, Nanthabu, Htawbhat, Shweni, Wakmalwut. Main production areas of banana in Myanmar are Yangon Division, Mandalay Division, Ayeyarwaddy Division and Sagaing Division.

The purpose of the present study was to produce high-value clarified banana juice, to get high yield, to facilitate natural, highly nutritious and high quality of banana juice as a preliminary study to use  $\alpha$ -amylase enzyme.

## 2. MATERIALS AND METHODS

### 2.1 Collection of Samples

Three cultivars of Banana (HPEE GYAN, THEE HMWE, NGET PYAW CHIN) purchased from a local market was used in this study.

**Table1. Maturity Stages of Banana**

Stage 1	All green
Stage 2	Light green (green with faint hints of yellow)
Stage 3	Turning yellow, green tips (more green with yellow)
Stage 4	More yellow than green
Stage 5	Yellow with green tips
Stage 6	Yellow (completely)
Stage 7	Completely yellow and speckled with brown spots



Figure 1. HPEE GYAN, *Musa sapientum*



Figure 2. THEE HMWE, *Musa arakanensis*, Ripely



Figure 3. NGET PYAW CHIN, *Musa sapientum* L.var.champa Baker

## 2.2 Selection of Samples

Banana samples used in this experiments are sound and healthy, lacking noticeable defects (bruise), when turned to maturity stage 7. (Table 1)

## 2.3 Processing of Banana Juice

The detailed work plan is shown in figure 4.

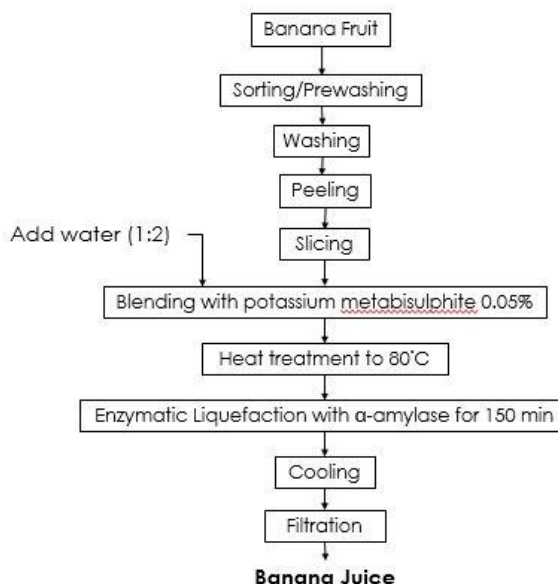


Figure 4. Process Flow Diagram of Banana Juice by  $\alpha$ -amylase treatment

### Procedure

Fresh and ripened bananas and their juices of weighed amount were extracted with the help of blender, filter with muslin cloth and crude juice filtrate measured and stored at 4°C.

The  $\alpha$ -amylase (SpeZyme ALPHA) with activity, 13.775 AAU/g (minimum), pH 6.0 with specific gravity 1.15-1.19 was used for this study.

The bananas fruits were washed, peeled manually and cut into small pieces. Pieces were then pulped using a kitchen blender for 2 mins into pulp. For each experiment 300 g pulp was subjected to various concentrations (0.1 ml, 0.2 ml, 0.4 ml) vol/wt % of  $\alpha$ -amylase treatment conditions as shown in Figure 4.

The required quantity of  $\alpha$ -amylase enzyme was added to 300 g batches of banana pulp and incubated at 80°C and 150 min. At the end of the treatment, the enzymes in the pulp was inactivated by heating at 90°C for 5 min and immediately cooled to room temperature. The supernatant was filtered through a fine mesh nylon cloth spread on glass funnel and juice was collected and measured with cylinder and stored at 4°C.

## 3. RESULTS AND DISCUSSION

The physicochemical properties of three banana cultivars (samples) were analysed and the resulting data are shown in Table 2.

In the experimental work, it had examined that raw banana juice is turbid, viscous and gray in colour if not used with 0.05% potassium metabisulphite solutions. It is the most effective

method to inactivate polyphenol oxidase (PPO) to inhibit browning and ensure colour stability. This work was initiated to study the enzymatic clarification of banana juice using  $\alpha$ -amylase.

Banana juice of three cultivars was treated with  $\alpha$ -amylase at various concentrations (0.1, 0.2, 0.4 ml) at the temperature 80°C, and time 150 min of treatment. The effect of these enzyme treatments on filterability, clarity, turbidity and viscosity of the juice were studied and compared with the resulting data of banana juice without enzyme treatment, as shown in Table 3 and 4.

Polyphenol oxidase (PPO) was very active in the treated juice and control juice, but was inactivated completely by the sulphite and heating treatments. Heating banana puree prior to juice extraction was the most effective method after sulfite treatment to inactivate PPO and ensure colour stability. Heating whole bananas was very effective in inactivating PPO, but the colour was comparatively unstable. This was apparently due to non-enzymatic browning, which could be due to migration of oxidizable compounds (such as certain phenolics) from the banana peel into the pulp during heating.

Findings of the above experiments are:

- $\alpha$ -amylase (starch degrading enzyme) gave a little effect on the clarity and viscosity of banana juices.
- All three types of banana got small juice volume with 0.4 ml of  $\alpha$ -amylase concentration.
- Treatment with  $\alpha$ -amylase, only NGET PYAW CHIN gave extracted juice volume, 26.7%.

Viewing from the above facts,  $\alpha$ -amylase has no significant effect on the yield, pH and Brix on all three types of bananas, as this factors depend on maturity and quality of bananas.

**Table 2. Comparison Studies of Physicochemical Properties in Three Banana Cultivars**

Sr. No	Test Parameter	HPEE GYAN	THEE HMWE	NGET PYAW CHIN
1.	Moisture	73.53%	71.53%	70.64%
2.	Crude Protein	0.82%	1.30%	0.92%
3.	Total Sugar	14.19%	15.95%	12.76%
4.	Reducing Sugar	14.30%	11.17%	7.61%
5.	Starch	0.19%	0.71%	11.42%
6.	Titrateable Acidity (ml of 0.1N NaOH per 100g sample)	74.38	50.92	77.68
7.	pH (at 25°C)	4.42	4.67	4.22

By FIDSL Lab

**Table 3. Experimental Studies of 1:2 Ratio Banana Juice with  $\alpha$ -amylase**

Sample with various enzyme concentration	pH	Total soluble solids (°Bx)	Waste Residue	Extracted Volume
HPEE GYAN with 0.1 ml $\alpha$ -amylase	4.7	7	265g	410ml

with 0.2 ml $\alpha$ -amylase	5.0	7	221g	500ml
with 0.4 ml $\alpha$ -amylase	4.9	9	225g	520ml
<b>THEE HMWE</b> with 0.1 ml $\alpha$ -amylase	5.1	8	215g	430ml
with 0.2 ml $\alpha$ -amylase	5.0	9	135g	560ml
with 0.4 ml $\alpha$ -amylase	5.0	9	137g	590ml
<b>NGET PYAW CHIN</b> with 0.1 ml $\alpha$ -amylase	4.6	8	177g	630ml
with 0.2 ml $\alpha$ -amylase	4.8	9	80g	600ml
with 0.4 ml $\alpha$ -amylase	4.8	9	71g	680ml

With Potassium Metabisulphite 0.05%.

**Table 4. Experimental Studies of 1:2 Ratio Banana Juice without enzyme**

Sample	pH	Total soluble solids (°Bx)	Waste Residue	Extracted Volume
HPEE GYAN	4.9	7	500 g	200 ml
THEE HMWE	5.1	8	269.4 g	450 ml
NGET PYAW CHIN	4.7	8	412.4 g	350 ml

#### 4. CONCLUSION

High juice yield is an important goal for juice manufacture. Many modern process for tropical fruit juice production employ enzymes as important processing aids to obtain high yields and clarity. The above study clearly indicates that juice appearance is not improved by  $\alpha$ -amylase clarification and also physical quality characteristics in terms of reduced viscosity, decreased turbidity, and improved filterability. To overcome through, research using enzymes such as pectinases for maceration is required to use.

#### 5. RECOMMENDATIONS

Based on the findings,

It is recommended as

- Banana has high sugar content and had been recognized for its desirable flavour, banana syrup can then be an alternative for utilization of the disqualified (maturity > 7) banana.
- Banana are usually too pulpy and pectinaceous to yield juices. One of the most effective methods is enzymatic liquefaction by pectinase.
- For maturity stage 7, no or a little starch is included in banana. It is not appropriate to use with amyolytic enzyme treatment on banana juice preparation.

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#### 7. REFERENCES

- [1] Charles A.Sims and Robert P. Bates. 1994. "Challenges to Processing Tropical Fruit Juices: Banana as an Example", Proc. Fla. State Hort. Soc. 107, pp. 315-319.

- [2] Tapre, A.R and Jain, R.K. 2014. “Optimization of an Enzyme Assisted Banana Pulp Clarification Process”, International Food Research Journal, Vol. 21, No.5, pp. 2043-2048. <http://www.ifrj.upm.edu.my>.
- [3] Byaruagaba-Bazirake GW, Van Ransburg P and Kyamuhangire W.2012. “Characteristics of Enzyme-Treated Banana Juice from Three Cultivars of Tropical and Subtropical Africa”, African Journal of Food Science and Technology, Vol.3, No.10, pp. 277-290.
- [4] Ahmed B, Uddin M.B and Jubayer M.F. 2014. “Extraction and Standardization of Selected Fruit Juices by Enzymatic Process”, Peak Journal of Food Science and Technology, Vol. 2, No.2, pp. 18-27. <http://www.peakjournals.org/sub-journals-PJFST-html>.
- [5] Harsh P. Sharma, Hiral Patel and Sugandha Sharma. 2014.“Enzymatic Extraction and Clarification of Juice from Various Fruits- A Review”, Trends in Post Harvest Technology. Vol.2, No.2, pp.1-14.
- [6] Aiyer, P. V. (2005). Amylase and their application. African Journal of Biotechnology.
- [7] Lozano, L. N. (2001). Amylase for apple juice processing.