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EFFECT OF STORAGE PERIOD ON CHEMICAL PROPERTIES OF RTS PREPARED FROM KARONDA (*CARISSA CARANDAS* L.) BLENDED JUICES

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Abstract

The karonda juice blended with guava, papaya and pineapple juices in different proportions and RTS drink was developed and evaluated for their chemical properties at 15 days interval for 2 months storage period. The pH, TSS, TSS/Acid ratio, total sugars and reducing sugars increased, while acidity, non-reducing sugars and ascorbic acid decreased with increase in storage period.

Key words : Karonda, guava, papaya, pineapple, blended juice and RTS.

Introduction

Karonda (*Carissa carandas* L.), which is an underutilized minor fruit crop of India and grows well in South Africa, Australia, India, Malaysia, Sri Lanka, Bangladesh and Myanmar. In India, karonda have been grown in Maharashtra, Bihar, West Bengal, Orissa, Gujarat, Madhya Pradesh, Rajasthan and Uttar Pradesh (Sawant *et al*., 2002) and is grown as stay cop in other parts of the country.

Karonda fruits are sour and astringent in taste and are a rich source of iron and an excellent source of vitamin A, C and B complex, fibre, carbohydrates and minerals such as calcium, phosphorous, potassium, sodium and sulphur (Peter, 2007). Ripe fruits are sub-acidic to sweet in taste with peculiar aroma. The fruits may be eaten as a dessert when ripe or used in the preparation of fruit products such as candies, jelly, squash and chutney. The storage life of karonda is very short because of its soft flesh and high moisture content.

It may be stored for a week at 13°C and 95% relative humidity. Under the changing world trade scenario, the fruit can be exploited on a commercial scale in the processing industries.

It is a general assumption that juice from a single variety of fruit is not often palatable in taste and aroma. It may be lack in one quality attribute or another. Blending is likely to compensate for certain characteristics by reuniting flavours and eliminating or diluting undesirable component of the juice thus maintaining a balance between the quality characters in the final product (Bhatia *et al*., 1992). The blending of fruit juices could be an economic requisite to utilize some of fruits for processing, which may not otherwise have favourable characters such as colour, aroma, mouth feel including overall cost for the preparation of the processed products. It may also enhance the appearance, nutrition, flavour of the product and lead to new product development (Kalra *et al*., 1991). Now-a-days the consumers are demanding products with no chemical preservatives, free from additives, natural with assured safety and having good shelf life. Thus, fruit based beverages can be used to replace the synthetic beverages, which are devoid of nutritional value and hence the present investigation is carried out for the utilization of karonda fruit juice for the preparation of karonda RTS by blending with guava, pineapple and papaya juice for its quantitative and qualitative traits.

Materials and Methods

The present investigation was carried out at the Department of Post Harvest Technology, Horticultural

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College and Research Institute, Venkataramannagudem, West Godavari district of Andhra Pradesh (India) during the year 2013-14. For this experiment uniformly and fully riped fruits of karonda were procured from the forest area besides Horticultural College and Research Institute, Venkataramannagudem, West Godavari District of Andhra Pradesh and the fruits were washed under running water and after cleaning put into blender and extracted the juice. The juice obtained was strained through double layered muslin cloth to remove bigger pulp particles into a stainless steel container.

The ripened and blemish free guava fruits were first washed under running tap water, lye peeled in 2% NaOH solution (boiling) for 1.5 minutes, cooled by dipping in cold water and then thoroughly washed in running water to remove sodium hydroxide solution then peeled fruits were cut into small pieces, put into blender and added ascorbic acid @ 1000 mg/ kg of fruits to prevent browning, passed through a stainless steel sieve of 30 mm mesh and removed seeds and fruit pieces and the juice was strained through double layered muslin cloth and collected the juice into a stainless steel container.

The well matured, firm and ripened papaya fruits were selected, washed, cleaned and hand peeled with the help of stainless steel knife and the outer skin was removed. The fruit is cut into two halves and seeds were removed. The fruit was chopped into small pieces and put into juice blender and obtained the pulp and the pulp was squeezed through a double layered muslin cloth and collected the juice into a stainless steel container.

The well matured ripened pineapple fruits were selected, hand peeled with the help of stainless steel knife and the crown, rind, eyes and core was removed. Then the fruit was cut into small pieces and fed into blender for extraction of the juice. The juice was strained through a double layered muslin cloth into a stainless steel container.

After extraction of juices, the guava, papaya and pineapple juices were blended with karonda juice on volume basis in different ratios as:

T_1 : Blend of 75% karonda juice + 25% guava juice

T_2 : Blend of 50% karonda juice + 50% guava juice

T_3 : Blend of 25% karonda juice + 75% guava juice

T_4 : Blend of 75% karonda juice +25% papaya juice

T_5 : Blend of 50% karonda juice +50% papaya juice

T_6 : Blend of 25% karonda juice +75% papaya juice

T_7 : Blend of 75% karonda juice +25% pineapple juice

T_8 : Blend of 50% karonda juice + 50% pineapple juice.

T_9 : Blend of 25% karonda juice + 75% pineapple juice.

T_{10} : Control (100% karonda juice)

The RTS was prepared with 10% blended juice, 10% sugar, 0.20% citric acid and 250 mg sodium benzoate per liter of RTS. The prepared RTS beverages were filled in 200 ml glass bottles, when they are hot and pasteurized at 65°C for 30 minutes and then cooled, labeled and stored at ambient temperature for storage studies.

The chemical properties including pH of the RTS beverage were determined by using digital pH meter (ELICO LI-127). The TSS was determined by using hand refractometer (HRN-18) and expressed in °Brix. The acidity was determined by AOAC (1984) method. The TSS/Acid ratio was calculated by dividing the TSS value with the titrable acidity and expressed in ratio (Ranganna, 1986). The total sugars and reducing sugars were determined by the method of Lane and Eyon (AOAC, 1984). The non-reducing sugars determined by subtracting the per cent reducing sugars from per cent total sugars. The vitamin-C content was estimated by 2, 6-dichlorophenol indophenol dye visual titration method (AOAC, 1984). The data on chemical quality was statistically analyzed using factorial Completely Randomized Design (Panse and Sukhatme, 1985).

Results and Discussion

pH

Among different treatments, 25% karonda juice + 75% papaya juice blend (T_6) recorded significantly the highest of 3.35 followed by 25% karonda juice + 75% pineapple juice blend (T_9) of 3.32. There was a significant increase in pH during storage period in all the treatments (table 1). The increase in pH might be due possible involvement of acids in various reactions as acidity and pH are inversely proportional to each other as stated by Awisjan and Dorcus Masih (2012). The similar pattern of increase in pH was reported by Tiwari (2000) in guava-papaya RTS and Jain *et al*. (1984) in bael, lemon and orange squashes.

TSS

Among different treatments, 25% karonda juice + 75% pineapple juice blend (T_9) recorded significantly the highest of 14.78°Brix. There was a significant increase in TSS during storage period in all the treatments (table 1). This increase in total soluble solids might be due to conversion of insoluble polysaccharides and organic acids

Table 1 : Effect of storage period on pH, total soluble solids and titrable acidity of RTS prepared from karonda blended juices.

Treatments	pH						Total soluble solids (°Brix)						Titrable acidity (%)					
	Days after storage																	
	0	15	30	45	60	Mean	0	15	30	45	60	Mean	0	15	30	45	60	Mean
T_1-75% Karonda juice + 25% Guava juice	2.92	3.00	3.06	3.15	3.22	**3.07**	12.50	12.83	13.20	13.58	13.77	**13.18**	0.35	0.30	0.29	0.25	0.24	**0.29**
T_2-50% Karonda juice + 50% Guava juice	2.84	2.96	3.01	3.10	3.17	**3.02**	12.83	12.85	13.10	13.27	13.50	**13.11**	0.34	0.35	0.30	0.24	0.22	**0.29**
T_3-25% Karonda juice + 75% Guava juice	2.99	3.10	3.15	3.21	3.27	**3.14**	12.90	13.07	13.48	13.50	13.63	**13.32**	0.31	0.29	0.30	0.27	0.24	**0.28**
T_4-75% Karonda juice + 25% Papaya juice	3.13	3.19	3.29	3.30	3.40	**3.26**	13.10	13.02	13.70	14.13	14.40	**13.67**	0.33	0.32	0.29	0.24	0.21	**0.28**
T_5-50% Karonda juice + 50% Papaya juice	3.15	3.22	3.30	3.40	3.44	**3.30**	13.17	13.63	14.03	14.30	14.73	**13.97**	0.32	0.29	0.27	0.27	0.21	**0.27**
T_6-25% Karonda juice + 75% Papaya juice	3.20	3.29	3.34	3.42	3.48	**3.35**	14.03	13.73	14.70	14.70	15.07	**14.45**	0.30	0.29	0.24	0.22	0.20	**0.25**
T_7-75% Karonda juice + 25% Pineapple juice	2.98	3.05	3.09	3.13	3.19	**3.09**	13.60	13.60	14.07	14.30	14.53	**14.02**	0.35	0.33	0.33	0.28	0.26	**0.31**
T_8-50% Karonda juice + 50% Pineapple juice	2.97	3.07	3.13	3.19	3.27	**3.12**	13.73	14.50	14.40	14.60	14.70	**14.39**	0.33	0.32	0.30	0.28	0.27	**0.30**
T_9-25% Karonda juice + 75% Pineapple juice	3.17	3.26	3.32	3.40	3.45	**3.32**	14.20	14.53	14.73	15.03	15.40	**14.78**	0.31	0.28	0.29	0.23	0.21	**0.27**
T_{10}-100% Karonda juice	2.82	2.90	2.95	3.02	3.09	**2.95**	12.27	12.67	13.00	13.10	13.23	**12.85**	0.38	0.36	0.35	0.30	0.29	**0.33**
Mean	**3.02**	**3.10**	**3.16**	**3.23**	**3.30**		**13.23**	**13.44**	**13.84**	**14.05**	**14.30**		**0.33**	**0.31**	**0.29**	**0.26**	**0.24**	

	pH			Total soluble solids (°Brix)			Titrable acidity (%)		
Factors	**A (Treatments)**	**B (Days)**	**A×B**	**A (Treatments)**	**B (Days)**	**A×B**	**A (Treatments)**	**B (Days)**	**A×B**
S.E m ±	0.006	0.004	0.013	0.07	0.05	0.16	0.003	0.002	0.007
CD at 5%	0.02	0.01	0.04	0.20	0.14	N.S	0.01	0.01	0.02

into sugars. These results were in conformity with Sharma *et al*. (2008) in guava-papaya RTS and Deka *et al*. (2005) in mango-pineapple RTS.

Titrable acidity

Among different treatments, 25% karonda juice + 75% papaya juice blend (**T_6**) recorded significantly the lowest of 0.25% followed by 0.27% in 25% karonda juice + 75% pineapple juice blend (**T_9**) and 50% karonda juice + 50% papaya juice (**T_5**) (table 1). There was a significant decrease in titrable acidity during storage period in all the treatments and the decrease in titrable acidity might be attributed to the bioconversion of acids to sugars or it could be attributed to the chemical interaction between the organic constituents of the juice induced by the temperature and action of enzymes as stated by Palaniswamy and Muthukrishnan (1974). Similar results were also reported by Saxena *et al*. (1996) in grape-pineapple beverage and Deka *et al*. (2005) in mango-pineapple RTS.

TSS/Acid ratio

Among different treatments, 25% karonda juice + 75% papaya juice blend (**T_6**) recorded significantly the highest of 57.59 followed by 25% karonda juice + 75% pineapple juice blend (**T_9**) of 56.84. There was a significant increase in TSS/ Acid ratio during storage period in all the treatments (table 2). The increase in the TSS/Acid ratio might be due to increased TSS and decreased acidity during storage by the conversion of oligosaccharides into sugars. The similar results were also reported by Sharma *et al*. (2008) in guava-papaya RTS and Kumar *et al*. (2010) in aonla-guava RTS.

Total sugars

Among different treatments, 25% karonda juice + 75% pineapple juice blend (**T_9**) recorded significantly the highest of 13.53% total sugars. There was a significant increase in total sugars during storage period in all the treatments (table 2). The increase in the total sugars content could be due to breakdown of

Table 2 : Effect of storage period on TSS/Acid ratio, total sugars and reducing sugars of RTS prepared from karonda blended juices.

Treatments	TSS/Acid ratio						Total sugars (%)						Reducing sugars (%)					
	Days after storage																	
	0	15	30	45	60	Mean	0	15	30	45	60	Mean	0	15	30	45	60	Mean
T_1-75% Karonda juice + 25% Guava juice	35.72	42.30	45.03	53.63	56.59	**46.65**	11.95	12.12	12.34	12.78	12.87	**12.41**	4.74	5.14	6.12	6.98	7.30	**6.06**
T_2-50% Karonda juice + 50% Guava juice	37.37	36.79	43.19	54.55	60.48	**46.48**	12.68	12.83	12.99	13.11	13.23	**12.97**	4.91	6.02	7.74	7.92	8.09	**6.94**
T_3-25% Karonda juice + 75% Guava juice	41.68	45.13	45.68	50.03	56.85	**47.87**	11.73	11.90	12.40	12.76	12.97	**12.35**	4.33	6.13	6.91	7.45	7.91	**6.54**
T_4-75% Karonda juice + 25% Papaya juice	39.71	40.72	47.80	59.76	67.53	**51.10**	11.84	12.07	12.49	12.83	12.94	**12.43**	5.24	5.75	6.23	6.99	7.74	**6.39**
T_5-50% Karonda juice + 50% Papaya juice	41.62	47.69	52.22	53.08	71.59	**53.24**	12.28	12.75	13.25	13.64	13.80	**13.14**	5.11	5.65	6.37	7.12	7.99	**6.45**
T_6-25% Karonda juice + 75% Papaya juice	46.27	47.94	61.52	67.20	72.94	**57.59**	12.54	12.97	13.42	13.80	13.91	**13.33**	4.71	6.02	6.95	7.23	7.42	**6.47**
T_7-75% Karonda juice + 25% Pineapple juice	39.24	41.26	43.13	51.14	55.98	**46.14**	11.65	12.08	12.67	12.77	12.83	**12.40**	4.32	6.17	6.90	7.14	7.23	**6.35**
T_8-50% Karonda juice + 50% Pineapple juice	41.64	45.33	47.48	51.55	53.78	**47.96**	12.43	12.91	13.43	13.51	13.64	**13.18**	4.21	5.49	6.57	7.02	7.26	**6.11**
T_9-25% Karonda juice + 75% Pineapple juice	45.35	51.32	50.85	64.47	72.23	**56.84**	12.78	13.42	13.68	13.84	13.95	**13.53**	4.93	5.98	7.38	7.87	8.45	**6.92**
T_{10}-100% Karonda juice	32.27	36.91	41.97	43.20	46.19	**40.11**	11.14	11.96	12.21	12.35	12.42	**12.02**	4.10	5.12	6.54	6.43	7.15	**5.87**
Mean	**40.09**	**42.74**	**47.89**	**54.86**	**61.41**		**12.10**	**12.50**	**12.89**	**13.14**	**13.26**		**4.66**	**5.75**	**6.77**	**7.21**	**7.65**	

	TSS/Acid ratio			Total sugars (%)			Reducing sugars (%)		
Factors	**A (Treatments)**	**B (Days)**	**A×B**	**A (Treatments)**	**B (Days)**	**A×B**	**A (Treatments)**	**B (Days)**	**A×B**
S.E m ±	0.54	0.38	1.20	0.06	0.04	0.13	0.05	0.04	0.11
CD at 5%	1.51	1.07	3.38	0.16	0.11	N.S	0.14	0.10	0.32

polysaccharides and insoluble carbohydrate polymers into simple sugar. The similar results were also reported by Sharma *et al*. (2008) in guava-papaya RTS and Deka *et al*. (2005) in mango-pineapple RTS.

Reducing sugars

Among different treatments, 50% karonda juice + 50% guava juice blend (**T_2**) recorded significantly the highest of 6.94% reducing sugars followed by 25% karonda juice + 75% pineapple juice blend (**T_9**) of 6.92%. There was a significant increase in reducing sugars during storage period in all the treatments. The increase in reducing sugars could be due to breakdown of polysaccharides into simple sugars as stated by Kalra *et al*. (1985). A similar trend of increase in reducing sugar content of beverages on storage was also reported by Sharma *et al*. (2008) and Tiwari (2000) in guava-papaya RTS and Deka *et al*. (2005) in mango-pineapple RTS (table 2).

Non-reducing sugars

Among different treatments, 25% karonda juice + 75% guava juice (**T_3**) recorded significantly the lowest of 5.79% non-reducing sugars followed by 50% karonda juice + 50% guava juice blend (**T_2**) of 6.03% (table 3). There was a significant decrease in non-reducing sugars during storage period in all the treatments and the decrease in the non-reducing sugars content could be due to gradual inversion of non-reducing sugars into reducing sugars by hydrolysis during storage as stated by Baramanray *et al*. (1995). The similar results were also reported by Sharma *et al*. (2008) and Tiwari (2000) in guava-papaya RTS.

Ascorbic acid

Among different treatments, 25% karonda juice + 75% guava juice blend (**T_3**) recorded significantly the highest ascorbic acid of 11.78 mg/100 g. There was a significant decrease in ascorbic acid during storage period in all the treatments. The ascorbic acid is easily destroyed by oxidation, especially at high temperatures

Table 3 : Effect of storage period on non-reducing sugars and ascorbic acid content of RTS prepared from karonda blended juices.

Treatments	Non-reducing sugars (%)						Ascorbic acid content (mg/100g)					
	Days after storage											
	0	15	30	45	60	Mean	0	15	30	45	60	Mean
T_1 -75% Karonda juice + 25% Guava juice	7.21	6.98	6.22	5.80	5.57	**6.36**	7.32	7.27	6.73	6.24	6.07	**6.73**
T_2 -50% Karonda juice + 50% Guava juice	7.77	6.81	5.25	5.19	5.14	**6.03**	9.14	9.03	8.42	8.21	8.02	**8.56**
T_3 -25% Karonda juice + 75% Guava juice	7.40	5.77	5.43	5.31	5.06	**5.79**	12.71	12.14	12.02	11.09	10.96	**11.78**
T_4 -75% Karonda juice + 25% Papaya juice	6.60	6.32	6.26	5.84	5.20	**6.04**	5.04	4.82	4.27	4.04	3.98	**4.43**
T_5 -50% Karonda juice + 50% Papaya juice	7.17	7.11	6.88	6.52	5.81	**6.70**	5.22	5.13	4.96	4.54	4.31	**4.83**
T_6 -25% Karonda juice + 75% Papaya juice	7.83	6.95	6.47	6.57	6.49	**6.86**	5.21	5.07	4.41	4.25	4.14	**4.61**
T_7 -75% Karonda juice + 25% Pineapple juice	7.35	5.91	5.77	5.63	5.60	**6.05**	4.32	4.14	3.92	3.83	3.76	**4.00**
T_8 -50% Karonda juice + 50% Pineapple juice	8.22	7.42	6.86	6.49	6.38	**7.07**	4.26	4.03	3.90	3.60	3.64	**3.88**
T_9 -25% Karonda juice + 75% Pineapple juice	7.86	7.44	6.30	5.97	5.50	**6.61**	4.53	4.31	4.04	3.77	3.53	**4.04**
T_{10} -100% Karonda juice	7.04	6.84	5.67	5.92	5.27	**6.15**	3.57	3.42	3.35	3.10	2.99	**3.29**
Mean	**7.45**	**6.75**	**6.11**	**5.92**	**5.60**		**6.13**	**5.94**	**5.60**	**5.27**	**5.14**	

	Non-reducing sugars (%)			Ascorbic acid content (mg/ 100g)		
Factors	**A (Treatments)**	**B (Days)**	**A×B**	**A (Treatments)**	**B (Days)**	**A×B**
S.E m ±	0.07	0.05	0.16	0.03	0.02	0.06
CD at 5%	0.20	0.14	0.44	0.07	0.05	0.17

and the vitamin is easily lost during food processing and storage (Potter and Hotchkiss, 1995). This could be due to degradation of ascorbic acid to dehydro-ascorbic acid by oxidative enzymes and application of heat. However, conversion of ascorbic acid to dehydro-ascorbic acid does not alter the nutritive value of beverages, as dehydro-ascorbic acid is equally utilizable as ascorbic acid (Mapson, 1970 and West *et al*., 1974). The similar results were also reported by Sharma *et al*. (2008) and Tiwari (2000) in guava-papaya RTS and Deka *et al*. (2005) in mango-pineapple RTS (table 3).

Conclusion

The pH, TSS, TSS/Acid ratio, total sugars and reducing sugars increased while, acidity, non-reducing sugars, ascorbic acid decreased with increasing in storage period, however the RTS prepared from 25% karonda juice + 75% pineapple juice blend (T_9) was found the best in all quality parameters.

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