Preparation of guava jam blended with sapota

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Abstract: Jam is prepared from fruit pulp by boiling with sufficient quantity of sugar to a moderately thick consistency. There are different types of fruit jams like strawberry jam, mango jam, pineapple jam, apple jam and mixed fruit jam. Hence an attempt was made to find out the possibilities of mixing guava and sapota for making jam and utilizing a major potion of marketable surplus of guava. Guava and Sapota pulp was blended in the ratios of 100:0, 90:10, 80:20, 70:30, and 60:40 respectively to prepare blended jams. The treatment of T_4, 60% guava pulp and 40% sapota pulp, showed significantly less titrable acidity (1.05%), higher TSS (74.2° Brix) and total sugar (67.28%). Among the blended jams, the highest score for colour (8.64), flavor (8.88), consistency (8.97), taste (8.12), and overall acceptability (8.78) was judged in the treatment 60% guava pulp and 40% sapota pulp. Treatment T_4, 60% guava pulp and 40% sapota pulp was more in red color.

Keywords: guava, sapota, blending jam, chemical analysis, sensory evaluation, colour analysis

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1 Introduction

India is bestowed with varied agro climatic conditions, so it can produce a wide variety of fruits and vegetables. Now, it is the second largest producer of fruits and vegetables after China sharing 10% and 13.28% respectively in world production. India has produced 49,360,000 t fruits and 93,000,000 t vegetables during year 2009-2010. The major fruits grown in India include mango, banana, papaya, orange, mosumbi, guava, apple, pineapple, sapota, ber, pomegranate, strawberry, litchi etc. (Anonymous, 2010). In India, less than 2% of the fruits and vegetables produced are processed against 65% in the United States. Jams are basically prepared from fruits and various sugars that are made considerable mainly by heat treatment. There are different types of fruit jams like strawberry jam, mango jam, pineapple jam, apple jam, and mixed fruit jam. Hence an attempt was made to find out the possibilities of mixing guava and sapota for making jam and utilizing a major portion of marketable surplus of guava.

Guava (*Psidium guajava* L) is now cultivated in all parts of India. The tree is almost naturalized in India and it is common to find this spreading shrub laden with aromatic fruits in some remote corner. The guava is known by different names such as amrud, piyara, peru, koyya, jamakaya, sede pandu, etc. It excels most other fruit crops in productivity, hardness, adaptability, and vitamin C content. The fruit is one of the richest source of vitamin C. It contains four to 10 times more vitamin C than some citrus fruits do. The guava contains very little vitamin A or carotene. However, it is fairly rich in most other mineral nutrients. The vitamin C value of the fruits increases with maturity and is maximum when the fruit is fully ripe. However, the vitamin content declines when the fruit is overripe or soft. The guava contains numerous pale coloured seeds which are quite rich in aromatic oil (14%) which is orange yellow in colour.

Sapota or sapodilla is a native of tropical America, having originated in Mexico of Central America. It is a

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delicious fruit also known as chiku, dilly, nispero, zapotte, sapota plum, sapodilla, or prickly pear. India has about 162,000 hm^{-2} of land under cultivation of sapota and produces about 1,358,000 t of sapota per year [Ministry of Commerce and Industries Data Sheet, Government of India 2009-2010]. Although sapota is cultivated in India primarily for its edible fruit, and it is cultivated in Mexico, Guatemala and Venezuela mainly for the extraction of chicle gum, resinous latex derived from the bark. Indian production of sapodilla continues to grow, and there is an active research program in this country with specific goals toward improving storage, transport, and marketing strategies. The principal constituents of mature fruit are tannins and carbohydrates. Out of the carbohydrates, free sugars such as glucose, fructose and galactose form a major portion, whereas starch is found in small quantities or absent. The presence of fairly large quantities of tannins imparts an astringent flavour, but this astringency is masked by total sugars. The fruit also contains 1.13% sapotin, the principle bitter component. Ascorbic acid content decreases with the ripening of fruit (Broughten and Wong, 1979). The fruit also has appreciable amounts of protein, fat, fiber, and minerals. The present investigation was undertaken to study the making of Guava jam and the blended jams with sapota and to study the effect of sapota blends on the quality, sensory, and colour analysis of the guava jam.

2 Material and methods

Guava and sapota fruits used for the preparation of pulp were procured from the local market of the Chiplun. Leaves, stalks, blossom ends, defective ones, and other undesirable portions were removed from the guava fruits. The ripened guava fruits were thoroughly washed to remove any adhering dust and dirt. The fruits were cut into small pieces with stainless steel knife and water was added at 300 mL/kg of fruit and boiled for about 25-30 min with continuous stirring. The fruits were allowed to cool and then mashed in order to remove the seeds with the help of stainless steel sieves. Then it was grinded in the mixer to form the pulp of uniform thick consistency. This pulp was again passed through the sieves and muslin cloth in order to remove the undesirable portion. This pulp was used for preparation of guava jam. The total soluble solid (TSS) of the guava pulp was in the range of 10.5-10.9 ^{o}Brix. Sapota pulp was extracted by cutting the washed fruit into small pieces and by removing the seeds and core position the sliced pieces were grinded in the mixer grinder. The initial physico-chemical parameters of pulp were analyzed as per procedure given by Ranganna (1986). Guava and sapota pulp were blended in the ratio of 100:0, 90:10, 80:20, 70:30, and 60:40 respectively (Table 1) to prepare the jams by addition of desired quantities of sugar, citric acid, and sodium benzoate.

Table 1 Experimental design for preparation of jam

Treatment	Guava pulp/%	Sapota pulp/%
T_0	100	0
T_1	90	10
T_2	80	20
T_3	70	30
T_4	60	40

Quality analysis of blended jam:

Titrable acidity: took one g blended jam and dissolve it in 20 mL distilled water, add two to three drops of phenoptheline indicator then titrate it with 0.1 N NaOH till pink colour appears. Titrable acidity can be calculated as in Equation (1).

$$T_a = \frac{B \times 0.1 \times 0.064 \times 100}{W} \quad (1)$$

where, T_a is titrable acidity; B is reading burette; W is weight of sample.

pH value: the pH value of the sample was measured with a digital glass electrode pH meter (CD 175 E) at room temperature, which was calibrated prior to sample pH measurement using buffer solutions of pH value 4.0 and 7.0 (Ranganna, 1999).

Total soluble solid: total soluble solid of blended jam was determined by digital refractometer.

Determination of sugars: determination of sugars (total sugars, reducing sugar and non-reducing sugar) was carried out through Lane and Eynon Method as was described by James (1995)

Total sugar and reducing sugar:

We took 5 g of sample into a beaker and added 100 mL of warm water. The solution was stirred until

all the soluble matters were dissolved and filtered through wattman paper into a 250 volumetric flask Pipetted 100 mL of the solution prepared into a conical flask, added 10 mL dilued HCL and boiled for 5 min. On cooling, neutralize the solution to phenolphthalein with 10% NaOH and make up to volume in a 250 volumetric flask. This solution was used for titration against Fehling's solution and reading was calculated Equations (2) and (3).

$$T_t = \frac{4.95 \times 250 \times 2.5}{T \times W \times 10} \times 100\% \quad (2)$$

$$R_s = \frac{T \times W \times 10}{49.5 \times 250} \times 100\% \quad (3)$$

where, T_t is total sugar, %; T is titre; R_s is reducing sugar, %.

Non-reducing sugar was estimated as the difference between the total sugar content and reducing sugar content.

Ascorbic acid: Ascorbic acid is an important constituent of fruits and vegetables. It is a reducing agent, and is determined by its reaction with 2, 6-dichlorophenol indophenol. The dye which is blue in alkaline solution and red in the acidic solution is reduced to colourless form.

Took 10-20 mL of fruit juice or 10 g of solid food and blend it with 3% HPO_3 to make the total volume of 100 mL, filter or centrifuge this material. The ascorbic acid can be calculated as Equation (4).

$$A_a = \frac{T_r \times D_f \times V_m \times V_s}{V_e \times W_t} \times 100\% \quad (4)$$

where, A_a is ascorbic acid; T_r is titer; D_f is dye factor; V_m is volume of solution made; V_s is volume of sample; V_e is volume of extract; W_t is weight of sample taken.

Sensory evaluation: sensory evaluation on the basis of 9-point hedonic scale of all the prepared blended jam was done by taste panel. The tasting panel was consisting of 10 members. They were asked to evaluate the colour, flavor, consistency, taste and overall acceptability by a scoring rate, 9 means like extremely, 8 means like very much, 7 means like moderately, 6 means like slightly, 5 means neither like nor dislike, 4 means dislike slightly, 3 means dislike moderately, 2 means dislike very much and 1 means dislike extremely. The different preferences as indicated by scores were evaluated by statistical methods. The analysis of variance with CRD was used for this evaluation. The difference was quantified by Duncan's Multiple Range Test. The procedures of MSTAT were followed for statistical analysis.

Colour : the colour of blended jam was measured using a Hunter's Lab colour analyzer. In the Hunter's lab colourimeter, the colour of a sample is denoted by the three dimensions, L^*, a^*, and b^*. The L^*, a^*, and b* readings were then recorded in the software provided in an attached PC. The L^* value gives a measure of the lightness of the product colour from 100 for perfect white to 0 for black, as the eye would evaluate it. The redness/greenness and yellowness/ blueness are denoted by the a^* and b^* values, respectively. The colour of the samples was measured after putting the samples in front of smallest aperture.

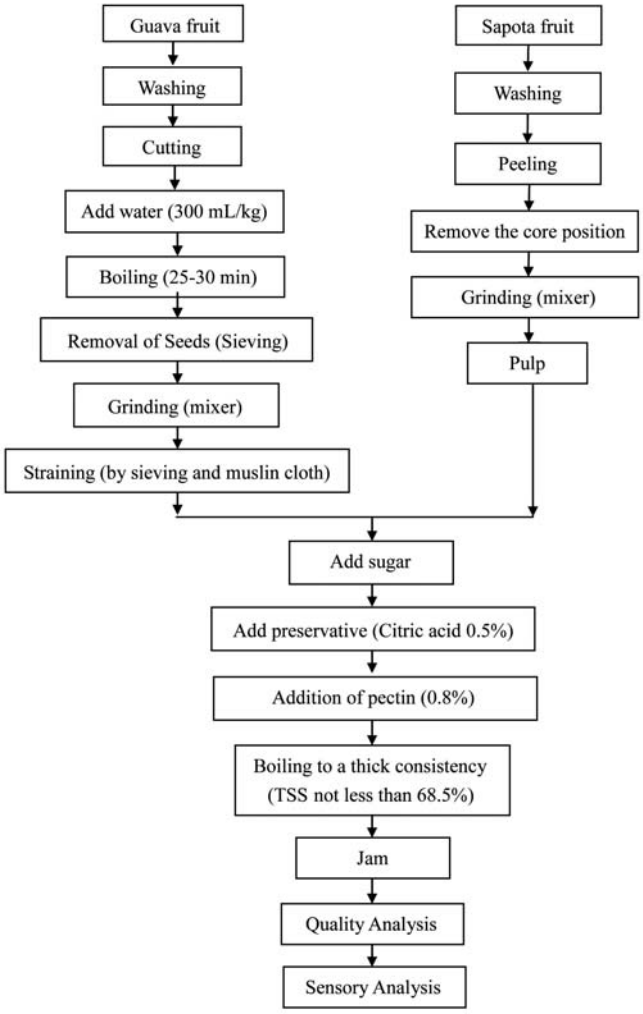

Figure 1 Flow process chart for preparation of guava and sapota blended jam

3 Results and discussion

The chemical analysis of jam was carried out by evaluation of different chemical properties, such as total soluble solid, titrable acidity, reducing sugar, non reducing sugar, total sugar, ascorbic acid, and pH value.

Table 2 shows the proximate composition for different levels of guava and sapota on the making of blended jam. There was no significant (p>0.05) difference in titrable acidity between the treatment T_0 (100 % guava pulp), T_1 (90% guava pulp and 10% sapota pulp), T_2 (80% guava pulp and 20% sapota pulp) and treatment T_3 (70% guava pulp and 30% sapota pulp), but treatment T_4 (60% guava pulp and 40% sapota pulp) showed significantly less titrable acidity as compared to other four treatments. Titrable acidity of treatment T_0 (100 % guava pulp), T_1(90% guava pulp and 10% sapota pulp), T_2 (80% guava pulp and 20% sapota pulp) and treatment T_3 (70% guava pulp and 30% sapota pulp) of blended jam was higher than that of treatment T_4 (60% guava pulp and 40% sapota pulp), which may be due to the enzymatic de-esterification and degradation of pectin resulting in an increase of total acid and hence, decrease in pH values. Similarly, results were obtained by Iboyaima Singh et al. (2000) while working on enzymatic liquefaction of mango pulp. Total soluble solid (°Brix) of treatment T_4 (60% guava pulp and 40% sapota pulp) was higher than that of treatment T_0 (100 % guava pulp), T_1 (90% guava pulp and 10% sapota pulp), T_2 (80% guava pulp and 20% sapota pulp), and treatment T_3 (70% guava pulp and 30% sapota pulp), which may be due to the enzymatic conversion of monosaccharides into sugar molecules and degradation of pectin resulting in an increase of total soluble solids. The increase in total sugar is mainly due to the hydrolysis of starch. Similar results were also obtained by Iboyaima Singh et al. (2000), Richard et al. (1963), and Rajanala et al. (1995), while working on the enzymatic liquefaction of mango, grapes and banana fruits respectively. They have observed a significant increase in total sugar and reducing sugar content of grape juice and banana juice prepared using pectinolytic enzymes, and our results are also in agreement with these findings. Whereas ascorbic acid decreased from 173.84% to 50.413% with increase in sapota proportion.

Table 2 Effect of sapota and guava on TSS, Titratable acidity, pH value, reducing sugar, non-reducing sugar, and total sugar of blended jam

Sr. No	Parameter	Chemical analysis				
		T_0	T_1	T2	T_3	T_4
1	TSS/° Brix	66.5 ± 0.2	67.5 ± 0.87	69.5 ± 0.54	69.5 ± 0.54	74.2 ± 0.11
2	Titrable acidity/%	1.37 ± 0.03	1. 33 ± 0.54	1. 30± 0.22	1.29 ± 0.44	1.05 ± 0.21
3	pH value	4.07 ± 0.45	4.51 ± 0.22	4.72 ± 0.06	4.88 ± 0.78	4.97 ± 0.45
4	Total sugar/%	26.81± 0.8	28.9 ± 0.56	44.24 ± 0.87	53.75 ± 0.02	67.28 ± 0.22
5	Reducing sugar/%	4.6 ± 0.78	4.8 ± 0.77	8.21 ± 0.55	10.30 ± 0.87	14.01 ± 0.64
6	Non-reducing sugar/%	22.21± 0.54	24.81± 0.71	36.03 ± 0.41	43.45 ± 0.64	53.27 ± 0.11
7	Ascorbic acid/mg	173.84± 0.22	78.228± 0.54	60.844 ± 0.04	52.152 ± 0.11	50.413 ± 0.21

Results drawn from a consumer acceptance test indicate that the Treatment T_4 (60% guava pulp and 40% sapota pulp) was more attractive and preferred by all the panelists because it tasted better in terms of colour, flavor, consistency, taste, and overall acceptability (Table 3). It shows that 60% guava pulp and 40% sapota pulp was effective in preserving the color, flavor, consistency, taste, and overall acceptability of blended jam. The scores of 5.72, 5.62, 6.45, 5.87, 5.81 and 8.7, 8.88, 8.97, 8.12, 8.78 for colour, flavour, consistency, taste, and overall acceptability of blended jam of treatment T_3 and T_4 respectively. Maximum score (8.97) for consistency was obtained by blended jam prepared from 60% guava pulp and 40% sapota pulp.

Statistical analysis of sensory evaluation obtained by various judges: the statistical analysis was performed on

the basis of grade score. The data was collected during the sensory analysis. The statistical analysis was carried out in MS excel programme and ANOVA (Analysis of variance) Tables were prepared. It is evident from the tables that all the organoleptic qualities were significantly affected at 5 % level of significance.

Table 3 Average score of blended jam by consumer panel

Parameter	T_0	T_1	T_2	T_3	T_4
Colour	5.42	4.62	5.75	5.72	8.7
Flavour	5.64	4.87	5.62	5.62	8.88
Consistency	6.28	5.97	6.45	6.45	8.97
Taste	5.23	4.25	5.87	5.87	8.12
Overall acceptability	6.42	4.68	5.81	5.81	8.78

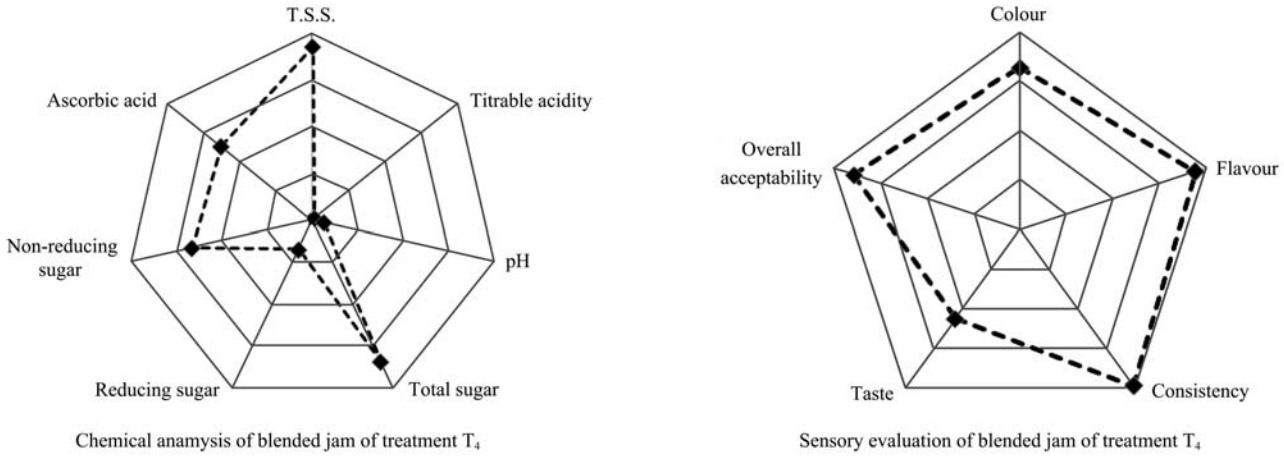

Figure 2 Chemical analysis and sensory evaluation of blended jam of treatment T_4

The results of analysis of variance (Table 4) show that $F_{cal} = 1.380 < F_{crit} = 2.578$ ($n_1 = 5$). It means that there is no difference in the colour of blended jam. The results of analysis of variance show that $F_{cal} = 26.553 > F_{crit} = 2.578$ ($n_1 = 5$), which means that there is a difference in flavour of the blended jam with added different proportions of guava and sapota blended jam of T_3. The results of analysis of variance (Table 4) show that $F_{cal} = 5.006 > F_{crit} = 2.578$ ($n_1 = 5$), which means that there is difference in blended jam's consistency with several additives of guava and sapota among the three samples of blended jam. The results of analysis of variance (Table 4) show that $F_{cal} = 1.22 < F_{crit} = 2.578$ ($n_1 = 5$). It means that there is difference in the taste of blended jam with the added different proportions of guava and sapota. Likewise the result of analysis of variance show that $F_{cal} = 15.03 > F_{crit} = 2.578$ ($n_1 = 5$), which means that there is difference in overall acceptability of blended jam.

Table 4 Means of sensory attributes of blended jam incorporated with different level of guava and sapota pulp

Sensory score					
Paramter	Colour	Flavour	Consistency	Taste	Overall acceptability
T_0	6.42 ±0.64	6.64 ±0.5	6.28 ±0.05	7.23 ±0.45	6.42 ± 0.97
T_1	4.62 ±0..66	4.87 ±0.48	5.97 ±0.21	4.25 ±0.98	4.68 ± 0.32
T_2	5.75 ±0.79	5.62 ±0.55	6.45 ±0.79	5.87 ±0.21	5.81 ±0.46
T_3	6.62 ±0.64	6.5 ±0.44	6.75 ±0.97	6.87 ±0.22	6.68 ±0.02
T_4	8.97 ±0.02	7.88 ±0.02	8.64 ±0.64	8.12 ±0.03	8.78 ±0.02
ANOVA					
Sum of square	2.92	30.92	10.28	30.08	26.6
Degree of freedom	4	4	4	4	4
Mean sum square	0.73	7.73	2.57	7.52	6.65
F	1.380	26.553	5.006	19.22	15.03
P	0.255	2.41E-11	0.002	2.77E-09	7.06E-08
F_{crit}	2.578	2.578	2.578	2.578	2.578

Colour appeared to be a very important criterion for the initial acceptability of the product by the consumer. The color difference, values (*L*, *a*, and *b* values) of Treatment T_4 (60% guava pulp and 40% sapota pulp) was measured (Table 5) probably due to the release of carotenoids as a result of enzyme addition. The addition of sapota resulted in an increase in the *a**. The *a** values of Treatment T_4 (60% guava pulp and 40% sapota pulp) was increased by increasing of sapota pulp, and these results confirmed with the result of Saenz et al. (1993). Treatment T_4, 60% guava pulp and 40% sapota pulp was more in red color because the hue angle was positive. These results are in accordance with the same results of Tung-Sun et al. (1995).

Table 5 Colour of Blended jam with different treatments of guava and sapota

Sr. No	Treatment	*L**	*a**	*b**
1	T_0	63.66±2.01	5.40±2.02	18.85±0.25
2	T_1	63.83±0.23	5.46±0.62	21.63±2.00
3	T_2	64.45±0.54	5.55±0.35	18.29±0.25
4	T_3	65.78±0.64	5.78 ±0.64	15.78± 0.78
5	T_4	68.15±0.52	5.89± 0.67	19.65± 0.75

4 Conclusion

From the present experiment it is concluded that the treatment T_4 (60% guava and 40% sapota pulp) has improved the overall quality with special reference to chemical analysis, colour analysis, and sensory evaluation of blended jam. The added 60% guava and 40% sapota pulp resulted in moderate titrable acidity and consistency, more stable red colour during colour analysis and highest sensory score in sensory evaluation. It is evident from our finding that this new product can be feasible even at pilot scale level. Hence, it is possible to meet both national and international export demand for blended jam.

References

Amerine, M. A., R. M. Pangborn, E. B. Roessler. 1965. Principles of sensory evaluations of food. Academic Press, London.

Anonymous. 1971. Sensory evaluation. IS 6373-1971. Indian Standards Institution.

Balakrishnan, K. 2003. Maturity and biochemical composition of fruits of sapota cultivars. *Madras Agricultural Journal*, 90(4-6): 319-321.

Broughton, W. J., and H. C. Wong. 1979. Storage conditions and ripening of chiku fruits (*Achras sapota*). *Scientia Horticulturae*, 10(4): 377-385.

Ganjyal, G. M., M. A. Hanna, and D. S. K. Devadattam. 2003. Processing of Sapota (Sapodilla): Drying. *Journal of Food Science*, 68(2): 517-520.

Iboyaima singh, N. G, C. Dhuique mayor, and L. Yves. 1999. Physico- chemical changes during Enzymatic Liquefaction of mango pulp. CIRAD, FLHOR Department., France.

Ministry of Commerce and Industries Data Sheet, Government of India 2009-10.

Nidhi, C., and P. Matthew. 2006. Development of guava candies. *Journal of Food Sciences. Technology*, 43(2): 210-212.

Poonam Sharma, Iftikhar Shakir, Yessar Durrani, Imtiaz Hussian. 2009. Development and storage studies of seabuckthorn and apple blended jam. *Beverage and Food World*, 36(1):51-52.

Richard, J., K. R. Sreekantiah, and D. S. Johar. 1963. Studies on pectinolytic enzyme production by fungi-part V. Use of pectinolytic enzyme preparation in the extraction and clarification of grape juice. *Food Science*, 12: 369.

Rajanala, R., S. M. Tyagi, and G. S. Chauhan. 1995. Effect of enzymic liquefaction of banana pulp on juice yield and its characteristics. *Beverage and Food World*, 14(3) : 10-12.

Ranganna, S. 1986. Handbook of analysis and quality control for fruit and vegetable products. Tata McGraw Hill Publishing Company, New Delhi: 623-624.

Saenz, C., E. Sepulved, E, Araya, and C. Calvo. 1993. Colour changes in concentrated juices of prickly pear (Opuntia Ficus Indica) during storage at different temperatures, *Lebensmittel-Wissenschaft & Technology*, 26(1): 417-421.

Tung-Sun, C., M. Siddiq, N. Sinha, and J. Cash. 1995. Commercial pectinases and the yield and quality of stanley plum juice. *Journal of Food Processing and Preservation*, 19(2): 89-101.