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Development of RTS from papaya *(Carica papaya* L.) and *aloe vera* (*Aloe barbadensis* Miller.) pulp

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Abstract
Investigation on development of RTS from papaya and *aloe vera* blended pulp during the year 2015-2016. The prepared quality RTS from 10 % blend, 13 % TSS, 0.25 % acidity and 70 ppm SO_2 were found to be best during organoleptic evaluation. The developed RTS was packed in sterilized glass bottles (200mL capacity) and stored at room temperature for storage study. The storage ability of prepared RTS the TSS, acidity, reducing sugars, total sugars and browning were increased, whereas ascorbic acid, non-reducing sugar and organoleptic quality was decreased with increased storage period.

Keywords: Papaya, *Aloe vera*, Blended pulp, RTS, Organoleptic quality

Introduction
Papaya fruits *(Carica papaya* L.) is a tropical fruits and belonging to family Caricaceae. It is originated from Mexico, North South America and Central America. Papaya fruits are rich in nutrients especially pro vitamin-A, carotene (Winkem and Miller, 1965) [24], which is prevents blindness disease in children and human. It is important source of ascorbic acid in the human diet especially in rural areas of tropical Latin America (Dearriola *et al.,* 1980) [4]. Papaya has many medicinal and nutritional properties which cure a number of diseases and disorder in human being (Nagarajan, 2002). Traditionally this fruits have been used in the preparation of RTS, squash, nectar, sherbets, juice and confections like tutti-fruiti, candy slices (*Murabba*), etc. Papaya fruits are year-round available and especially during winter season but all have not been consumed to desired extent. The fruits are perishable in nature they require immediate processing to avoid post harvest losses 20-25% (Bharadwaj *et al.*, 2011).
Aloe vera (*Aloe barbadensis* Miller.) is originated from South Africa belonging to the Liliaceae family. The plant has stiff, grey-green, fleshy leaves containing clear gel in a central mucilaginous pulp. *Aloe vera* comes under food related products and is being used as an ingredient for functional foods, mainly in the development of health drinks and beverages like tea etc (Singh *et al*., 2009) [19]. The use of *aloe vera* including healing of wounds and burns, immunizing fresh bite damage, protection skin damage from x-rays, lung cancer, reducing blood sugar in diabetes etc. *Aloe vera* has a bitter taste which can be unpleasant in raw state and its palatability could be enhanced with addition of some other fruit juices. The medicinal vale of papaya and *aloe vera* become more important in developing countries relies on traditional medicine, mostly plant drugs for their primary health care needs (Malhotra *et al.*, 2010) [11]. Development of papaya beverage incorporating *aloe vera* would be beneficial for growers, processor, marketing agencies and consumers because of nutritive, medicinal and therapeutic values of both papaya and *aloe vera*. Hence, present work was carried to optimize level of papaya pulp and *aloe vera* jel in development of RTS with desirable characteristics.

Extraction of papaya pulp as well as *aloe vera* gel
The techniques used for papaya pulp as well as *aloe vera* gel extraction were shown in Fig-1 and Fig-2, respectively. The ripe fruits of papaya and mature leaves of *aloe vera* were collected from the Main Experiment Station of Horticulture, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur during peak season and used for pulp and gel extraction.

Preparation of Ready-to-Serve

The total soluble solids and acidity present in the different combination of blended pulp were determined by hand refractometer and titration, respectively. The calculations were done for sugar and acid present in the blends as well as for remaining amount of sugar, citric acid, potassium metabisulphite and water required to prepare the finished ready-to-serve of desired recipes.

One liter RTS of each combination of blended (table-2) consisting 10 % blend, 13 % TSS, 0.25 % acidity and 70 ppm SO_2 were prepared and organoleptically evaluated to find out the best combination of blend, papaya pulp and *aloe vera* gel. Finally 3 liters of RTS was prepared with best combination of blended pulp, filled into bottles of 200 mL capacity leaving 2 cm head space, crown corked, pasteurized and kept for shelf-life assessment and preparation method of RTS is shown in Fig 3.

Methodology adopted in observations

The total soluble solids (TSS) of the sample were assessed by hand refractometer at 20 ^{0}C (Ranganna, 2010) [15]. The acidity was titrated against N/10 NaOH solution using phenolphthalein as indicator (Ranganna, 2010) [15]. To determined vitamin-C, with 3 % Metaphasphoric acid solution and titrated against 2, 6- dichlorophenol-indophenol dye solution (Ranganna, 2010) [15]. To estimated the sugars, by using Fehling's solution 'A' and 'B' (Lane and Eynone, 1923) [10] and titrated against 1.0 % Dextrose solution in boiling condition using methyl blue as indicator. To observed browning with the help of UV Spectrophotometer at 440 nm wave length. The colour was measured at 440 nm in term of O.D. using 60% aqueous alcohol as blank solution as described by Ranganna, 2010 [15]. The organoleptic evaluation for assessing the taste, colour, flavor, aroma and texture of RTS was conducted by a semi trained judges, who scored on the 9.0 point Hedonic Rating Scale (Amerine *et al*., 1965) [1]. The data were recorded on different parameters and statistical analysis using completely randomized design (Panse and Sukhatme, 1985) [14].

Results and Discussion

The chemical characteristics of papaya pulp as well as *aloe vera* gel is depicted in Table-1. The total soluble solids, acidity and vitamin-C of papaya pulp were recorded 14.50 per cent, 0.18 per cent and 65.30 mL/100g respectively. The reducing, non-reducing and total sugars content in papaya pulp were recorded 4.52, 6.10 and 10.62 per cent, respectively, whereas *aloe vera* gel contained total soluble solids, acidity and vitamin-C were noted 2.10 per cent, 0.08 per cent and 2.45 mL/100g respectively. The reducing, non-reducing and total sugars content in *aloe vera* gel were recorded 1.03, 1.13 and 2.16 per cent, respectively Overall papaya pulp contains higher amount of TSS, acidity, vitamin-C and sugars in comparison to *aloe vera* gel.

Data as embodied in table-3 indicated that total soluble solids increased gradually after one month of storage. An increase in total soluble solids during storage in RTS might be due to the conversion of polysaccharides into sugars. Similar results that increase in TSS during storage were reported by Nidhi *et al*., (2007) [13] in bael-guava blended RTS, Verma *et al.,* (2008) [23] in bael RTS, nectar and squash, Sharma *et al.,* (2009) [17] in guava-jamun blended RTS and squash, Deen and Kumar (2014) [5] in mango-ginger RTS and Sindumathi and Premalatha (2015) [18] in papaya-pineapple blended RTS.

Data on revealed that the acidity of RTS was increased gradually (table-2) during entire period of storage study. To increase the acidity content in blended RTS by pectic substances have been present in the fruit pulp (Conn and Stumf, 1976) [3], hence degradation of pectin substances of pulp into soluble solids might have contributed towards an increase in acidity of stored RTS. This is in consonance with the findings of Nidhi *et al.,* (2008) [12] on bael and guava blended RTS, Deen and Singh (2012) [6] on karonda squash, Balaji and Prasad (2014) [2] on kinnow-aonla blended RTS and Tiwari and Deen (2015) [21] in bael and *aloe vera* RTS.

It is clear from the data vitamin-C content in stored RTS was continuously decreased (table-3) during entire period of storage study. The decrease in vitamin-C content of the RTS could be due to oxidation by trapped oxygen in glass bottles which results a formation of highly volatile and unstable dehydro ascorbic acid. The findings of present investigation matches with those as reported by Nidhi *et al.,* 2007 [13], Zulfakar *et al.,* 2011 [25] and Deen and Singh, 2012 [6], Kumar and Deen, 2014 [5] have also reported loss of vitamin 'C' in blended RTS and squash of different fruits based during storage studied at room temperature.

The increase in reducing and total sugars content of RTS could be due to inversion of non-reducing sugar into reducing sugars as decreases in non-reducing sugar corresponded to increase in reducing sugars content (table-3). Hydrolysis of polysaccharides like pectin and starch could also be one of the reasons for increase in the sugars content. Similar observations were also observed by the several workers like Nidhi *et al.,* (2007) [13] in bael-guava blended RTS and squash, Verma *et al.,* (2008) [23] in bael RTS, squash and nectar, Deen and Singh (2012) [6] in karonda squash, Deen and Kumar (2014) [5] in mango-ginger RTS.

The non-reducing sugar of RTS decreased continuously throughout the entire period of storage (table-3), which might be because of inversion. Similar observations were reported by Kumar *et al.,* (2012) [9] in guava blended with *aloe vera* and roselle RTS and nectar and Singh *et al.,* (2013) [20] in custard apple RTS, Deen and Kumar (2014) [5] in mango-ginger RTS, Tiwari and Deen (2015) [21] in blended RTS of bael and *aloe vera*.

It is evident from the observations for progressive increase in browning of RTS was observed in term of O.D. (table-3) with the storage period in present findings. This could be mainly due to the non-enzymatic reaction such as reaction of organic acids with sugars, which leads to the formation of brown pigments. The browning was also reported in bael-guava blended ready-to-serve and squash (Nidhi *et al.,* 2007) [13], in aonla and bael RTS (Tandon *et al.,* 2007) [22], in karonda squash (Deen and Singh, 2012) [6], in mango-ginger RTS (Deen and Kumar, 2014) [5].

Organoleptic score of RTS decreased gradually with increased the storage period at ambient temperature (table-4). Loss in organoleptic quality of beverage after certain period is obvious because of undesirable changes in the RTS. Temperature plays an important role in inducing certain biochemical changes in the beverage, which leads to development of off flavour as well as discoloration and there by masking the original colour and flavour of the beverage. Similarly, reduction in organoleptic quality has also been reported in beverages of guava blended with *aloe vera* and roselle (Kumar *et al.,* 2012) [9], in guava-lime-ginger RTS beverage (Selvi *et al.,* 2013) [16], in kinnow-aonla blended RTS (Balaji and Prasad, 2014) [2], in papaya-pineapple blended RTS (Sindumathi and Premalatha, 2015) [18] and in blended pear-jamun juice (Kapoor and Ranote, 2015) [7].

Table 1: Chemical characteristics of papaya pulp as well as aloe vera gel.

S. No.	Chemical characteristics	Papaya pulp	Aloe vera gel
1	Total soluble solids (%)	14.50	2.10
2	Acidity (%)	0.18	0.08
3	Vitamin-C (mL/100 g)	65.30	2.45
4	Reducing sugars (%)	4.52	1.03
5	Non-reducing sugar (%)	6.10	1.13
6	Total sugars (%)	10.62	2.16

Table 2: Organoleptic quality of RTS prepared from different blended combinations of papaya pulp and aloe vera gel.

Different combinations of papaya-aloe vera (%) blended pulp	Characteristics					
	Appearance	Colour	Flavour	Taste	Texture	Overall acceptability
100:0.00	7.10	8.12	7.25	7.60	7.90	7.80
0.00:100	6.45	6.30	6.20	6.10	7.80	6.45
50:50	7.50	7.40	7.10	7.30	7.50	7.45
75:25	8.15	8.20	8.15	8.10	8.40	8.45
25:75	6.60	6.50	6.70	6.40	7.10	6.50
SEm±	0.040	0.048	0.077	0.093	0.080	0.074
CD at 5 %	0.114	0.135	0.218	0.266	0.228	0.209

Score & Rating: 9: Like extremely, 8: Like very much, 7: Like moderately.

Table 3: Chemical changes during storage of papaya and aloe vera blended RTS.

Storage period (months)	TSS (%)	Acidity (%)	Vitamin- C (mL/100g)	Reducing sugars (%)	Non-reducing sugar (%)	Total sugars (%)	Browning (O.D.)
0	13.00	0.25	4.10	0.30	11.50	11.80	0.35
1	13.00	0.27	4.00	0.90	11.30	12.20	0.35
2	13.50	0.29	3.85	1.50	11.10	12.60	0.38
3	14.10	0.31	3.75	2.40	10.80	13.20	0.41
4	14.80	0.32	3.60	3.30	10.60	13.90	0.44
SEm ±	0.180	0.012	0.077	0.103	0.129	0.219	0.018
CD at 5%	0.569	0.040	0.244	0.325	0.407	0.691	0.041

Table 4: Changes in organoleptic quality during storage of papaya and aloe vera blended RTS.

Storage period (months)	Characteristics of organoleptic quality					
	Appearance	colour	Flavour	Taste	Texture	Overall acceptability
0	8.15	8.20	8.15	8.10	8.40	8.45
1	8.00	8.00	7.90	7.80	8.00	8.30
2	7.90	7.80	7.60	7.60	7.90	8.00
3	7.70	7.60	7.50	7.40	7.60	7.60
4	7.45	7.30	7.40	7.20	7.35	7.45
SEm±	0.077	0.052	0.103	0.103	0.026	0.143
CD at 5 %	0.244	0.163	0.325	0.325	0.082	0.447

Score & Rating: 9: Like extremely, 8: Like very much, 7: Like moderately.

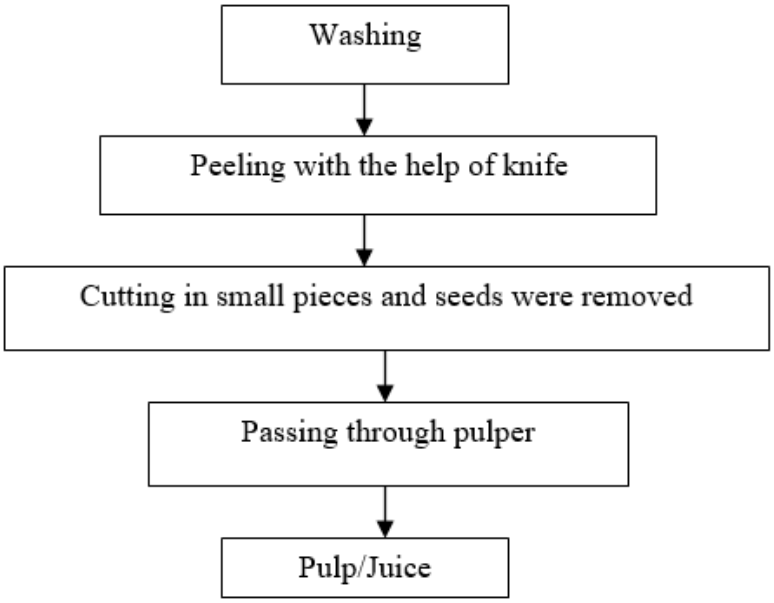

Fig 1: Flow sheet for extraction of pulp from ripe papaya fruits.

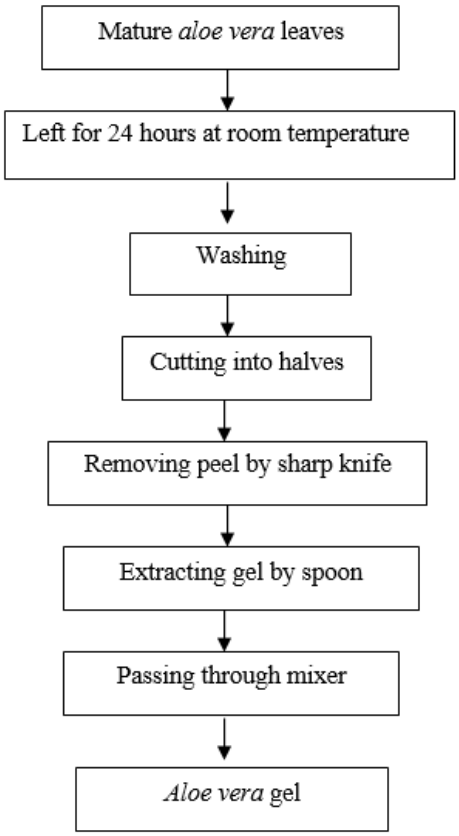

Fig 2: Flow sheet for extraction of gel from mature fresh aloe vera leaves.

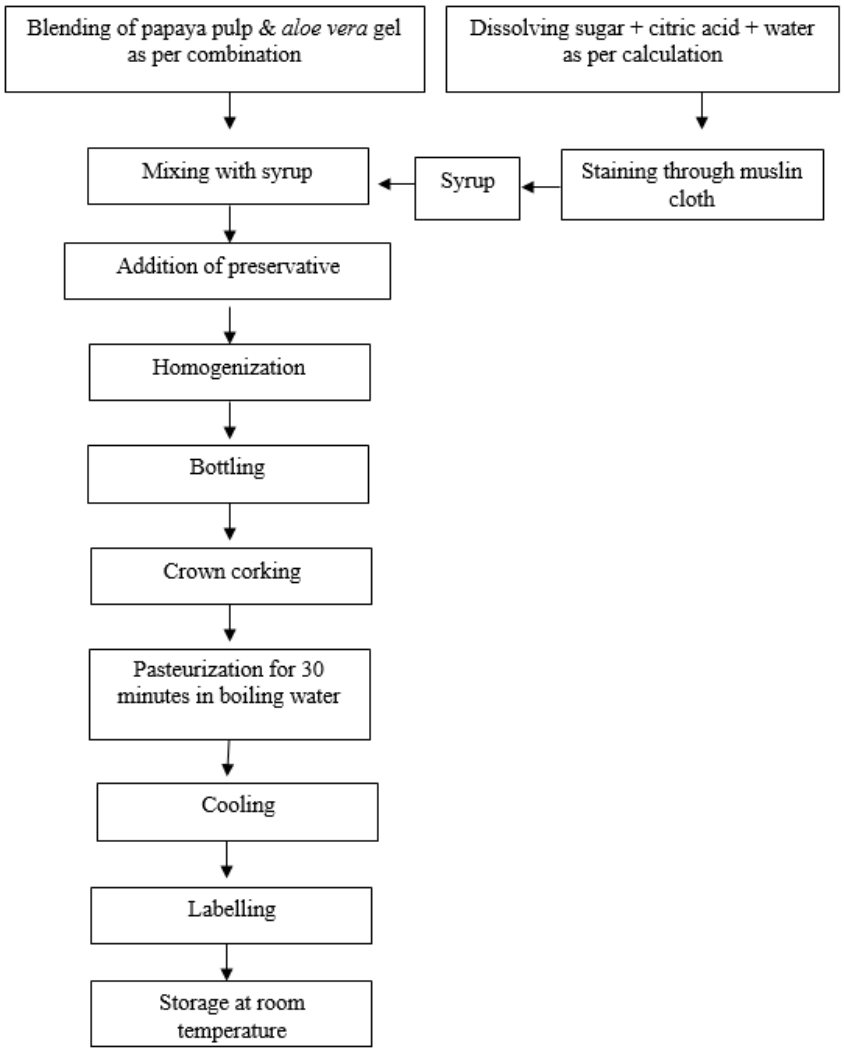

Fig 3: Flow sheet for preparation of blended papaya + aloe vera RTS.

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