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Studies on preparation and storability of lime blended aloe (*Aloe vera*) RTS

A Swarnalatha, D Lakshminarayana, P Prasanth, J Cheena and S Praneeth Kumar

Abstract
In the present study, efforts have been made to prepare ready-to-serve (RTS) drink, which was made from blend comprising of 90:10 and 85:15 Aloe (*Aloe vera*) and lime (*Citrus aurantifolia*), respectively were found to be most acceptable in terms of organoleptic quality than other combinations (100:0, 95:5, 80:20 and 75:25 Aloe and lime juice, respectively). The selected two combinations (90:10 and 85:15) were treated with KMS - 70 ppm and SB - 120 ppm, stored under ambient and refrigerated storage conditions for three months. The stored RTS was evaluated for physico-chemical analysis at an interval of 15 days. It was observed that, there was gradual increase in TSS, total sugars, reducing sugars and acidity while, contradictory decrease in pH and non-reducing sugars. The overall results indicated that, among different treatment combinations, T2 - 90:10 (aloe: lime) + KMS -70 ppm stored at refrigerated condition was found to be best over other treatment combinations after 90 days of storage, followed by T4 - 85:15 (aloe: lime) + KMS - 70 ppm.

Keywords: Aloe, lime, RTS, KMS potassium metabisulfite and SB sodium benzoate

Introduction
Aloe (*Aloe vera*) is commonly known as Ghritkumari, belongs to the family, Liliaceae and originated from Arabian Peninsula region. It is mostly cultivated in the dry regions of Africa, Europe, and Asia and it was introduced into other parts of the world for ornamental purpose. The word Aloe derived from Arabic word "Alloeh," which means "bitter and shiny substance". Aloe is a perennial, xerophytic, naturally occurring medicinal plant with a wide range of therapeutic applications. Aloe leaf contains 20 minerals, 18 amino acids, 12 vitamins and 92 enzymes (Chauhan *et al.*, 2007) [7]. The bitter taste and cathartic effect of Aloe leaf gel tends to be due to anthraquinones, especially barbaloin (aloin), a glucoside of Aloe- emodin. It is also used in pharmaceutical industry for preparation of ointments, gels, production of tablets, cosmetics (Hamman, 2008) [11]. Aloe possesses many pharmaceutical activities including antimicrobial, antioxidant, antiulcer, anticancer, antidiabetic and other immunomodulatory properties due to polysaccharides found in the leaf gel. Health benefits of *Aloe vera* include its application in wound healing, treating burns, lung cancer, digestive problem, allergies and improving immune system (Lu Zhi *et al.*, 2008) [17]. Aloe gel is a translucent mucilaginous jelly that is found in the parenchyma cells (Bhattacharya *et al.*, 2011) [4]. Aloe is popularly known as “Mussambar” in Indian market. According to Horticulture Area Production Information System (HAPIS Area Production Estimate Reports) 2019-2020 final estimates, In India, Aloe occupied the area of 3.165 ('000 ha) with production of 27.616 ('000 MT). Whereas in Telangana, it is cultivated in an area of 0.057 ('000 ha) with production of 2.825 ('000 MT). Lime (*Citrus aurantifolia*) is an important therapeutic plant belonging to the family Rutaceae and originated probably from Asia. Fruits are rich in vitamin C and excellent source of calcium, phosphorus and iron. The health benefits of lime include weight loss, skin care, good digestion, relief from constipation, eye care, prevention of scurvy, peptic ulcer, breathing problems, gout, vomiting, dehydration and inflammation (Mohanapriya *et al.*, 2013) [19]. Citrus fruits, especially lime, have been shown to have high anti-oxidant effects such as anti-cancer, anti-inflammatory and anti-fungal properties (Karoui and Marzouk, 2013) [14].
The Aloe juice is used in variety of food items like RTS health drink, Aloe lemon drink, sherbet, soluble fiber diet drinks. It has a bitter taste, unpleasant in raw state and its palatability can be improved by addition of other fruit juices. RTS drink made from a combination of two or more ingredients are good alternative for development of new product and beneficial in terms of sensory, nutritional and health properties (Boghani *et al.*, 2012).

The blending of fruit juices could be an opportunity to utilize some varieties of fruits for processing, which may otherwise don't have favourable characters such as colour, aroma, mouth feel (Balaswamy *et al.*, 2011) [1]. Introduction of new types of value-added beverages might improve socio-economic status of the country and one of the best commonly acceptable beverages is Ready to Serve (RTS). The purpose behind the use of lime blending in aloe to mask the unpleasant odour, taste and to increase flavour of aloe RTS (Tiwari and Deen, 2015) [23].

Preservatives as a group of chemical compounds deliberately added to food or that appears in food as a result of pre-processing treatment, processing or storage includes organic acid (Propanoic acid, Sorbic acid, Benzoic acid), Sulphates (KMS), ethylene oxide and sodium nitrates. Up to a maximum permissible level of 0.1 per cent, benzoic acid and sodium benzoate are usually considered. Potassium metabisulphite is a water-soluble preservative used in pulp and fruit juices in permissible amounts. Citric acid is found naturally in most fruits and is also used as a preservative.

Keeping in view of the nutritive and health benefits of Aloe and lime, the present work has been initiated to study on preparation and storability of lime blended Aloe RTS.

Material and methods

The present investigation entitled "Studies on preparation and storability of lime blended Aloe (*Aloe vera*) RTS" was carried out at PG Laboratory, College of Horticulture, Rajendranagar, Hyderabad during 2020-2021. *Aloe vera* leaves utilized in this experiment were procured from Medicinal and Aromatic Plants Research Station, Sri Konda Laxman Telangana State Horticultural University (SKLTSHU), Rajendranagar, Hyderabad. Healthy and matured leaves of large size without injuries were selected and harvested manually. Healthy lime fruits were purchased from local market, Rajendranagar, Hyderabad for executing the experiment.

Extraction of Aloe juice

Selected aloe leaves were harvested by using a sharp knife. After harvesting leaves were must be processed within 6 hours, and washed with clean water. To avoid contamination of internal fillet with the yellow sap, the pulp was removed by using traditional hand filleting method. The bottom one-inch leaf base (the white part) was separated by cutting transversely at the base and the cut area was kept touching the ground for half an hour, which aids in the removal of yellow latex (aloin which is responsible for characteristic bitterness). The leaves were cleaned again, and a sharp knife was used to remove the tapering point (2-4 inch) of the top as well as small, sharp spines along the leaf margins. The bottom rind was removed in the same way, and the rind portions with the remaining mucilage were discarded. Then fillet was made into homogenized pulp with the help of a mixer. Thus, obtained homogenized pulp was filtered and used for further processing.

Extraction of Lime juice

Fruits utilized in the experiment were cleaned thoroughly twice with fresh water. After washing, lime fruits were cut into two halves, then squeezed with squeezer to extract clear juice. The juice was strained with muslin cloth and clear juice was used for RTS preparation.

Method of preparation of RTS beverage

The extracted Aloe juice was blended with lime juice in the desired ratios. Sugar syrup was made separately by just heating the sugar until it dissolved with addition of desired amount of citric acid, and strained through muslin cloth. The cooled syrup was then blended with the desired amount of lime blended aloe juice. Finally, standardized amount of preservative chemical was added by dissolving it in little amount of juice and mixed with prepared juice. Then it was filled immediately into pre-sterilized bottles of 200 ml capacity, leaving one inch headspace and bottles were crown corked, heat processed (30 min.) in boiling water bath later cooled to room temperature, labelled and stored at ambient and refrigerated conditions (Figure 1).

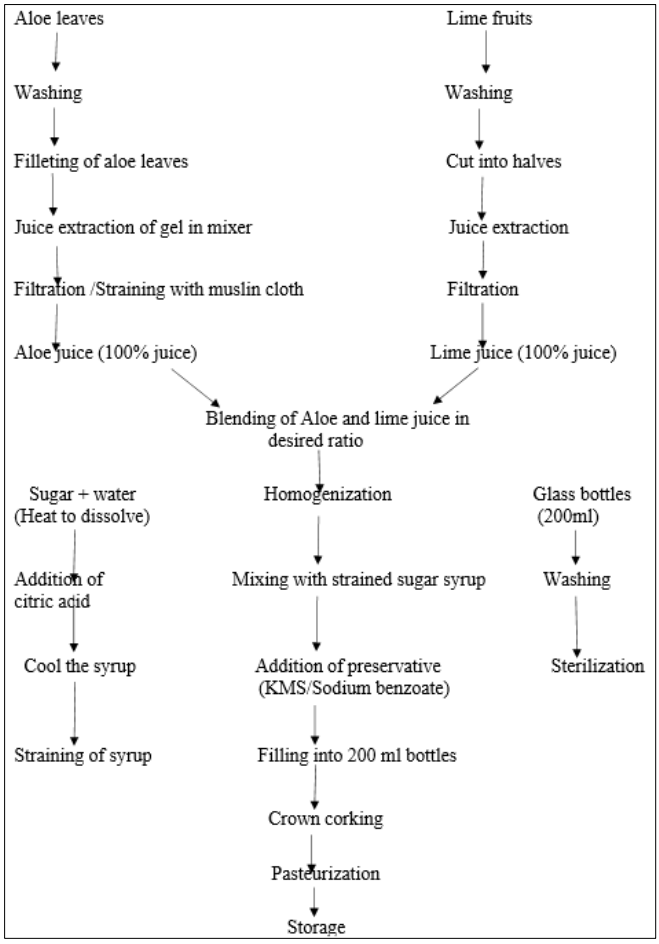

Fig 1: Flow sheet for preparation of lime blended Aloe RTS

Experimental details Treatments

Factor - I

- T1 - 90:10 (aloe: lime) + Sodium benzoate (120 ppm)
- T2 - 90:10 (aloe: lime) + KMS (70 ppm)
- T3 - 85:15 (aloe: lime) + Sodium benzoate (120 ppm)
- T4 - 85:15 (aloe: lime) + KMS (70 ppm)

Factor - II storage conditions (C)

- Ambient storage condition (C1)
- Refrigerated storage condition (C2)

Physico-chemical analysis of lime blended Aloe RTS

Estimation of TSS was done with the help of digital refractometer (Model: H1 96801 Refractometer 0-85°Brix

HANNA instruments) and expressed as °Brix. The pH values were determined with the help of an electronic pH meter. Estimation of titrable acidity was carried out by titrating against 0.1N NaOH using the method given by Ranganna (1986) [22]. Reducing sugars, total sugars were estimated by using the procedure as outlined by Lane and Eynon method (Ranganna, 1986) [22]. Non-Reducing Sugars were calculated by using the following formula

Non-reducing sugars (%) = (Total sugars % - Reducing sugars %)

Results and Discussion Total soluble solids

The data pertaining to TSS of lime blended Aloe RTS as influenced by the treatments and storage conditions is presented in table 1. The mean values of TSS revealed significant difference among treatments and increase during storage period. Maximum TSS values were recorded in T4 - 85:15 (aloe: lime) + KMS-70 ppm rather than other treatments up to 30 days, whereas on 45th, 60th, 75th and 90th days after storage, T2 - 90:10 (aloe: lime) + KMS-70 ppm recorded significantly higher values. The increase in TSS was due to the hydrolysis of the polysaccharides (starch and pectin) into simple sugars such as monosaccharides (glucose and fructose), oligosaccharides (sucrose) and other constituents (Hemalatha *et al.*, 2018) [12]. More increase in TSS was found in drink stored under ambient conditions over refrigerated conditions. These results are also in conformity with the findings of Hamid *et al.* (2017) [10] in mulberry RTS drink increased TSS from 12 to 12.4 °Brix and this might be due to the faster rate of reaction because of high temperature in ambient storage than refrigerated conditions.

Table 1: Effect of chemical preservatives and storage conditions on total soluble solids (°Brix) of lime blended Aloe RTS

Total Soluble Solids (°Brix)																							
Storage conditions (C)																							
Treatments (T)	Day 1			15th Day			30th Day			45th Day			60th Day			75th Day			90th Day				
	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean		
T1	12.60	12.58	12.59^{d}	12.60	12.57	12.58^{cd}	12.89	12.78	12.84^{c}	13.26	13.08	13.17^{c}	13.74	13.62	13.68^{c}	14.25	14.09	14.17^{c}	15.28	15.11	15.20^{c}		
T2	12.63	12.62	12.62^{c}	12.63	12.60	12.62^{bc}	13.07	12.96	13.02^{b}	14.25	14.18	14.22^{a}	14.67	14.53	14.60^{a}	15.02	14.91	14.97^{a}	16.24	15.90	16.07^{a}		
T3	12.71	12.69	12.70^{b}	12.73	12.68	12.71^{b}	12.76	12.70	12.73^{d}	12.98	12.94	12.96^{d}	13.31	13.20	13.26^{d}	13.70	13.68	13.69^{d}	14.73	14.67	14.70^{d}		
T4	12.76	12.73	12.75^{a}	13.13	12.83	12.98^{a}	13.25	12.92	13.09^{a}	13.82	13.67	13.75^{b}	14.18	14.09	14.14^{b}	14.61	14.59	14.60^{b}	15.64	15.57	15.61^{b}		
Mean	12.68^{a}	12.66^{b}		12.78^{a}	12.67^{b}		13.00^{a}	12.84^{b}		13.58^{a}	13.47^{b}		13.98^{a}	13.86^{b}		14.40^{a}	14.32^{b}		15.47^{a}	15.31^{b}			
	S. E(m)±		CD at 5%	S. E(m)±		CD at 5%	S. E(m)±		CD at 5%	S. E(m)±		CD at 5%	S. E(m)±		CD at 5%	S. E(m)±		CD at5%	S. E(m)±		CD at 5%		
T	0.012		0.037	0.032		0.098	0.016		0.047	0.015		0.046	0.005		0.016	0.020		0.060	0.020		0.061		
C	0.009		0.026	0.023		0.069	0.011		0.033	0.011		0.032	0.004		0.011	0.014		0.042	0.014		0.043		
T×C	0.017		NS	0.046		0.138	0.022		0.066	0.021		0.064	0.007		0.023	0.028		0.085	0.029		0.087		

C1 - Ambient storage C2 - Refrigerated storage
T1 - 90:10 (Aloe: lime) + Sodium benzoate - 120 ppm T2 - 90:10 (Aloe: lime) + KMS - 70 ppm
T3 - 85:15 (Aloe: lime) + Sodium benzoate - 120 ppm T4 - 85:15 (Aloe: lime) + KMS - 70 ppm

pH

The data related to pH of lime blended Aloe RTS as effected by the treatments and storage conditions is depicted in table 2. The results of present study also showed significant effect of storage period and treatments on pH of all samples with the increase in acidity and decrease in pH. Maximum mean value was recorded in T1 - 90:10 (aloe: lime) + SB-120 ppm (2.49). It is reported that gradual decrease in pH of RTS with advancement of storage, this might be due to increase in titrable acidity which indicate the inverse relation existing between pH and acidity. This result was in accordance with Foke *et al.* (2018) [8] found in dragon fruit RTS. Hossain *et al.* (2017) [13] observed that decrease in pH from 4.87 to 4.63 in jackfruit aloe blended RTS stored under refrigerated condition. Decrease in pH value avoids the growth of pathogenic microorganisms which enhance its shelf life and acts as preservative (Bharadwaj and Mukherjee, 2011) [3].

Table 2: Effect of chemical preservatives and storage conditions on pH of lime blended Aloe RTS

pH																							
Storage conditions (C)																							
Treatments (T)	Day 1			15th Day			30th Day			45th Day			60th Day			75th Day			90th Day				
	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean		
T1	2.68	2.62	2.65 ^{a}	2.65	2.60	2.63 ^{a}	2.64	2.58	2.61 ^{a}	2.60	2.58	2.59 ^{a}	2.55	2.55	2.55 ^{a}	2.52	2.52	2.52 ^{a}	2.49	2.48	2.49 ^{a}		
T2	2.64	2.64	2.64 ^{ab}	2.61	2.62	2.62^{ab}	2.61	2.59	2.60^{ab}	2.57	2.57	2.57^{ab}	2.54	2.51	2.53^{ab}	2.48	2.44	2.46 ^{b}	2.46	2.39	2.42 ^{b}		
T3	2.56	2.50	2.53 ^{c}	2.55	2.51	2.53 ^{c}	2.51	2.44	2.47 ^{c}	2.48	2.43	2.45 ^{c}	2.47	2.42	2.45 ^{c}	2.45	2.39	2.42 ^{c}	2.42	2.38	2.40 ^{bc}		
T4	2.46	2.45	2.46 ^{d}	2.43	2.42	2.43 ^{d}	2.47	2.37	2.42 ^{d}	2.45	2.38	2.42 ^{d}	2.44	2.37	2.40 ^{d}	2.37	2.30	2.33 ^{d}	2.30	2.28	2.29 ^{d}		
Mean	2.59^{a}	2.56^{b}		2.56^{a}	2.54^{b}		2.56^{a}	2.50^{b}		2.53^{a}	2.49^{b}		2.50^{a}	2.46^{b}		2.45^{a}	2.41^{b}		2.42^{a}	2.39^{b}			
	S.E(m)±		CDat5%	S.E(m)±		CDat5%	S.E(m)±		CDat5%	S.E(m)±		CDat5%	S.E(m)±		CDat5%	S.E(m)±		CD at5%	S.E(m)±		CDat5%		
T	0.009		0.027	0.006		0.018	0.008		0.025	0.007		0.020	0.005		0.015	0.008		0.023	0.008		0.023		
C	0.006		0.019	0.004		0.013	0.006		0.018	0.005		0.014	0.004		0.011	0.005		0.016	0.005		0.017		
T×C	0.012		0.038	0.008		0.025	0.012		0.035	0.009		0.028	0.007		0.022	0.011		0.032	0.011		0.033		

C1 - Ambient storage C2 - Refrigerated storage
T1 - 90:10 (Aloe: lime) + Sodium benzoate - 120 ppm T2 - 90:10 (Aloe: lime) + KMS - 70 ppm
T3 - 85:15 (Aloe: lime) + Sodium benzoate - 120 ppm T4 - 85:15 (Aloe: lime) + KMS - 70 ppm

Titrable acidity

The mean data regarding on titrable acidity of lime blended Aloe RTS is presented in table 3. The average increment in titrable acidity of lime blended Aloe RTS was observed during storage period. The treatment T4 - 85:15 (aloe: lime) + KMS-70 ppm recorded maximum acidity (0.64%), while

minimum in T1 - 90:10 (aloe: lime) + SB-120 ppm (0.48%). Between the storage conditions, refrigerated storage (C2) registered the highest acidity (18.4%). The increase in acidity in storage might be due to formation of organic acids by ascorbic acid degradation as well as progressive decrease in the pectin content. Similar result was found by Yadav *et al.* (2013) [24] in banana RTS and Kausar *et al.* (2016) [15] in aloe lemon RTS.

Table 3: Effect of chemical preservatives and storage conditions on titrable acidity (%) of lime blended Aloe RTS

Titrable acidity (%)																					
Storage conditions (C)																					
Treatments (T)	Day 1			15th Day			30th Day			45th Day			60th Day			75th Day			90th Day		
	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean
T1	0.30	0.29	0.30 ^{d}	0.32	0.30	0.31 ^{d}	0.38	0.34	0.36 ^{d}	0.38	0.44	0.41 ^{d}	0.39	0.49	0.44 ^{d}	0.41	0.51	0.46 ^{d}	0.43	0.53	0.48 ^{d}
T2	0.34	0.35	0.35 ^{c}	0.38	0.38	0.38 ^{c}	0.41	0.45	0.43 ^{c}	0.47	0.49	0.48 ^{c}	0.47	0.53	0.50^{bc}	0.45	0.54	0.50 ^{c}	0.47	0.56	0.52 ^{c}
T3	0.38	0.40	0.39 ^{b}	0.40	0.41	0.41^{b}	0.48	0.51	0.50^{ab}	0.52	0.53	0.53 ^{b}	0.55	0.57	0.56^{ab}	0.59	0.62	0.61^{ab}	0.60	0.61	0.61 ^{ab}
T4	0.41	0.42	0.42 ^{a}	0.44	0.45	0.45 ^{a}	0.47	0.54	0.51 ^{a}	0.56	0.58	0.57 ^{a}	0.59	0.61	0.60 ^{a}	0.62	0.64	0.63 ^{a}	0.64	0.65	0.64 ^{a}
Mean	0.36^{b}	0.37^{a}		0.38^{b}	0.39^{a}		0.44^{b}	0.46^{a}		0.49^{b}	0.51^{a}		0.50^{b}	0.55^{a}		0.52^{b}	0.58^{a}		0.54^{b}	0.59^{a}	
	S. E(m)±	CDat5%		S.E(m)±	CDat5%		S.E(m)±	CDat5%		S.E(m)±	CDat5%		S.E(m)±	CDat5%		S.E(m)±	CDat5%		S.E(m)±	CDat5%	
T	0.007	0.022		0.004	0.014		0.008	0.024		0.007	0.021		0.013	0.038		0.009	0.027		0.009	0.028	
C	0.005	NS		0.003	NS		0.006	0.017		0.005	0.015		0.009	0.027		0.006	0.019		0.007	0.020	
T×C	0.010	NS		0.006	NS		0.011	0.034		0.010	0.029		0.018	0.054		0.013	0.039		0.013	0.040	

C1 - Ambient storage C2 - Refrigerated storage
T1 - 90:10 (Aloe: lime) + Sodium benzoate - 120 ppm T2 - 90:10 (Aloe: lime) + KMS - 70 ppm
T3 - 85:15 (Aloe: lime) + Sodium benzoate - 120 ppm T4 - 85:15 (Aloe: lime) + KMS - 70 ppm

Reducing sugars

The data related to reducing sugars of lime blended Aloe RTS is depicted in table. 4. Among the treatments, significantly highest reducing sugars were reported in treatment T2 - 90:10 (aloe: lime) + KMS-70 ppm (4.63 - 10.33%). Increasing pattern in values of reducing sugars were observed during storage from day 1 to 90 days *viz.*, 4.44 - 9.82% in ambient (C1) and 4.42 - 9.67% in refrigerated (C2) conditions. This increase might be due to the hydrolysis of non-reducing sugars into reducing sugars and maximum increase under ambient conditions which might be due to the faster rate of reaction because of higher temperature. Similar increasing trend of reducing sugars (2.73-5.93%) was reported by Bhagwan and Awadesh (2014) in mango ginger RTS beverage. Madhuri and Priyanka (2017) [18] reported that maximum mean value of reducing sugars observed in (14%) guava based RTS stored at ambient storage.

Table 4: Effect of chemical preservatives and storage conditions on reducing sugars (%) of lime blended Aloe RTS

Reducing sugars (%)																					
Storage conditions (C)																					
Treatments (T)	Day 1			15th Day			30th Day			45th Day			60th Day			75th Day			90th Day		
	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean
T1	4.47	4.62	4.55 ^{b}	4.27	4.26	4.27 ^{d}	4.45	4.42	4.44 ^{d}	5.03	4.66	4.84 ^{d}	6.95	6.81	6.88 ^{d}	7.21	7.15	7.18 ^{d}	8.71	8.57	8.64 ^{d}
T2	4.70	4.55	4.63 ^{a}	4.72	4.59	4.65 ^{a}	6.01	5.64	5.83 ^{a}	6.51	6.03	6.27 ^{a}	9.02	8.55	8.79 ^{a}	9.28	8.86	9.07 ^{a}	10.68	9.98	10.33^{a}
T3	4.21	4.20	4.21 ^{d}	4.47	4.33	4.40 ^{c}	4.97	4.59	4.78 ^{c}	5.50	5.48	5.49 ^{c}	7.63	7.06	7.35 ^{c}	8.55	8.58	8.57 ^{c}	9.72	9.64	9.68 ^{c}
T4	4.38	4.31	4.35 ^{c}	4.54	4.66	4.60 ^{b}	5.56	6.00	5.78^{ab}	6.06	6.47	6.26^{ab}	8.58	8.99	8.79^{ab}	8.96	9.18	9.07^{ab}	10.15	10.49	10.32^{ab}
Mean	4.44^{a}	4.42^{b}		4.50^{a}	4.47^{b}		5.25^{a}	5.17^{b}		5.78^{a}	5.67^{b}		8.05^{a}	7.85^{b}		8.50^{a}	8.42^{b}		9.82^{a}	9.67^{b}	
	S.E(m)±	CDat5%		S.E(m)±	CDat5%		S.E(m)±	CDat5%		S.E(m)±	CDat5%		S.E(m)±	CDat5%		S.E(m)±	CDat5%		S.E(m)±	CD at5%	
T	0.007	0.022		0.009	0.027		0.033	0.099		0.045	0.134		0.019	0.057		0.014	0.041		0.011	0.034	
C	0.005	0.016		0.006	0.019		0.023	0.070		0.032	0.095		0.014	0.040		0.010	0.029		0.008	0.024	
T×C	0.010	0.031		0.012	0.038		0.047	0.140		0.063	0.190		0.027	0.081		0.019	0.058		0.016	0.048	

C1 - Ambient storage C2 - Refrigerated storage
T1 - 90:10 (Aloe: lime) + Sodium benzoate - 120 ppm T2 - 90:10 (Aloe: lime) + KMS - 70 ppm
T3 - 85:15 (Aloe: lime) + Sodium benzoate - 120 ppm T4 - 85:15 (Aloe: lime) + KMS - 70 ppm

Total sugars

The mean data (table.5) pertaining to total sugars of lime blended Aloe RTS indicating that significant differences were observed among the treatments, storage conditions and their interaction effect. Maximum total sugars were recorded in T2 - 90:10 (aloe: lime) + KMS-70 ppm (14.81 - 20.10%). The increase in total sugar content could be due to the accelerated hydrolysis of insoluble polysaccharides, other carbohydrate polymers and also inversion of sugars (Panghal *et al.*, 2017) [20]. However, the maximum total sugars were observed in ambient storage (C1) (19.36%) compared to refrigerated storage (C2) (19.0%). Patel *et al.* (2015) [21] observed that highest total sugar increase (52.81 to 54.88%) in banana 75% + pine apple 25% at ambient storage during 9 months of storage. Gill *et al.* (2020) [9] reported that increase in total sugar (7.91- 8.68%) observed in aloe blended kagzi lime RTS during 90 days of storage.

Table 5: Effect of chemical preservatives and storage conditions on total sugars (%) of lime blended Aloe RTS

Total sugars (%)																					
Storage conditions (C)																					
Treatments (T)	Day 1			15th Day			30th Day			45th Day			60th Day			75th Day			90th Day		
	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean	C1	C2	Mean
T1	14.62	14.73	14.68^{b}	14.25	14.26	14.26^{d}	14.32	14.37	14.35^{d}	14.83	14.59	14.71^{d}	16.67	16.66	16.67^{d}	16.86	16.85	16.86^{d}	18.18	18.12	18.15^{d}

T2	14.94	14.67	14.81[a]	14.93	14.71	14.82[a]	16.16	15.69	16.11[a]	16.68	16.05	16.37[a]	19.02	18.45	18.74[a]	19.20	18.72	18.96[a]	20.51	19.69	20.10[a]
T3	14.27	14.25	14.26[d]	14.35	14.21	14.28[c]	14.76	14.31	14.54[c]	14.96	15.19	15.07[c]	17.23	16.48	16.86[c]	18.05	17.96	18.01[c]	19.09	18.88	18.99[c]
T4	14.34	14.27	14.31[c]	14.66	14.74	14.70[b]	15.62	15.65	15.64[b]	15.91	15.95	15.93[b]	18.33	18.39	18.36[d]	18.60	18.53	18.57[b]	19.65	19.67	19.66[d]
Mean	14.54[a]	14.48[b]		14.55[a]	14.48[b]		15.22[a]	15.01[b]		15.65[a]	15.39[b]		17.81[a]	17.50[b]		18.18[a]	18.02[b]		19.36[a]	19.09[b]	
	S. E(m)±	**CD at 5%**		**S. E(m)±**	**CDat5%**		**S. E(m)±**	**CDat5%**		**S. E(m)±**	**CDat5%**		**S. E(m)±**	**CDat5%**		**S. E(m)±**	**CDat5%**		**S. E(m)±**	**CDat5%**	
T	0.018	0.053		0.008	0.025		0.009	0.027		0.020	0.062		0.021	0.064		0.043	0.130		0.040	0.121	
C	0.012	0.037		0.006	0.017		0.006	0.019		0.014	0.044		0.015	0.045		0.030	0.092		0.028	0.085	
T×C	0.025	0.074		0.012	0.035		0.013	0.038		0.029	0.087		0.030	0.091		0.061	0.184		0.057	0.171	

C1 - Ambient storage C2 - Refrigerated storage
T1 - 90:10 (Aloe: lime) + Sodium benzoate - 120 ppm T2 - 90:10 (Aloe: lime) + KMS - 70 ppm
T3 - 85:15 (Aloe: lime) + Sodium benzoate - 120 ppm T4 - 85:15 (Aloe: lime) + KMS - 70 ppm

Non-reducing sugars

The changes in non-reducing sugars were observed significant difference among the treatments (table.6). However, highest non-reducing sugars were reported in T2 - 90:10 (aloe: lime) + KMS-70 ppm (10.18 - 9.77%) during 90 days of storage. The per cent of non-reducing sugars in lime blended Aloe RTS were decreased gradually from day one to 90 days of storage *i.e.,* 10.1 - 9.54% (C1) (ambient) and 10.06 - 9.42% (C2) (refrigerated).

The decline in non- reducing sugar might be because of eventual rise in total sugars and reducing sugars which is consequences of breakdown of complex sugars like pectin and conversion of non-reducing sugars into reducing sugars. Similar results were reported by Byanna and Gowda (2012) [6] in sweet orange nectar and Kumar and Deen (2017) [16] in wood apple RTS.

Table 6: Effect of chemical preservatives and storage conditions on non-reducing sugars (%) of lime blended Aloe RTS

Non-reducing sugars (%)																					
Storage conditions (C)																					
Treatments (T)	**Day 1**			**15th Day**			**30th Day**			**45th Day**			**60th Day**			**75th Day**			**90th Day**		
	C1	**C2**	**Mean**	**C1**	**C2**	**Mean**	**C1**	**C2**	**Mean**	**C1**	**C2**	**Mean**	**C1**	**C2**	**Mean**	**C1**	**C2**	**Mean**	**C1**	**C2**	**Mean**
T1	10.15	10.11	10.13 [b]	9.99	9.98	9.99 [c]	9.87	9.95	9.91 [b]	9.80	9.93	9.87 [b]	9.70	9.86	9.78 [b]	9.65	9.70	9.68 [b]	9.47	9.55	9.51 [b]
T2	10.24	10.12	10.18 [a]	10.21	10.10	10.16[a]	10.15	10.05	10.1 [a]	10.1	10.02	10.06[a]	10.0	9.90	9.95 [a]	9.92	9.86	9.89 [a]	9.83	9.71	9.77 [a]
T3	10.06	10.05	10.06 [c]	9.88	9.87	9.88 [d]	9.79	9.72	9.76 [d]	9.69	9.48	9.59 [d]	9.60	9.42	9.51[cd]	9.50	9.38	9.44[cd]	9.37	9.24	9.31[cd]
T4	9.96	9.95	9.95 [d]	10.12	10.08	10.10[b]	10.06	9.65	9.86 [c]	9.85	9.45	9.65 [c]	9.75	9.39	9.57 [c]	9.64	9.35	9.50 [c]	9.50	9.18	9.34 [c]
Mean	10.10[a]	10.06[b]		10.05[a]	10.01[b]		9.97[a]	9.84[b]		9.86[a]	9.72[b]		9.76[a]	9.64[b]		9.68[a]	9.57[b]		9.54[a]	9.42[b]	
	S. E(m)±	**CDat5%**		**S. E(m)±**	**CDat5%**		**S. E(m)±**	**CDat5%**		**S.E(m)±**	**CD at5%**		**S.E(m)±**	**CDat5%**		**S.E(m)±**	**CDat5%**		**S.E(m)±**	**CDat5%**	
T	0.014	0.042		0.008	0.025		0.008	0.025		0.018	0.054		0.020	0.062		0.025	0.076		0.026	0.079	
C	0.010	0.030		0.006	0.017		0.006	0.017		0.013	0.038		0.014	0.044		0.018	0.054		0.018	0.056	
T×C	0.020	0.060		0.012	0.035		0.012	0.035		0.025	0.076		0.029	0.087		0.035	0.107		0.037	0.111	

C1 - Ambient storage C2 - Refrigerated storage
T1 - 90:10 (Aloe: lime) + Sodium benzoate - 120 ppm T2 - 90:10 (Aloe: lime) + KMS - 70 ppm
T3 - 85:15 (Aloe: lime) + Sodium benzoate - 120 ppm T4 - 85:15 (Aloe: lime) + KMS - 70 ppm

Conclusion

The prepared lime blended Aloe RTS drink is an excellent beverage over existing artificial and synthetic beverages in the market and can be commercially explored in the nutraceutical market for its health benefits. The present investigation resulted that Physico-chemical attributes of lime blended Aloe RTS can be well preserved at refrigerated storage for 90 days. Hence, it can be concluded that T2 - 90: 10 (aloe: lime) + KMS-70 ppm stored at refrigerated condition (C2) was found to be satisfactory, followed by T4 - 85:15 (aloe: lime) + KMS -70 ppm.

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