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EFFECT OF EXTRACTION TECHNIQUES ON PHYSICOCHEMICAL PROPERTIES OF PASSION FRUIT JUICE

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Abstract
Passion fruit (Passiflora edulis Sims) belongs to the family Passifloraceae, which have two distinct forms, the standard purple (Passiflora edulis Sims f. edulis) and the yellow (Passiflora edulis f. flavicarpa). The fruits are valued for its captivating flavour, nutritional benefits and medicinal properties.Three methods of juice extraction (enzymatic, mechanical and conventional methods) were compared to identify the most efficient method. Among the different enzymatic treatments tried pectinase 5 ml per litre incubated at 50° C for 90 minutes was found ideal. This treatment yielded more quantity of juice with high TSS, acidity and total sugars. The juice yield was comparatively less in mechanical and conventional method of extraction.
Keywords: Passion fruit, enzymatic juice extraction, physicochemical properties

I. INTRODUCTION

Fruits are the choicest discovery of mankind which elevated the race to the civilization of the present century. Horticulture produces constitute a significant segment of the Indian agriculture and economy. India is in the second position after China in the world fruit production statistics. Many minor fruits are also contributing to the Indian fruit production. Passion fruit is one among the minor fruits which are considered to be less exploited and cultivated to a limited extend only.

The passion fruit (*Passiflora edulis* Sims.) from tropical America produces a fruit with unique flavour and aroma. It belongs to family Passifloraceae and there are two types, yellow (*Passiflora edulis f. flavicarpa*) and purple (*Passiflora edulis f. edulis*). Passion fruit is cultivated for both fresh consumption as well as for processing purpose. It is grown mostly in number of tropical and sub-tropical countries. Owing to the poor shelf life of passion fruit, its use is limited to fresh consumption at the areas of production (Jena, 2013). The fruit pulp embedded with seeds together with its high viscosity pose difficulty for direct use as well as for processing. Different methods of pulp or juice extraction like enzymatic, mechanical and manual are reported in some fruits. The enzyme aided juice extraction has been advantageous in fruits which are difficult for juice extraction.

II. MATERIALS AND METHODS

TECHNOLOGY FOR JUICE EXTRACTION

Passion fruit were subjected to following methods of juice extraction.

Addition of enzymes

Standardisation of quantity of enzyme

Pectinase and cellulase and their mixture at equal quantities were added to the fresh pulp at 1, 3 and 5ml per L and incubated at 50° C for 60 minutes at 200 rpm in a shaker cum incubator. Juice was taken by straining without any addition of pressure. Best treatments were selected based on the percentage recovery of juice.

Standardisation of incubation time and temperature

The freshly extracted passion fruit pulp were added with selected enzyme at specified concentration and incubated at 45, 60 and 90 minutes at incubation temperature of 40°C and 50° C. Based on the recovery percentage and quality of juice, the best method were selected.

Mechanical extraction

Juice was taken in a juice extractor from 1kg passion fruit pulp. After filtration weight of the juice was recorded. Based on this recovery percentage of juice was calculated.

Conventional method

Juice was taken from 1kg passion fruit pulp by squeezing through a muslin cloth and weight of juice was recorded. Based on this recovery percentage of juice was calculated.

The experiment was conducted in a Completely Randomized Design (CRD) with three replications in each treatment.

Identification of best method of juice extraction

The best enzyme treatment was identified first and the same was compared with mechanical and conventional methods based on the juice recovery and quality.

Observations

The juice recovery, quality of juice and organoleptic characters of the juice was recorded as detailed below.

Percentage recovery of juice

Juice was extracted from 1 kg of pulp by different methods (enzymatic, mechanical and manual methods). Juice obtained by each method was weighed using an electronic balance. Based on the values, percentage recovery of juice was worked out.

Quality attributes

Changes in biochemical constituents like TSS, titratable acidity, total sugars vitamin C, total carotenoids were recorded. TSS was measured using a hand refractometer followed by temperature correction and the values were expressed in degree brix. Titratable acidity and vitamin C were estimated by standard methods of analysis (AOAC, 1998). Reducing, non-reducing and total sugars were estimated by titrimetric method using Fehling's solution and expressed as percentage (Ranganna, 1997).

III. RESULTS AND DISCUSSION

Among the different concentration of enzymes (pectinase and cellulase) tried, pectinase 5 ml per litre incubated at 50° C for 60 minutes was found to yield more quantity of juice. Similar results were obtained by Mary (2005) in banana, where addition of pectinase enzyme at the rate of 5 ml per kg pulp and incubating for four hours at room temperature resulted in production of more quantity of clarified juice. The juice recovery was comparatively very low cellulase as well as mixture of pectinase and

cellulase enzyme treatments. The presence of lumps in passion fruit juice is due to high cell wall polysaccharides formed mainly due to compounding of pectin. The more effective breaking of this bonds might have happened due to treatment with pectinase resulting in yield of more juice. In order to get more precision in incubation time and temperature after adding pectinase, the experiment was repeated by varying the duration (45, 60 and 90 minutes) and temperature (40°C and 50° C).

Among the different time and temperature tried T6 (Pectinase 5 ml per litre incubated at 50° C for 90 minutes) was found ideal. The experiment have shown that treatment of enzyme with the juice for 90 minutes yielded more juice compared to that for 60 minutes. Incubation at 40°C had no merit than that at 50°C.

Identification of best method of juice extraction

Comparison of best enzymatic method of extraction with mechanical and conventional method have shown that enzymatic method yield more juice compared to other two. The recovery percentage with enzymatic method was 27-28% more than that with mechanical extraction. The increase in juice recovery percentage in enzymatic method was 2-3% higher than manual method.

Among biochemical characters analysed, TSS, acidity and total sugars were high in the juice extracted through enzymatic method, whereas ascorbic acid content and total carotenoids were low compared to other two methods. Arsad *et al*. (2015) studied the effect of different enzymatic treatments on sugar palm fruit juice processing and obtained similar results. Sugar palm fruit purees were treated individually and in combination using two types of commercial enzymes like Novozymes cellulose and pectinex ultra SP-L at a concentration of 0.05 (w/w) and incubated at 45°C for 60 minutes. The enzyme treatment reduced the juice viscosity and ascorbic acid content, promoted juice clarification and increased juice yield, TSS and sugar content.

Even though manual method of juice extraction was comparable with the enzymatic method, it was labour intensive and hence enzymatic method was selected for extracting juice for product development.

Table 1. Juice recovery in response to varying quantity of enzymes

Treatments	Recovery of juice (%)
T1	63.53^{c} (7.97)
T2	65.96^{b} (8.12)
T3	73.52^{a}(8.57)
T4	58.31^{h} (7.64)
T5	60.21^{f} (7.76)
T6	61.55^{e} (7.85)
T7	59.18^{g} (7.69)
T8	61.65^{e} (7.85)
T9	62.48^{d} (7.90)
CD (0.05)	0.021

Table 2. Juice recovery in response to pectinase (5 ml per litre) treatment at different incubation time and temperature

Treatments	Recovery of juice (%)
T1	67.06
T2	69.84
T3	71.17
T4	69.19

T5	73.52
T6	74.91
CD (0.05)	0.775

Table 3. Effect of extraction method on recovery of juice

Treatments	**Recovery of juice (%)**
T1	74.91(8.66)
T2	71.97(8.48)
T3	46.85(6.84)
CD (0.05)	0.139

Table 4. Effect of method of extraction on quality of juice

	Treatments	**TSS (°Brix)**	**Titratable acidity (%)**	**Total sugar (%)**	**Ascorbic acid (mg $100g^{-1}$)**	**Total carotenoids (mg $100g^{-1}$)**
Acc.1 (yellow)	**T1**	19.56	3.12	9.51	23.13	2.67
	T2	19.42	3.08	9.42	25.95	2.81
	T3	19.42	3.08	9.43	25.95	2.82
	CD (0.05)	0.089	0.035	0.052	0.237	0.026

IV. CONCLUSION

Three methods of juice extraction (enzymatic, mechanical and conventional methods) were compared to identify the most efficient method. Among the different enzymatic treatments tried pectinase 5 ml per litre incubated at 50° C for 90 minutes was found ideal. This treatment yielded more quantity of juice with high TSS, acidity and total sugars. The juice yield was comparatively less in mechanical and conventional method of extraction.

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