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To study the shelf life of *Aloe vera* fortified mango RTS with different time and temperature combinations on it's organoleptic and functional properties

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Abstract
Aloe vera finds tremendous application in food and cosmetic industry due to its medicinal and functional attributes. In the present study, the RTS beverage prepared from blend comprising 75% mango (*Mangifera indica* L) and 25% *Aloe vera* (*Aloe barbadensis* miller) was found to be most acceptable than other combinations (0 and 100%, 100 and 0%, 50 and 50% and 25 and 50% mango and *Aloe vera* pulp, respectively). Storage study of developed *Aloe vera* mango RTS was carried out at two different temperatures, i.e., 10 and 25 ºC. The RTS was organoleptically acceptable up to two months of storage at 10 ºC. During storage studies the total soluble solids, acidity, reducing sugar, total sugar increased whereas, ascorbic acid, non-reducing content and organoleptic scores decreased more significantly during storage at 25 ºC then at 10º C. DPPH activity and polyphenol content of *Aloe vera* mango RTS kept at 10 ºC, decreased less significantly ($p \leq 0.05$) during storage. The marginal changes of overall attributes in developed RTS with storage at low temperature shows its consumer acceptability in terms of taste, colour & appearance, consistency, flavor and medicinal and functional attributes.

Keywords: *Aloe vera* (*Aloe barbadensis* miller), mango (*Mengefera indica*), RTS beverage, sensorial attributes, physicochemical properties, functional attributes

Introduction
Aloe vera (*Aloe barbadensis* miller) belongs to Liliaceae family traditional being utilized as contemporary folk remedy (Volger and Ernest, 1999) [31]. There are over 250 species of *Aloe vera* grown around the world; However only two species viz. *A. barbadensis* Miller and *A. aborescens* are considered the most potent ones (Valverde *et al*. 2005) [30]. *Aloe vera* is one of the few herbs widely used in Western society, with the manufacturing of *Aloe vera* extracts being one of the largest botanical industries worldwide (Grindlay and Reynolds 1986; Eshun and He, 2004) [10, 9]. *Aloe vera* is used in the cosmetic, food, and pharmaceutical industries. The food industry uses *Aloe* in the manufacture of functional foods, especially health drinks, and as a bitter agent (Saccu, Bogoni, and Procida 2001) [26]. Mango admixed *Aloe vera* based new product developed [1] which is offering health benefits which improves the functional properties. The developed product have been labeled functional food Functional food have rich source of bioactive and antioxidant compound, in which that quality is minimum in conventional food. Photochemistry of *Aloe vera* gel have revealed the presence of more than 200 active substances including vitamins, minerals, enzymes, sugars, anthoaquinones of phenol compounds, lignin, saponins, sterols, amino acids and salicylic acid. *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.

Fresh *Aloe vera* leaves used to obtain two components, firstly bitter yellow latex from peripheral bundle sheath of aloe, called *Aloe vera* sap and a mucilaginous gel from parenchymatous tissue. The interest and use of gel has increased dramatically in the field of health care and cosmetics (Devi and Rao 2005). It can be utilized as a valuable ingredient for food application due to its biological activities and functional properties (Kojo and Qian, 2010) [16]. *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. *Aloe vera* in food products like jam and jelly, Yagurt and beverages of orange, grape, cranberry, strawberry, raspberry, pineapple (Niramon *et al*. 1996; Malhotra *et al*. 2010) [23].

Mango (*Mangifera indica* L.) from *Anacardiaceae* family is one of the most widely eaten tropical fruit because of its unique taste, attractive color and flavor, affordability and nutritional qualities. It is a rich source of vitamins, organic acids, carbohydrates, amino acids, phenolic acids (e.g., gallic acid, caffeic acid, and tannic acid) and certain volatile compounds (Pino *et al*. 2005) [24]. Many of the pharmacological properties attributed to mango might be due to the presence of phenolic acids. These phenolic compound possess potent antioxidant activity that play an important role in human nutrition as preventative agents against several diseases caused by oxidative stress, protecting the body tissues against oxidative stress with their antioxidant, anti-mutagen, anti-inflammatory, and anti-carcinogenic properties (Chiou *et al*. 2007) [6]. However, mango fruits are climacteric and ripen rapidly after harvest, this limits their storage, handling and transport potential (Lalel *et al*. 2003) [17]. This can be overcome by processing the ripe mango pulp to RTS beverages and fruit drinks by blending with other medicinal plant like *Aloe vera* which will improve the sensorial and functional attribute of developed product.

Blended drinks are good alternative for development of new products to provide benefit of taste, nutrition as well as medicinal properties. The blending of fruits like mango, lime, aonla, grape and pineapple pulp/juice in appropriate proportion could improve the nutritional quality of the Alvera based RTS beverages (Deka, 2000) [7].

Based on the above mentioned potential application, *Aloe vera*- mango RTS beverage with improved physicochemical and functional attributes were studied.

Material and methods

Aloe vera leaves were procured from the Department of Botany, Banaras Hindu University, Varanasi and full ripened Neelam mango fruit was procured from local market sunderpur Varanasi. Other raw material including sugar, glass bottles, Mango flavour essence were also procured from the local market. Reagents for analytical study were procured from Merc, Himedia and Sigma-aldrich, USA.

Methodology

The leaves of *Aloe vera* were sound, undamaged, mold/rot free and matured (3-4year) in order to keep all the active ingredients in full concentration. The pulp was taken out by the traditional hand filleting method to avoid contamination of internal fillet with the yellow sap. In this method, the lower 1 inch of the leaf base (the white part attached to the large rosette stem of the plant), the tapering point (2-4 inch) of the leaf top and the short, sharp spines located along the leaf margins were removed by a sharp knife, then the knife, was introduced into the mucilage layer below the green rind avoiding the vascular bundles and the top rind was removed. The bottom rind was similarly removed and the rind parts, to which a significant amount of mucilage remains attached, were discarded. This is of critical concern because the highest concentration of potentially beneficial Aloe constituents are found in this mucilage, as this layer represents the constituents synthesized by the vascular bundle cells empowered by energy developed in the green (chlorophyll-containing) rind cells through sun-induced photosynthesis. The filleting operation must be completed within 36 hours of harvesting the leaves. Fig.1. the pulp was heated to 65± ºC for 15±5 min. After heating, the pulp was mashed with the hand beater. The mashed pulp was strained with muslin cloth to get *Aloe vera* juice.

Standardization of blends for RTS

The following ratio of *Aloe vera* and mango pulp were evaluated to standardize the blend for the development of quality RTS:

Treatment- 1
10% blend consisting of 100% mango pulp + 0% *Aloe vera* pulp adjusted to 16% TSS, 0.25% acidity and 70 ppm SO_2.

Treatment- 2
10% blend consisting of 0% mango pulp + 100% *Aloe vera* pulp adjusted to 16% TSS, 0.25% acidity and 70 ppm SO_2.

Treatment- 3
10% blend consisting of 50% mango pulp + 50% *Aloe vera* pulp adjusted to 1% TSS, 0.25% acidity and 70 ppm SO_2.

Treatment- 4
10% blend consisting of 75% mango pulp + 25% *Aloe vera* pulp adjusted to 16% TSS, 0.25% acidity and 70 ppm SO_2.

Treatment- 5
10% blend consisting of 25% mango pulp + 75% *Aloe vera* pulp adjusted to 16% TSS, 0.25% acidity and 70 ppm SO_2.

Preparation of RTS

RTS containing 10% blend, 12% TSS, 0.25% acidity and 70 ppm SO_2 were prepared by different treatments of each blend combination of mango and *Aloe vera* pulp mentioned in Table 1. These RTS were organoleptically evaluated on 9 point hedonic scale to find out the best combination of blend. The fresh, well ripened Neelam variety of mango was taken and squash to extract the pulp which later was mixed with *Aloe vera* pulp in different combinations. The process flow chart for preparation of *Aloe vera* RTS is shown in Fig. 1.

Physicochemical analysis of *Aloe vera* – mango RTS

The pH values were determined with the help of an electronic pH meter (Thermo Scientific, 2 star), TSS measurement was done with the help of a hand refractometer (Bellingham Stanley Ltd., UK) with detection range: 0-32 ºC and values expressed as ºBrix. Acidity of various samples was determined by titrating against 0.1N NaOH according to AOAC (1995) [1] method. Ascorbic acid content was determined by the titration method using 2,6-dichlorophenolendophenol dye ($C_{12}H_7NCl_2$) as previously reported (Johnson, B.C., 1948) [14]. The total sugar of different trials were determined by phenol sulfuric acid-uv method (DuBois *et al*. 1956) [5] and Reducing sugar was determined by, DNS method (Miller, 1959) [20]. The total phenolic content was determined by the Folin-Ciocalteau method (Kaur & Kapoor, 2002) [15]. The DPPH radical scavenging assay was based on the previous method (Michalska *et al.* 2007) [19].

Microbial Analysis

Microbial analysis was done to determine the total plate count (TPC) of the samples on the nutrient agar media for bacterial count by the method recommended by Harrigan and McCance (1966) [12]. Nutrient agar media was prepared and the samples were serially diluted up to 10^{-5} dilution factor. 0.25 ml of the samples, suspended in 0.9 N saline solutions, was transferred to the respective petri dishes of nutrient agar media. Three

replicates were taken for each dilution. The inoculated petri dishes were incubated in a BOD incubator (Eyelalti 700, China) for 48 hours at 37±1ºC and bacterial colonies were calculated by the following formula.
TPC (cfu/ml) = No. of colonies × dilution factor / 0.25

Determination of sensory qualities
Sensory quality attributes viz. colour and appearance; consistency, flavour, taste and overall acceptability of the samples were evaluated using a 9-point hedonic rating test by a panel of six judges by the method recommended by Ranganna (2001) [25].

Statistical analysis
The data obtained from the various experiments were recorded and subjected to statistical analysis as per the Analysis of Variance method of Factorial Complete Randomized Design (CRD). The significance and non-significance of data obtained from various experiments were judged with the help of an F (variance ratio) Table. The significant difference between the means was tested against the critical difference at the 1% and 5% level of significance by using STPR software for data analysis.

Result and discussion
Standardization of blends for RTS
In present study, Blend *Aloe vera*-mango RTS prepared by blending 75% mango and 25% *Aloe vera* juice with 16.0% TSS gave best organoleptic result (Table 1). The beverage prepared with *Aloe vera* (25%), mango (75%) and added sugar with 16.0% TSS gave the predicted value of maximum colour & appearance (8.5), taste (7.8), flavor (9.0), consistency (7.9) score and Total sugar (15.5gml^{-1}), Reducing sugar (2.38gml^{-1}), non-reducing sugar (13.12gml^{-1}), Acidity (0.279%), pH (4.54), Vitamin C (6.67 mgml^{-1}), total polyphenol content (0.35mgml^{-1}), DPPH (43.78%) (Table 2).

Effect of temperature on physicochemical properties of *Aloe vera*-mango RTS beverage during storage periods
Colour and appearance
Temperature plays an important role in biochemical changes that leads to development of off flavor as well as discolorations in the beverages during storage. Table 3 represented the effect of two different temperature i.e. 10 ºC and 25 ºC, respectively on colour and appearance of *Aloe vera*-mango RTS beverage during storage. It is explicit that the score for colour and appearance decreased significant during that storage period from 0 to 60 days. The maximum decreased was observed in sample (A^{25}_m) stored under 25 ºC, which decreased from 8.1 ± 0.36 To 6.73 ± 0.14. Minimum decreased was observed in sample (A^{10}_m) stored under 10 ºC, which decreased from 8.1 ± 0.36 to 7.4 ± 0.057. Reduction in organoleptic quality obtained in present study is in correlation to previous report of effect of storage temperature on pomegranate juice (Jakhar and Pathak, 2012).

Taste
The 9 point hedonic scale scores for taste of *Aloe vera*-mango RTS beverage showed significant decrease ($p < 0.05$) during that storage (Table 2). Table 2 clearly deduced that the score for taste showed maximum decreased in sample (A^{25}_m) stored under 25 ºC. Which decreased from 8.2 ± 0.60 to 6.4 ± 0.21, minimum decreased was observed in sample (A^{10}_m) stored under 10 ºC.

Flavour
The 9 point hedonic scale scores for flavour of *Aloe vera*-mango RTS beverage storage under two conditions at 10 ºC and 25 ºC are presented in the table 2 it is explicit that the score for taste decreased significant during that storage period from 0 to 60 days. The maximum decreased was observed in sample (A^{25}_m) stored under 25 ºC. Which decreased from 8.3 ± 0.40 to 6.4 ± 0.56 Minimum decreased was observed in sample (A^{10}_m) stored under 10 ºC. Which decreased from 8.2 ± 0.60 to 7.2 ± 0.58 In the statistical analysis, it was found that the data are significant for different treatments ($P \leq 0.05$). Similar findings were reported by Satkar *et al*. (2013) [27] they observed that the bitter guard RTS was found to be more acceptable after 3 months of storage when stored in refrigerated system. Temperature plays an important role in biochemical changes that leads to development of off flavour as well as discoloration in the beverages.

Consistency
The 9 point hedonic scale scores for Consistency of *Aloe vera*-mango RTS beverage storage under two conditions at 10 ºC and 25 ºC are presented in the Table 2 it is explicit that the score for taste decreased significant during that storage period from 0 to 60 days. The maximum decreased was observed in sample (A^{25}_m) stored under 25 ºC. Which decreased from 8.2 ± 0.49 to 6.6 ± 0.35, minimum decreased was observed in sample (A^{10}_m) stored under 10 ºC which decreased from 8.2 ± 0.49 to 7.2 ± 0.52.

Total sugar
The experimental data for changes in total sugar of *Aloe vera*-mango RTS beverage storage under two different temperatures are shown in Table 4. The Total sugar increased significantly during that storage ($p<0.05$. The maximum increase was observed in sample (A^{25}_m) stored at 25 ºC. Which increased from 15.53 ± 0.057 to 17.19 ± 0.013 g/100 ml. Minimum increased was observed in sample (A^{10}_m) stored under 10 ºC. Which increased from 15.53 ± 0.057 to 16.26 ± 0.028 g/100 ml**.** This minimum decrease in total sugars during storage may be attributed to accelerated hydrolysis of insoluble polysaccharides and other carbohydrate polymers (Narayana, *et al*. 1996) [22]. The Maillard reaction and other chemical reactions of sugars with acids during storage also lead to a decrease in total sugar content. In the statistical analysis, it was found that the data are significant for different treatments and storage periods ($P \leq 0.05$) (Table 4).

Reducing sugar and non-reducing sugar
Studying the physicochemical properties of *Aloe vera*-mango RTS suggests that the reducing sugar concentration increased significantly during the storage period of 60 days under two condition at 10 ºC and 25 ºC and maximum increase was observed in sample (A^{25}_m) stored under 25 ºC. Reducing sugar concentration increased from 2.40 ± 0.04 to 5.61 ± 0.11g/100 ml from 0 to 60 days. However sample (A^{10}_m) stored under 10 ºC showed minimum increase in reducing sugar which increased from 2.40 ± 0.04 to 3.74 ± 0.045 g/100 ml during 60 days of storage. The increase in reducing sugar content in *Aloe vera*-mango RTS may be due to hydrolysis of sucrose to glucose and fructose by the acid present in the beverages along with simultaneous decrease in the non-reducing sugars (Lotha, 1992). The combined effect of treatment and storage was found to be significant ($P \leq 0.05$) (Table 4). The increase in reducing sugar is due to inversion of non-reducing sugar to

reducing sugars under acidic conditions, which correlates with earlier findings (Aruna *et al*. 1997) [2]. The increase in reducing sugars can be attributed to the hydrolysis of non-reducing sugars during processing and storage. The results of the present study contradict earlier reports by Barwal *et al*. (2005) [5], who observed a decrease in sugar concentration in bitter gourd; however, in that trial, storage time was 90 days, which is much longer in comparison to the present study.

Similarly, the maximum decrease in non-reducing sugar was observed in sample (A^{25}_m) stored under 25 ºC, which showed non-reducing sugar concentration of 13.13 ± 0.02 to 11.15 ± 0.10 g/100ml at 0 and 60 days of storage, respectively. Minimum decreased in non-reducing sugar, from 13.13 ±0.017 to 12.07 ± 0.105g/100ml was observed in sample (A^{10}_m) stored under 10 ºC (Table 4). The combined effect of treatment and storage was found to be significant ($P \leq 0.05$)

Ascorbic acid content

Ascorbic acid content decreased significantly during storage under 25 ºC as compared to 10 ºC. The ascorbic acid content in sample (A^{25}_m) stored under 25 ºC decreased from 6.22 ± 0.38 to 4.22 ± 0.11 $mgml^{-1}$. The reduction in ascorbic acid during storage could be due to its oxidation to dehydro-ascorbic acid (Mokady *et al*. 1997) [21]**.** In the statistical analysis, it was found that the data are significant for storage period ($P \leq 0.05$) (Table 4). Atmospheric temperature, oxygen and the presence of trace metals also affects the ascorbic acid degradation during storage, as previously reported by (Kirk *et al*. 1977). Hence, it might have been destroyed during processing and subsequently during the storage period due to its oxidation. (Baljeet *et al*. 2013) [4]

Titrable Acidity and pH

Titrable acidity of *Aloe vera*-mango RTS beverage increased significantly during that storage period from 0 to 60 days. The maximum increased was observed in sample (A^{25}_m) stored under 25 ºC. which increased from 0.25 ± 0.011 to 0.32 ± 0.014%. However, minimum increase in titrable acidity was observed in sample (A^{10}_m) stored under 10 ºC. Which showed marginal increased from 0.25 ± 0.011 to 0.28 ± 0.005 per cent. Similar trends were reported by (Hamaran and Amutha 2007), who observed an increment in acidity values of banana and sapota beverage stored at ambient conditions (35–36 ºC) and low temperature (3–5 ºC). Statistical analysis revealed that the combined effect of different replicate and storage period were significant ($P \leq 0.05$) (Table 5). The increase in acidity was observed in all treatments due to the formation of organic acids by ascorbic acid present in *Aloe vera* and Mango. The rise in acidity with increased storage time can be also attributed to degradation of polyphenol content in *Aloe vera* and Mango Juice. Rapid conversion of proteins to amino acids is also responsible for increases in titrable acidity in *Aloe vera-Mango* RTS.

The experimental data for changes in pH of *Aloe vera*-Mango RTS beverage storage stored under two conditions at 10 and 25 ºC are presented in Table 4. It is explicit that the pH decreased significant during that storage period from 0 to 60 days. The maximum decrease was observed in sample (A^{25}_m) stored under 25 ºC, which decreased from 4.28 ± 0.25 to 2.46 ± 0.11 minimum decreased was observed in sample (A^{10}_m) stored under 10 ºC which decreased from 4.28 ± 0.25 to 2.9 ± 0.005. Similar trends were reported by (Hamaran and Amutha 2007) in the case of banana and sapota beverage stored at different temperatures for 180 days. This gradual decrease in pH has a significant effect as lower pH does not allow pathogenic microorganisms to grow and hence acts as a preservative.

In the statistical analysis, it was found that the data are significant for different replicate and storage periods ($P \leq 0.05$). The combined effect of treatment and storage were found to be non-significant (Table 5). The interactive effect of mint extract and storage period had a significant effect on pH decrease due to the presence of flavenoids and terpenoids. Decrease in pH of samples may be due to the action of ascorbic acid on the sugar and protein component of RTS juice. Production of organic acids and amino acids leads to an increase in acidity and a decrease in pH as already reported for mango RTS (Sikder *et al*. 2001) [29].

Variation in microbial load during storage period

Microbial analysis was performed for sample under two different temperature for 60 days at 10^{-3} dilution. Maximum bacterial count was found in sample A^{25}_m stored at 25 ºC, which increased from 0.10 ± 0.005 to 1.27 ± 0.064 × 10^{-3}cfu/ml from 0 to 60 days. However, minimum increased was observed in sample (A^{10}_m) stored at 10 ºC, which decreased from 0.10 ± 0.005 to 0.99 ± 0.011× 10^{-3}cfu/ml (Table 5).

Total polyphenol content

Fig. 2 represents the changes in total polyphenol content of *Aloe vera*-mango RTS beverage storage stored under two different temperatures i.e. 10 ºC and 25 ºC. It is explicit that the total polyphenol decreased significant during that storage period from 0 to 60 days. The maximum decreased was observed in sample (A^{25}_m) stored under 25 ºC. The phenol compound play an important role to determining the colour and flavour of a product, but its loss might be due to these compounds is highly volatile and easily oxidizable, which condensed in to brown pigments (Siddiqui *et al*. 2013). This may probably be due to greater movement of oxygen, water vapour and oxidation of ascorbic acid, organic acid and polyphenols during storage.

DPPH activity

DPPH activity decreased less significantly in sample (A^{10}_m) stored under 10 ºC during the storage period of 60 days. DPPH activity decreased from 42.35 ± 0.39 to 41.43 ± 0.11 per cent in sample (A^{10}_m) stored under 10 ºC (Fig.3). However, the sample (A^{25}_m) stored under 25 ºC showed more reduction in DPPH activity which may be attributed to generation of browning compounds (melanoidins) by maillard reaction due to heat treatment that shows potent antioxidant activity (Baba *et al*. 2014) [3].

Table 1: Organoleptic quality of RTS prepared from different blends of mango and *Aloe vera* pulp

Treatments	Different combination of blends		Organoleptic quality score	Rating
	Mango pulp (%)	*Aloe vera* pulp (%)		
T_0	100	Nil	7.00	Like moderately
T_1	Nil	100	6.36	Like slightly
T_2	50	50	7.50	Like moderately
T_3	75	25	8.00	Like very much
T_4	25	75	6.77	Like slightly
CD at 5%				

Table 2: Physicochemical & organoleptic properties of *Aloe vera*-mango RTS beverages. (75% mango, 25% *Aloe vera*, 10% juice, 0.25% acidity, 70 ppm SO_2)

Sensory Properties		Physicochemical properties			
Color & Appearance	8.5	Total sugar (g/ml)	15.5	pH	4.54
Taste	7.8	Reducing Sugar (g/ml)	2.38	Ascorbic acid (mg/ml)	6.67
Flavor	9.0	Non-reducing sugar (g/ml)	13.12	Polyphenol (mg/ml)	0.35
Consistency	7.9	Acidity (%)	0.279	DPPH (%)	43.78

Table 3: Changes in colour and appearance, taste, flavor and consistency of *Aloe vera*-mango RTS beverage during storage.

Storage Days	Colour and appearance		Taste		Flavour		Consistency	
	At (10 ºC)	At (25 ºC)	At (10 ºC)	At (25 ºC)	At (10 ºC)	At (25 ºC)	At (10 ºC)	At (25 ºC)
0	8.1 ± 0.36	8.1 ± 0.36	8.2 ± 0.60	8.2 ± 0.60	8.3 ± 0.40	8.3 ± 0.40	8.2 ± 0.49	8.2 ± 0.49
15	7.8 ± 0.15	7.76 ± 0.37	7.7 ± 0.40	7.7 ± 0.60	8.0 ± 0.45	7.8 ± 0.34	8 ± 0.52	7.6 ± 0.36
30	7.6 ± 0.15	7.46 ± 0.47	7.5 ± 0.4	7.3 ± 0.43	7.9 ± 0.45	7.4 ± 0.17	7.7 ± 0.43	7.2 ± 0.26
45	7.4 ± 0.05	7.16 ± 0.28	7.2 ± 0.25	6.8 ± 0.32	7.5 ± 0.45	6.9 ± 0.11	7.4 ± 0.51	7.0 ± 0.26
60	7.1 ± 0.1	6.73 ± 0.14	7.0 ± 0.1	6.4 ± 0.21	7.2 ± 0.58	6.4 ± 0.56	7.2 ± 0.52	6.6 ± 0.35
Effect		CD $_{(0.01)}$		CD $_{(0.01)}$		CD $_{(0.01)}$		CD $_{(0.01)}$
Temp.(A)		0.308		0.332		0.308		0.332
Storage (B)		0.487		0.525		0.487		0.525
A × B		N/A		N/A		N/A		N/A

Table 4: Changes in total sugar, reducing sugar, non-reducing sugar and ascorbic acid of *Aloe vera*-mango RTS beverage during storage.

Storage Days	Total sugar (g/ml)		Reducing sugar (g/ml)		Non-reducing sugar (g/ml)		Ascorbic acid (mg/ml)	
	At (10 ºC)	At (25 ºC)	At (10 ºC)	At (25 ºC)	At (10 ºC)	At (25 ºC)	At (10 ºC)	At (25 ºC)
0	15.53 ± 0.057	15.53 ± 0.057	2.40 ± 0.04	2.40 ± 0.04	13.13 ±0.017	13.13 ± 0.017	6.22 ± 0.45	2.40 ± 0.04
15	15.56 ± 0.017	15.81 ± 0.028	2.71 ± 0.15	2.78 ± 0.14	13.03 ± 0.055	12.81 ± 0.055	6.29 ± 0.28	2.78 ± 0.14
30	15.76 ± 0.028	16.17 ± 0.063	3.01 ± 0.07	3.69 ± 0.36	12.77 ± 0.068	12.24 ± 0.49	5.95 ± 0.18	3.69 ± 0.36
45	16.12 ± 0.046	16.76 ± 0.028	3.46 ± 0.08	4.12 ±0.10	12.36 ± 0.133	11.41 ± 0.16	5.42 ± 0.073	4.12 ±0.10
60	16.26 ± 0.028	17.19 ± 0.013	3.74 ± 0.04	5.61 ± 0.11	12.07 ± 0.105	11.15 ± 0.13	5.17 ± 0.06	5.61 ± 0.11
Effect		CD $_{(0.01)}$		CD $_{(0.01)}$		CD $_{(0.01)}$		CD $_{(0.01)}$
Temp.(A)		0.046		0.093		0.046		0.093
Storage (B)		0.073		0.147		0.073		0.147
A × B		0.103		0.208		0.103		0.208

Table 5: Changes in titrable acidity, pH and microbial load of *Aloe vera*-mango RTS beverage during storage.

Storage Days	Titrable acidity		pH		Microbial load10^{-3} Dilution (CFU/ml)	
	At (10 ºC)	At (25 ºC)	At (10 ºC)	At (25 ºC)	At (10 ºC)	At (25 ºC)
0	0.25± 0.011	0.25 ± 0.011	4.28 ± 0.25	4.28 ± 0.25	0.10 ± 0.005	0.10 ± 0.005
15	0.26 ± 0.005	0.26 ± 0.005	4.0 ± 0.16	3.98 ± 0.46	0.20 ± 0.005	0.38 ± 0.01
30	0.27 ± 0.10	0.27 ± 0.005	3.7 ± 0.22	3.60 ± 0.38	0.38 ± 0.005	0.71 ± 0.005
45	0.27 ± 0.005	0.28 ± 0.005	3.48 ± 0.38	3.25 ± 0.23	0.61 ± 0.015	1.10 ± 0.105
60	0.28 ± 0.005	0.32 ± 0.014	2.9 ± 0.005	2.46 ± 0.11	0.99 ± 0.011	1.27 ± 0.064
Effect		CD $_{(0.01)}$		CD $_{(0.01)}$		CD $_{(0.01)}$
Temp.(A)		0.008		N/A		0.030
Storage (B)		0.012		0.332		0.048
A × B		0.017		N/A		0.068

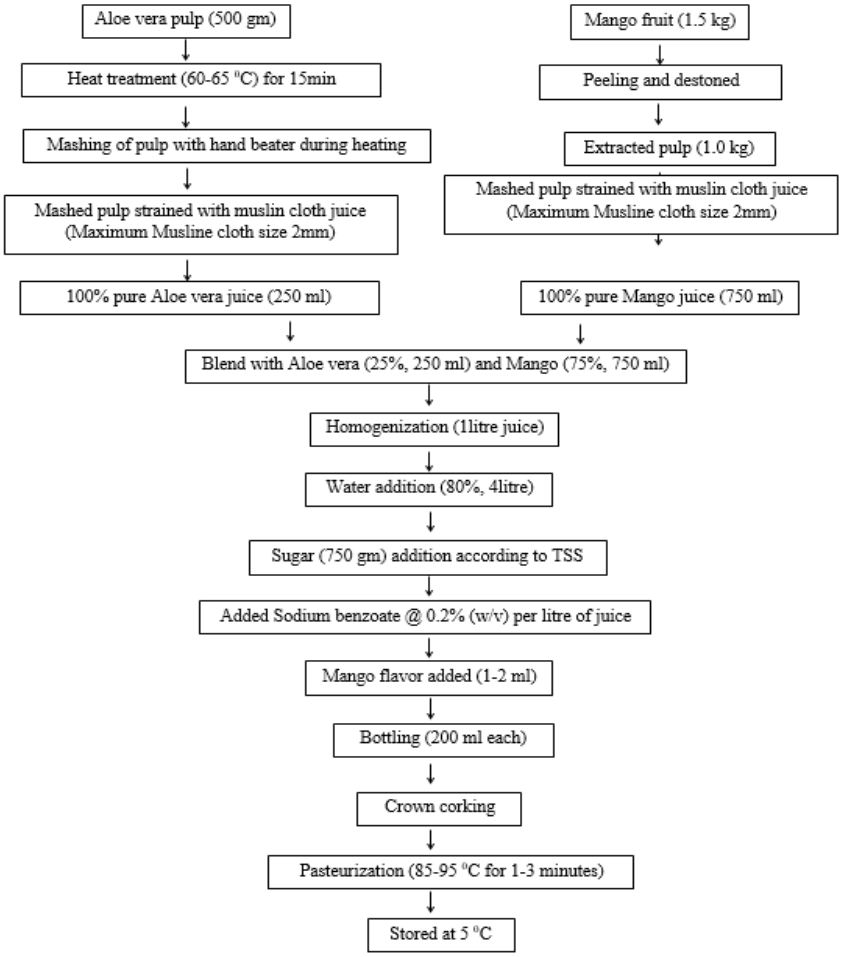

Fig 1: The process flow chart for preparation of *Aloe vera*-mango RTS beverage

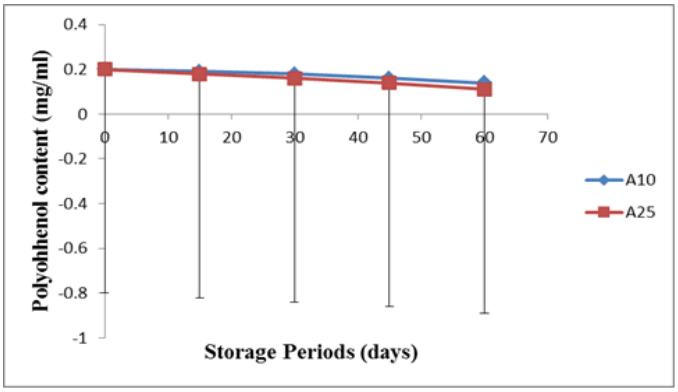

Fig 2: Effect of storage on total polyphenol content of *Aloe vera* mango blend RTS (SD±0.05)

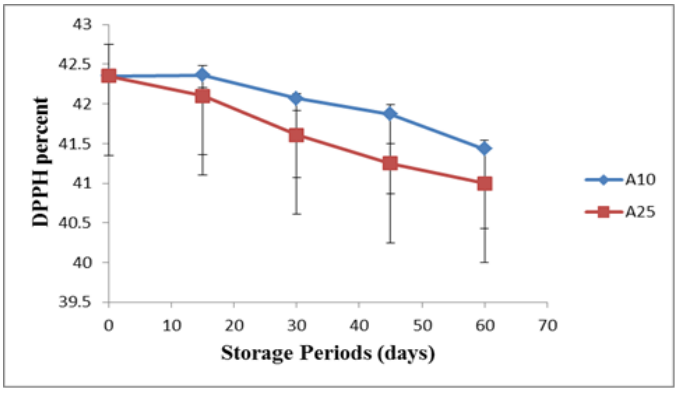

Fig 3: Effect of storage on DPPH activity of *Aloe vera* mango blend RTS (SD±0.05)

Conclusion

The present investigation suggests that organoleptic and functional properties viz; pH, TSS, titratable acidity, ascorbic acid content, total sugar, reducing and non-reducing content, total polyphenol content, DPPH activity of *Aloe vera*-mango RTS can be preserved at 10 °C storage temperature with desirable consumer acceptability for 60 days. The product may serve as an excellent beverage owing to its functional and nutritional properties. Further optimization of developed RTS with enhanced shelf life may make it a potential herbal beverage in the near future at a commercial scale.

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