Multi Enzyme Assisted Retention of Vitamins in Fruit Juice Clarification with Indirect Heating.

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Abstract

The centralized idea of this research is a clarification of juice by using immobilized enzymes and retention of nutritional components (Vitamins A and C) which were lost during the process. Enzymes which were used for clarification could be immobilized by alginate beds, alginate beds with the enzymes are placed in stainless steel Equipment through which juice was passed. For the activation of enzymes, we provide jacket on equipment and temperature of water adjusted as per requirement of a particular enzyme. We took the optimized temperature for mixed enzyme as 45^{o} C. As per result, we retained vitamin A and C up to 20%

Keywords: *Immobilised enzyme, stainless steel equipment, Alginate beds, vitamin A, vitamin C.*

1. Introduction

Clarified pulp and juice have always high demand for the preparation of ready to serve drinks, nutritional carbonated beverages etc [1]. Fruit juices are generally turbid due to water-insoluble particles like fibres, cellulose, hemicelluloses, protopectin, starch and lipids, some colloidal particles, pectin, protein, soluble starch. Depending on the final product, these substances must be avoided for maintenance of quality [2]. For clarification of juice physical or biochemical process are used in physical process juice is clarified by filtration method or by any mechanical process. In the biochemical process clarifying agents or enzymes are used for the clarification process [3].

If we added enzymes in juice complex compounds which are present in juice get converted into simple compounds and viscosity of pulp is reduced. [4,5,6,7]. Recently enzymes are used in the fruit industry because of following advantages: Increase in juice volume with retention of natural colour, flavour, and aroma. Complete degradation of polysaccharide into simple soluble sugars so that it would be easily digestible [8,9]. For activation of that enzyme juice is heated, but due to this nutritional loss occurs and also the loss of more amount of costly enzymes. In our research work, we immobilise the enzyme by preparing alginate beds. [10,11,12,13], so that enzymes cannot lose in the process and we can use it successfully up to 8-10 times. Due to immobilization, we save more amounts of costly enzymes in the processing of juice clarification.

2. Materials and Methods

The verity of Mango “ALPHONSOS” is taken from farm of college, Rajmachi, karad, Maharashtra, for study. Enzymes cellulase and pectinase, which are used for clarification of juice [14, 15] were procured from Raj laboratory, Karad.

2.1. Equipment

For clarification of juice we take stainless steel model due to good heat transfer capacity [17] and its inertness towards alginate beds which are inserted in inner tube. At a start of work, the proposed design had drawn as shown in fig 1. It consists of inner tube in which alginate beds are inserted and juice is transferred from those beds. For activation of enzymes we provided jacket for circulation of hot water, temperature of water is kept as required for activation of that enzyme.

2.2. Alginate beds: Alginate beds are prepared by using sodium alginate, enzymes, calcium chloride, and water.3% of Sodium alginate and 0.5 % of enzymes are added to 100 ml water and this solution is then added drop wise to the 20 M calcium chloride in prepared in distilled water, by using 5.0 ml syringe with attached needle no 20. [18]

2.3. Heater: Heater was used for heating of water which is circulated around the inner tube for indirect heating.

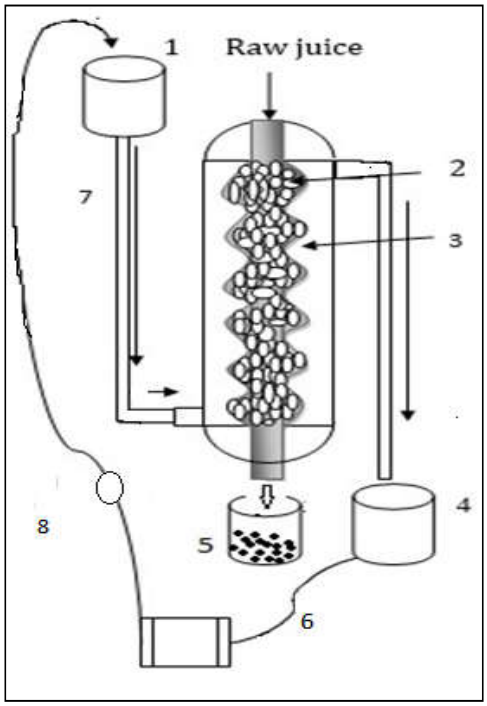
2.4. Water tank: For storage of water we used tank, which is used for indirect heating.

2.5. Rubber pipes: for circulation of water pipes are used.

2.6. Enzyme: In our research work we used Pectinase (800- 1200 U/g). [19] and cellulase (800- 1100 U/g)

2.7. Digital thermometer: For measure the temperature of water we used digital thermometer (-50^0c- 300^0C)

2.8. Centrifugal pump: We used small centrifugal pump for recirculation of water,



1. Water tank
2. Alginate beds.
3. Stainless still model
4. 2nd water tank
5. Clarified juice
6. Heater
7. Pipe
8. Pump

Figure 1. Model of juice clarification

3. Methodology

3.1. Pulp preparation: mango is firstly cleaned and washed to remove dust. Then peel of mango is removed and pulp of mango collected in beaker.

We filled immobilized enzyme in equipment, then allowed flow of hot water in equipment to activate enzymes. Temperature of water is 45.5^0c. We allow this water 1 hr for circulation [20]. As enzymes get activated we allow juice (which is to be clarified) in equipment through immobilized enzymes beds. Juice is passed through beds in 5-6 min. due to activated enzyme beds we get clarified juice.

3.2. Analytic method:

Vitamin A was calculated by carr-price method.

Analysis of Vitamin C was carried out by Xylene Extraction method and direct colorimetric determination.

3.3. Data Analysis: Juice clarity was measured by transmittance (%T) at 650nm using UV-visible Spectrophotometer.

4. Results and Discussion

After treatment of juice we compared our results with processed RTS by traditional method Comparison of nutritional quality is shown in tables.

Table 1. % Transmittance of clarified juice (at constant concentration of enzymes)

Sr. No.	Temperature	% Transmittance (at 650 nm)
1	40	73.47
2	**45**	**81.49**
3	50	75.60
4	55	74.69

As per table 1. The maximum transmittance is observed at **45^0C** for immobilized enzyme. So 45^0C is optimum temperature for pectinase and cellulase enzymes.

Table 2. Vitamin C content in juice samples/100ml

Sr. No.	Mango Pulp (mg)	Processed Juice(mg)	Clarified sample (mg)
1.	45.7	25.3	28.9
2.	43.6	23.5	26.7
3.	46.2	26.03	29.6

Table 2. Describes vitamin C composition of mango juice. As we process mango the concentration of vitamin C is reduced, but in clarified juice with above mentioned equipment retain concentration of Vitamin C up to 10 %

Table 3. Vitamin A content in juice samples/100ml

Sr. no.	Mango Pulp (IU)	Processed Juice(IU)	Clarified sample (IU)
1.	1262	735	943
2.	1267	780	961
3.	1275	678	980

From Above Mentioned Tables we can see that the juice sample Clarified with above mentioned equipment retains vitamin A and C also it was observed that maximum clarification of juice was occurred at temperature at 45^0C. As compare to standard juice company we retain 10- 20% more vitamins.

5. Conclusion

From above research it is concluded that if we use immobilised enzymes we can prevent loss of enzymes in clarification process and can be used that particular enzyme up to 8 to 10 fold. Along with immobilised enzyme if we provide indirect heat for enzyme activation we can retain vitamins 10-20 % more than traditional process.

6. References

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