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RESEARCH PAPER

Storage Studies of *Aloe vera* Juice Incorporated *Peda*

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Abstract

The present research was intended to study the feasibility of incorporation of *Aloe vera* juice in different ratios for preparation of *Aloe vera* incorporated *peda* and assess their storage life at ambient room temperature. The *peda* samples were analyzed for chemical quality attributes (moisture, protein and acidity) and microbial quality attributes (total plate count and yeast and mould count) during storage at room temperature (37±1°C). The analysis was carried out on 0th, 3rd, 5th and 7th days of storage. A reducing trend was observed in moisture content and increasing trend was observed in acidity content during the storage of *peda* samples at room temperature over a period of 7 days. The microbial analysis revealed that both total plate count and, yeast and mould count decreased with the increased incorporation of juice. During storage however, both the counts increased.

Keywords: *Aloe vera* juice, *peda*, storage, ambient temperature, chemical quality

Aloe vera plant is known to mankind since from time, due its medicinal and therapeutic values. Its applications have been recorded in ancient cultures of India, Egypt, Greece, Rome and China. Egyptians hailed *Aloe vera* as the plant of immortality. The Chinese called it their elixir of youth (Ahlawat and Khatkar, 2011). There are over 250 species of *Aloe* grown worldwide. However, only two species are grown commercially i.e. *Aloe* barbadensis Miller (*Aloe vera*) and *Aloe* aborescens (Valverde *et al.* 2005). *Aloe vera* (*Aloe barbadensis* Miller) belongs to Lileacea family traditional being utilized as contemporary folk remedy (Volger and Ernest 1999). It is a clump forming perennial plant with thick fibrous root which produces large basal leaves. The *Aloe* juice is derived from the leaf pulp of the plant. In food industry it is utilized in various functional foods especially for the preparation of health drinks with no laxative effects. It is also used in other food products including milk, ice cream, confectionery, etc. *Aloe vera* juice is also used as a flavoring component and preservative in some foods (Christaki and Florou-Paneri 2010).

The health benefits of *Aloe vera* have been propagated throughout the world. The phytochemical study of *Aloe vera* has revealed that there as many as 200 different types of functional ingredient molecules in *Aloe vera* (Davis 1997) including vitamins, minerals, enzymes, sugars, anthraquinones of phenolic compounds, lignin, saponins, sterols, amino acids and salicylic acid. Polysaccharides are considered to be the active ingredients for Aloe's anti-inflammation and immune modulation effects (Pugh *et al.* 2001). Globally, Western Europe is projected to hold the first rank in global *Aloe vera* extracts market followed by Asia-Pacific region by the end of the forecast period i.e. 2021 (Anonymous, 2016). These statistical data encourages for more and more scientific research and approach towards *Aloe vera* incorporated products.

India ranks first in milk production in the world and accounting to 19% of world's total milk production. The milk production in India is estimated to be 155.20 MT (FAO, 2016), and the largest Dairy products consumer in the world and its delicious traditional dairy products have wide marketing scope in Indian. These products need to be enhanced in terms of quality and functionality to attract overseas market and health orientated consumers. The Present dietary scenario necessitates exploring the possibility of incorporating novel ingredients in commonly consumed foods rather than developing new food product (Boghani *et al.* 2012). This approach of study can help the India to capitalize on consumers' interest in functional food also improve socio-economic status of the country. Looking to the functional, therapeutic and its bland flavour in nature, *Aloe vera* is more suitable for incorporation in various food formulations. Hence our present investigation was aimed to develop good quality *peda* by incorporating *Aloe vera* juice.

MATERIALS AND METHODS

Raw materials

The work was carried out in the Department of Dairy Technology of College of Dairy Science & Food Technology, C.G.K.V., Raipur (C.G.). Fresh Buffalo milk was procured from Naseeb Dairy, Raipur (C.G) and it was standardized to 6.0% fat and 9.0% SNF before product manufacture. Good quality commercial grade cane sugar was purchased from the local market of Raipur and used as sweetening agent. Fully matured *Aloe vera* leaves were procured from Department of Medicinal and Aromatic plants, Indira Gandhi Krishi Viswavidyalaya, Raipur (C.G).

Aloe vera juice extraction

In order to avoid contaminating the internal fillet with the yellow sap, traditional hand-filleting method was used for *Aloe vera* juice extraction (Avalos and Danhof, 2000; Ramachandra and Srinivasa Rao, 2008). In this method lower one inch of the leaf base, the tapering point (2–4 in.) of the leaf top, the short sharp spines located along the leaf margin are removed. The knife was then 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 with significant amount of mucilage remained attached were discarded. Thus, most of the "yellow sap" was discarded with the rind portions. The fillet was then washed with water to remove a majority of the deeper layer mucilage attached to the outer surface of the integral fillet. The fillet was chopped into cube and was grounded in a mixer; and it was then, filtered 3-4 times using muslin cloth. The filtrate was then, left for 24 h to decant at refrigeration condition. It was finally pasteurized and used.

Preparation of *khoa* and *peda*

Khoa and *peda* were prepared as per the methodology given by Gavhane *et al.* (2014) with slight modification; where in *Aloe vera* juice was incorporated at different levels (0%, 5%, 10%, 15% and 20%) during khoa pat formation stage.

The sugar was incorporated at constant level @ 30% by weight of khoa basis. Based on the sensory evaluation of *peda,* the level of *Aloe vera* incorporation was restricted to a maximum of 20% for final study. The treatment details were:

- T_0 - Buffalo milk *peda* (control)
- T_1 - khoa + *Aloe vera* juice@ 5 % on *khoa* weight basis.
- T_2 - khoa + *Aloe vera* juice@ 10 % on *khoa* weight basis.
- T_3 - khoa + *Aloe vera* juice@ 15 % on *khoa* weight basis and
- T_4 - khoa + *Aloe vera* juice@ 20% on *khoa* weight basis.

The entire process of Aloe Vera incorporated *peda* is depicted in Fig. 1.

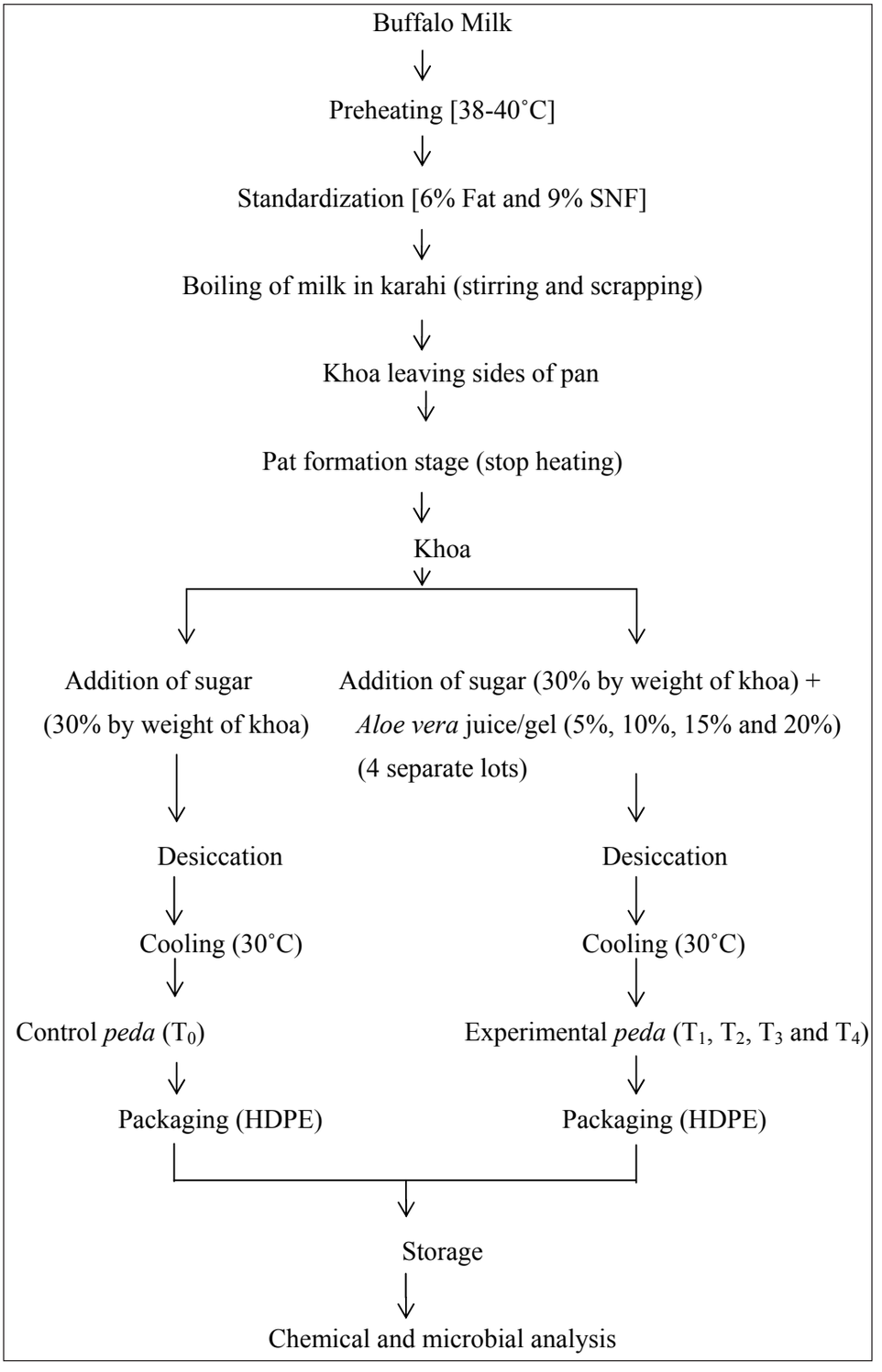


Fig. 1: Flow Chart For Preparation of *Aloe vera* Incorporated *Peda*

Storage study

The control and *Aloe vera* juice incorporated *peda* samples were packed in HDPE (Thickness is 98.5µm) and stored in incubator maintained at 37±1°C. The samples were subjected to chemical and microbial analysis on 0th, 3rd, 5th and 7th day except for protein, which was analysed on 0th and 7th day of storage.

Analysis

The *peda* samples were chemically analyzed for moisture (IS: 2785, 1964), acidity (IS, 18 Part (XI) (1981) and protein (Meneffee and Overman, 1940). Total plate count, yeast and mould counts were enumerated using standard procedure (ISI: 5402, 1969) and (ISI: 5402, 1969) respectively.

The samples were stored and subjected to chemical and microbial analysis. The experiment was replicated 4 times and the data were subjected to statistical analysis using Randomized Block Design with 5 treatments (1 control +4 mixed ratios).

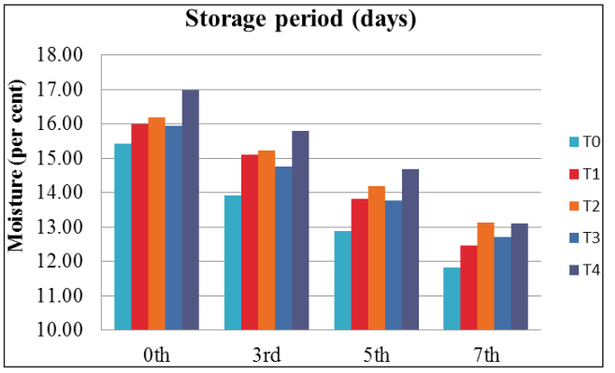
Statistical Analysis

RESULTS DISCUSSION

The effect of *Aloe vera* juice incorporation on chemical quality with respect to moisture, protein and acidity of *peda* were studied during storage at room temperature (37±1°C).

Effect of *Aloe vera* juice incorporation on moisture content of *peda* during storage at room temperature (37±1°C) is presented in Table 1. The statistical analysis, for samples stored at room temperature (37±1°C) revealed that the moisture content decreased significantly with increasing storage period and was significant (P≤0.05) at every storage period. It is evident that, for samples stored at room temperature, the control (T_0) had the lowest moisture of 13.50 per cent and differed significantly from experimental samples while, T_4 had the highest moisture of 15.13 per cent. The mean moisture per cent decreased from 16.10 on 0th day to 12.64 on 7th day. Yet the interaction between treatment and storage was found to be non-significant.

The decrease in moisture content in samples during storage might be attributed to partial evaporation of moisture. Jha *et al*. (2012) reported that moisture content of *lal peda* decreased from 12.0 to 9.75 per cent during storage at 37°C up to 9 days. Reddy (1990) also observed higher moisture loss during storage of *peda*. Londhe *et al*. (2012) studied the effect of packaging techniques on shelf life of brown *peda* and concluded that moisture content decreased during storage at 30±1°C.



The effect of *Aloe vera* juice incorporation on acidity of *peda* during storage is presented in Table 2. The data represent an increasing trend in acidity with increase in storage period. The high acidity gain in *Aloe vera* juice incorporated samples might be due to the high initial acid content of aloe juice. Further it may be due to change in chemical properties which are affected during storage. The present findings are in agreement with Sharma *et al.* (2003) who reported that the titrable acidity of malai *peda* (without packaging) increased from 0.32 to 0.84% after sixth day of storage at 32±1°C. Singh *et al.* (2012) reported that titrable acidity increased with increasing the level of *Aloe vera* juice from 0 to 15 per cent during manufacturing of Lassi.

The control (T_0) had the lowest acidity of 0.60 per cent, while, the sample T_4 had the highest acidity 0.75 per cent. The samples T_2 and T_3 were at par with each other. The a*vera*ge acidity per cent increased from 0.57on 0th day to 0.82 on 7th day. The statistical data revealed that during storage the acidity per cent increased significantly (P≤0.05) at every stage of

Table 1: Effect of *Aloe vera* juice incorporation on moisture content of the *peda* samples during storage at room temperature (37±1°C)

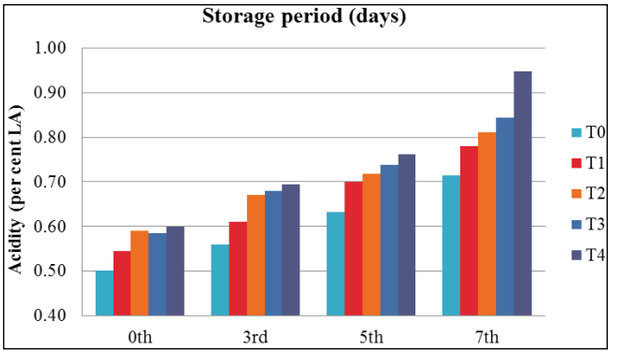
Treatments	Moisture (Per cent)				
	Storage Period in days (S)				
	0th Day	3rd Day	5th Day	7th Day	Mean of Treatments (T)
T_0	15.41	13.91	12.88	11.81	13.50
T_1	16.00	15.10	13.82	12.45	14.34
T_2	16.18	15.23	14.20	13.13	14.68
T_3	15.94	14.76	13.77	12.70	14.29
T_4	16.98	15.78	14.68	13.09	15.13
Mean of period (S)	16.10	14.96	13.87	12.64	
Statistical analysis					
Treatments	**MSS**	**F-Value**	**SE(m)**	**CD (5%)**	**CV (%)**
Treatment (T)	5.7276	42.766**	0.09	0.26	2.54
Storage period (S)	43.933	328.034**	0.08	0.23	
TxS	0.1277	0.953	0.18	NS	
Error	0.1339	—	—	—	

Table 2: Effect of *Aloe vera* juice incorporation on acidity content of the *peda* samples during storage at room temperature (37±1^{0}C)

Treatments	Acidity (Per cent LA)				
	Storage Period in days (S)				
	0th Day	3rd Day	5th Day	7th Day	Mean of Treatments (T)
T_0	0.50	0.56	0.63	0.72	0.60
T_1	0.54	0.61	0.70	0.78	0.66
T_2	0.59	0.67	0.72	0.81	0.70
T_3	0.59	0.68	0.74	0.84	0.71
T_4	0.60	0.69	0.76	0.95	0.75
Mean of period (S)	0.57	0.64	0.71	0.82	
Statistical analysis					
Treatments	**MSS**	**F-Value**	**SE(m)**	**CD (5%)**	**CV (%)**
Treatment (T)	0.0511	39.144**	0.01	0.03	5.26
Storage periods (S)	0.2324	178.010**	0.01	0.02	
TxS	0.0025	1.939	0.02	NS	
Error	0.0013	—	—	—	

storage interval. The interaction between treatment and storage was found to be non-significant (P≤0.05) on acidity of *peda* samples (Table 2).

The effect of *Aloe vera* juice incorporation on protein content of the *peda* samples during storage at room temperature (37±1°C) is presented in Table 3. The statistical data revealed that the protein was not affected by the incorporation of *Aloe vera* juice and storage period. It is also evident from the fact that the interaction effect of treatment and storage showed anon significant (P≤0.05) difference on protein content of *peda* samples.



Microbiological Quality

The effect of *Aloe vera* juice incorporation on microbial quality with respect to total plate and yeast and mould counts of *peda* were studied during storage at room temperature (37±1°C) and the results are discussed here.

Total plate count

The effect of storage period on control and *Aloe vera* juice incorporated *peda* samples is depicted in Table 4. The data represent a decreasing trend in total plate count (log_{10}cfu/g) of *peda* sample with increase in *Aloe vera* juice incorporation with an increasing trend with increase in storage period. The decrease in total plate count with increase in *Aloe vera* juice incorporation may be attributed to the fact that the *Aloe vera* juice contains anti-microbial, anti-fungal agents namely saponins, fatty acids, glucomannan and acemannan etc which have a barrier effect on bacterial growth. The control (T_0) had the highest total plate count 3.91 log_{10}cfu/g, while, T_4 had the lowest total plate count (3.58 log_{10}cfu/g).

The increasing trend in total plate count of *peda* samples with increase in storage period might be due to the proliferation of micro organisms during storage and also evident by the increase in the acidity during storage. Londhe *et al*. (2012) reported that total viable count increased during storage at 30°C. The rate of increase was higher in cardboard box lined with butter paper packed samples than packed in multilayer and vacuum packed samples. The total plate count increased from 3.65 log_{10}cfu/g on 0th day to 3.78 log_{10}cfu/g on 7th day.

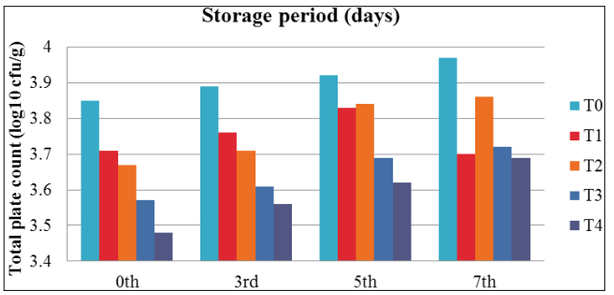
The total plate count of *peda* samples, prepared at different level of *Aloe vera* juice incorporation and storage period revealed that the total plate count of *peda* samples differed significantly ($p \leq 0.05$) between different level of *Aloe vera* juice incorporation and storage period. The interaction effect of treatment

Table 3: Effect of *Aloe vera* juice incorporation on protein content of the *peda* samples during storage at room temperature (37±1°C)

Treatments	Protein		
	Storage Period in days (S)		
	0th Day	7th Day	Mean of Treatments (T)
T_0	16.35	16.25	16.30
T_1	16.31	16.36	16.34
T_2	16.49	15.96	16.22
T_3	16.14	16.21	16.17
T_4	16.14	16.12	16.13
Mean of period (S)	16.28	16.18	

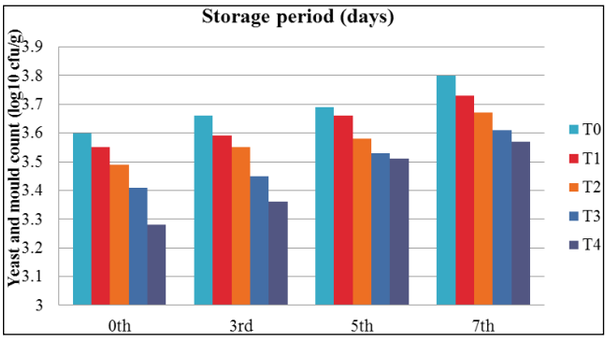
Statistical analysis					
Treatments	MSS	F- Value	SE(m)	CD (5%)	CV (%)
Treatment (T)	0.0581	0.202	0.19	NS	3.30
Storage period (S)	0.1189	0.414	0.12	NS	
TxS	0.1184	0.412	0.27	NS	
Error	0.2873	—	—	—	

and storage period had shown a non significant ($p \leq 0.05$) effect on total plate count (Table 4).



Yeast and mould count

Effect of *Aloe vera* juice incorporation on yeast and mould (log_{10}cfu/g) of *peda* samples during storage is presented in Table 5. The data represent a decreasing trend in yeast and mould count (log_{10}cfu/g) of *peda* sample with increase in *Aloe vera* juice incorporation. The control (T_0) had the highest yeast and mould count (3.68 log_{10}cfu/g) while, T_4 had the lowest yeast and mould count (3.43 log_{10}cfu/g). The decrease in yeast and mould count with increase in *Aloe vera* juice incorporation might be attributed to an *Aloe* protein (molecular mass 14KDa) known to be present in *Aloe vera* juice which has a potent antifungal property. Das *et al.* (2011) reported that the purified *Aloe* protein of 14KDa exhibited a potent anti-fungal activity against *Candida paraprilosis, Candida krusei* and *Candida albicans*. Nidiry *et al.* (2011) reported that aloin and *Aloe*-emodin are the two active principles, which contribute towards the antifungal property of *Aloe vera* juice.



The samples tested on 7th day of storage revealed that the control sample (T_0) had highest count of 3.80 log_{10}cfu/g compared to the *Aloe vera peda* samples, and T_4 had the lowest count of 3.57log_{10}cfu/g. The yeast and mould count of *peda* samples, prepared at

Table 4: Effect of *Aloe vera* juice incorporation on total plate count (log_{10}cfu/g) of the *peda* samples during storage at room temperature (37±1°C)

Treatments	Total plate count (log_{10}cfu/g)				
	Storage Period in days (S)				
	0th Day	3rd Day	5th Day	7th Day	Mean of Treatments (T)
T_0	3.85	3.89	3.92	3.97	3.91
T_1	3.71	3.76	3.83	3.70	3.75
T_2	3.67	3.71	3.84	3.86	3.77
T_3	3.57	3.61	3.69	3.72	3.65
T_4	3.48	3.56	3.62	3.69	3.58
Mean of period (S)	3.65	3.70	3.78	3.78	
	Statistical analysis				
Treatments	MSS	F-Value	SE (m)	CD (5%)	CV (%)
Treatment (T)	0.2558	89.939**	0.01	0.04	
Storage period (S)	0.1125	39.573**	0.01	0.03	1.42
TxS	0.0019	0.698	0.03	NS	
Error	0.0028	—	—	—	

Table 5: Effect of *Aloe vera* juice incorporation on yeast and mould count (log_{10}cfu/g) of the *peda* samples during storage at room temperature (37±1°C)

Treatments	Yeast and mould count (log_{10}cfu/g)				
	Storage Period in days (S)				
	0th Day	3rd Day	5th Day	7th Day	Mean of Treatments (T)
T_0	3.60	3.66	3.69	3.80	3.68
T_1	3.55	3.59	3.66	3.73	3.63
T_2	3.49	3.55	3.58	3.67	3.57
T_3	3.41	3.45	3.53	3.61	3.50
T_4	3.28	3.36	3.51	3.57	3.43
Mean of period (S)	3.46	3.52	3.59	3.67	
Statistical analysis					
Treatments	**MSS**	**F-Value**	**SE (m)**	**CD (5%)**	**CV (%)**
Treatment (T)	0.1693	50.838**	0.01	0.04	1.62
Storage period (S)	0.1674	50.245**	0.01	0.04	
TxS	0.003262	0.975	0.03	NS	
Error	0.0033	—	—	—	

different level of *Aloe vera* juice incorporation and storage period revealed that the yeast and mould count of *peda* samples differed significantly ($p \leq 0.05$) between different level of *Aloe vera* juice incorporation and storage period. The interaction effect of treatment and storage period had shown a non-significant ($p \leq 0.05$) effect on yeast and mould count (Table 5).

CONCLUSION

In present investigation, efforts were made to develop *Aloe vera* blended *peda* using khoa and *Aloe vera* juice. A decreasing trend in moisture content and increasing trend in acidity was observed over a storage period of 7 days. As *Aloe vera* juice incorporation level increased, total plate and yeast and mould counts decreased. The storage studies revealed that *Aloe vera* juice at 10 per cent level could be incorporated to produce good quality *peda* (sensory and microbial) without adversely affecting the chemical composition of finished product.

REFERENCES

Ahlawat, S.K. and Khatkar, S.B. 2011. Processing, food applications and safety of *Aloe vera* products: a review. *J Food Sci Technol*., **48**(5): 525–533.

Anonymous 2016. Global *Aloe-vera* Extract Market Outlook 2021http://www.researchandmarkets.com Accessed 21 February 2017.

Avalos, E.R. and Danhof, E.I. 2000. Method of processing *Aloe* leaves. U.S. patent application 6083508, July 4, 2000.

Boghani, A.H., Raheem, A. and Hashmi, S.I. 2012. Development and Storage Studies of Blended Papaya-*Aloe vera* Ready to Serve (RTS) Be*vera*ge. *J Food Process Technol*., 3: 185.

Christaki, E.V. and Florou-Paneri, P.C. 2010. *Aloe vera*: a plant for many uses. *J Food Agric Environ*., **8**(2): 245–249.

Das, S., Mishra, B., Gill, K., Md. Ashraf, S., Singh, K.A., Sinha, M., Sharma, S., Xess, I., Dalal, K., Singh, P.T. and Dey, S. 2011. Isolation and characterization of novel protein with anti-fungal and anti-inflammatory properties from *Aloe vera* leaf juice. *International Journal of Biological Macromolecules*, 48: 38–43.

Davis, R.H. 1997. *Aloe vera*- A scientific approach. Vantage Press Inc, New York, pp. 290–306.

FAO. 2016. Food outlook, biannual report on global food markets. Food and agriculture organisation of the united nations.

Gavhane, M.S., Kamble, N.S., Desale, R.J., Ghule, B.K. and Mule, P.R. 2014. Studies on preparation of *peda* with ginger powder. *Int J Food Agri Vet Sci*., **4**(2): 64-68.

IS, 18 Part (XI) 1981. Hand book of food analysis. Analysis of Dairy products. New Delhi: Bureau of Indian Standards.

IS: 2785 1964. Specification for Ice-Cream(Indian Standard Institution, Manak Bhavan,

ISI (1969) IS: 5402, Indian Standard Method for Plate Count of Bacteria in Food Stuffs (ManakBhavan, New Delhi-1).

ISI (1969) IS: 5403, Indian Standard Method for Yeast and Mould Count in Food Stuffs (Manak Bhavan, New Delhi-1)

Jha, A., Kumar, A., Jain, P., Om, H., Singh, R. and Bunkar, D.S. 2012. Physical-chemical and sensory changes during storage of *lal peda. J Food Sci Technol.,* **63**(5): 17-19.

Londhe, G., Pal, D. and Raju, P. 2012. Effect of packaging techniques on shelf life of brown *peda,* a milk based confection. *J. Food Sci and Technol.,* **47**(1): 117-125.

Meneffee, S.G. and Overman, O.R. 1940. A semi-micro kjeldhal method for determination of total nitrogen in milk. *J Dairy Sci.,* **23**(A): 143-147.

Nidiry, J.S.E., Ganeshan, G. and Lokesha, N.A. 2011. Antifungal activity of some extractives and constituents of *Aloe vera*. *Research Journal of Medicinal Plant*, **5**(2): 196-200.

Pugh, N., Ross, S.A., Sohly, M.A. and Pasco, D.S. 2001. Characterization of *Aloe* ride, a new high-molecular-weight polysaccharide from *Aloe vera* with potent immune stimulatory activity, *Journal of Agriculture and Food Chemistry*, **49**: 1030-1034.

Ramachandra, C.T. and Srinivasa Rao, P. 2008. Processing of *Aloe vera* leaf gel: a review. *Am J Agril. Biol. Sci.*, **3**(2): 502–510.

Reddy, C.R. and Rjorhia, G.S. 1990. Equilibrium Relative Humidity of khoa based Sweets (*Peda* and *Burfi*). *Asian J. Dairy Res.*, **9**(4): 200-204.

Sharma, H.K., Singhal, R.S. and Kulkarni, P.R. 2003. Effect of modified atmosphere packaging on the keeping quality of malai *peda*. *J. Food Sci. Technol.*, **40**(5): 543-545.

Singh, P.T., Kumari, S. and Sethi, S. 2012. Development of lassi containing *Aloe vera* juice and its quality characteristics. *J. Dairying, Foods & H.S.*, **31**(1): 1 - 4.

Valverde, J.M., Valero, D., Martinez-Romero, D., Guilln, F. and Castillo, S. 2005. Novel edible coating based on *Aloe vera* juice to maintain table grape quality and safety. *J Agric Food Chem.,* **53**: 7807-7813.

Volger, B.K. and Ernest, E. 1999. *Aloe vera*– a systematic review of its clinical effectiveness. *Br J Gen Pract.,* **49**: 823-828.