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Stability studies of sensory attributes of apricot pulp stored with chemical preservatives

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Abstract

The necessities of storage are very crucial aspects for better quality and shelf life of fruit pulp both at industrial and household level. In this study a locally grown Apricot variety (Halman) was selected and its pulp was given with chemicals treatment (Sodium Benzoate and Potassium Metabisulphite) in comparison with control samples and their various sensory parameters were studied during a storage period of 60 days under ambient temperature (28–32°C). All the quality parameters including colour, texture, taste, flavour, and overall acceptability were significantly ($p<0.05$) affected by both chemicals applied and storage period. Among the preservatives, Potassium metabisulphite and Sodium Benzoate at a concentrations of 500mg and both in combination (250mg PMS+ 250mg SB) were found to be most active in retaining overall organoleptic attributes and increasing the shelf life of apricot pulp up to 60 days without any spoilage. Thus, the apricot pulp could be preserved using optimized levels of chemical preservatives at household and industrial level.

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Introduction

Apricot (*Prunus armeniaca* L.) is the specie of Prunus, which can be classified with the Prunoidae subfamily Rosacea (Haydar *et al.* 2007). The global fresh production of apricot was 2,670,000 metric tons from 2000-2007. Turkey, Iran, Italy, Pakistan, France, Spain, Morocco, Syria, China, USA, Egypt and Greece are the most prominent countries where apricot production is extraordinary.

Turkey is the largest apricot producer with about 22 percent while other important producing countries include Iran (12.2%), Italy (7.3%) and Pakistan (6.7%) (Ercisli, 2009). This fruit is pleasant and having a charming aroma that's why it is consumed worldwide (Gutierrez *et al.* 2007). Nutritionally, apricot is a rich source of sugars, fibres, minerals, and vitamins (thiamine, riboflavin, niacin and pantothenic acid) (Sartaj *et al.* 2011). It also contains considerable amounts of carotenoids (in the form of b-carotene), and bioactive phytochemicals like chlorogenic, caffeic, p-coumaric and ferulic acids (Dragovic *et al.* 2007).

As a climacteric fruit apricot have a very little storage life (3-5 days) due to a high respiration rate and a rapid ripening process and also due to short time period from ripening to the degradation process (Egea *et al.* 2007; Agar and Polate, 1993). High respiration rate under natural conditions (El-Badawy and El-Salhy, 2011), and high moisture content and metabolic activities take place during post-harvest (Manning, 1996) also decreases its shelf life.

For longer preservation of fruits different preservation techniques exists aiming to slow down the changes that caused by foods deterioration, due to large number of physical, chemical, enzymatic as well as biological reactions (Gould, 2000).

Benzoic acid and sodium benzoate are considered to be harmless up to 0.1% which is the maximum permitted level. Sorbates are used in various foods because they are yeast and mold inhibitors. Sodium benzoate and potassium metabisulphite are commonly used for longer storage of fruit pulp because they have better antimicrobial activity and stops browning (Manganelli, Sofos and Busta, 1981; Lueck, 1990; Hussain *et al.* 2014). Calcium such as calcium chloride conserved the qualities of fruits, prevented physiological disorders and slows down the ripening process (Salunkhe and Desai, 1984).

The Codex Standards were adopted in Rome in 2001 and 2006 that defines maximum levels for the use of these chemicals in fruit preparations including pulp, purees and fruit. These are 1000mg/kg SB as benzoic acid and 500mg/kg PMS as residual SO_2 (Anonymous, 1995). However, exploitation of these preservatives may possesses danger to health and causes some emerging food borne diseases (Gibbons, 1992; Kaur and Arora, 1999; Akinpelu, 2001).

Numerous studies have found the effect of preservatives on sensory attributes of different fruits pulp. One study revealed that addition of SB and PMS adversely affects the sensory attributes of stored pulp but remained acceptable after 90 days of storage (Akhter *et al.* 2010). Hashmi *et al.* (2007) concluded that 0.2 % potassium metabisulphite helps in maintaining sensory characteristics of mango pulp packed in bulk plastic containers. Saini *et al.* (2000) observed that pulp preserved with potassium metabisulphite either individual or in combination with other preservatives maintains overall acceptability, nutrient stability and lessens the amount of microbes.

A similar study was conducted by Hussain *et al.* (2003) found sensory attributes of pulp samples were satisfactory up to 270 days of storage at ambient temperature. Although effect of preservatives on microbial and physicochemical parameters of apricot pulp has already been studied by Khattak *et al.* (2014) and Hussain *et al.* (2014) but the combined effect of storage and different chemicals on sensory attributes of Apricot pulp have not been reported yet. Henceforward, the present study was performed to enhance shelf life of apricot pulp by analyzing consequences of different preservatives on sensory properties of apricot pulp during storage.

Materials and Methods

The present study was conducted in the department of agriculture and food technology Karakoram international university Gilgit. The effect of two preservatives i.e. Sodium benzoate (SB) and Potassium Meta bisulphite (PMS) with different concentrations on sensory properties of chemically maintained apricot pulp was evaluated.

Chemicals

Two preservatives Sodium benzoate ($NaC_6H_5CO_2$) (Merck 6290) and Potassium metabisulphite ($K_2S_2O_5$) (Merck 106357) were purchased from dealers of local market.

Fruit sample

A local apricot variety (Halman) was selected for the present study. A fully ripened fruits were purchased from wholesale food market of Shigar Valley Gilgit-Baltistan. The fruit were selected on the basis of assessment of colour, ripeness, shapes, size or microbial damage. Fruit samples were placed into polyethylene bags and stored at 4°C until the analysis as described by Akin *et al.* (2008). After five days the fruit was washed thoroughly with distilled water in a pre-heated tray, to remove unwanted entities like dust, dirt, pesticides residues and surface microflora (Hussain *et al.* 2014). Then after pitting apricots were cut into two halves and were plunged in 1% citric acid solution as described by Kamal *et al.* (2015).

Apricot pulp preparation

After washing, the apricots were dried and processed immediately for the extraction of pulp. Pulp extraction was done with electric good quality blender. The fruit was crushed and pulp was separated by removing its stone. Extracted pulp was placed in water bath at a temperature of 82°C for 30 minutes as described by Hussain *et al.* (2014) and Khattak *et al.* (2014).

Treatment of preservatives

The homogenized pulp after extraction was given different pre-treatments that include.

T0= Controlled (No preservatives added)
T1= 500mg Potassium metabisulphite
T2=500mg Sodium Benzoate
T3= 250mg Potassium metabisulphite
T4= 250mg Sodium Benzoate
T5= 250mg Sodium Benzoate+250mg Potassium metabisulphite.

Packaging and storage conditions

The treated pulp (500g each) was transferred to sterilized glass bottles that were stored under ambient conditions (28–32°C) for a period of 60 days and analysis were carried out after every 20 days as described by Hussain *et al.* 2003; Hashmi *et al.* 2007; Akhter *et al.* 2010; Hussain *et al.* 2014.

Analysis of sensory attributes of apricot pulp

Ready to serve drinks were prepared from Both controlled and chemically preserved samples of apricot pulp and were presented to highly trained and skilful panel of judges for the evaluation of colour, taste, flavour, and overall acceptability in triplicate using a hedonic scale (HS) in accordance with the method described by Larmond (1977) modified by Basu *et al.* (2011).

The panel members (5 males and 5 females) were selected on the basis of their ability to discriminate and scale a wide-ranging sensory attributes of apricot pulp. Periodic analysis was done with the intervals of 0, 20, 40, and 60 days. The information contained on the sensory Performa given to the panel of judges was, 9=Like extremely, 8=Like very much, 7=Like moderately, 6=Like slightly, 5=Neither like or dislike, 4=Dislike slightly, 3=Dislike moderately, 2=Dislike very much, 1=Dislike extremely. The panellists expectorated the product. Sensory testing's were performed in the panel room which was completely free of dust, food, chemicals, odour, unnecessary sounds and mixing of day and light.

Statistical analysis

Data were analysed statistically, with the help of analysis of variance as pronounced by (Steel *et al.* 1997). XL Stat program for windows was used. Duncan's Multiple Range test was applied to calculate the difference between means (Duncan, 1955). Significance was clear at $p \leq 0.05$.

The experiment was repeated twice and the values are presented as means (SD±).

Results and discussion

In the present investigation the effect of different preservatives in retaining the sensorial attributes of stored apricot pulp was measured.

For these motives different concentrations of each preservative (500mg, 250mg) and in combination (250mg+250mg) as shown in Table 1, were inspected with controlled samples (without preservatives) for assessment.

Table 1. Treatment combinations (Mg/g) of various chemical preservatives used in apricot pulp.

Treatments	Sodium Benzoate (SB)	Potassium Metabisulphite (PMS)
To	---	---
T1	----	500mg
T2	500mg	
T3	----	250mg
T4	250mg	----
T5	250mg	250mg

Effect of preservatives on colour of apricot pulp

A significant quality parameter that attracts eyes of consumer towards the product is colour, which is ensured by visual examination. Statistical analysis of this study revealed that treatment and storage effect on colour of all the samples were significant ($p<0.05$). During the initial day, addition of preservatives in all the treated samples showed slight decrease in sensory attributes of apricot pulp. Periodical analysis showed a rapid decline in colour scores of all controlled samples while least decrease was found in samples treated with chemical preservatives during storage of 60 days where T1 (8.04) and T5 (8.21) showed lowest decrease and To (4.55) showed maximum decrease in colour scores of apricot pulp.

Table 2. Effect of preservatives on colour of apricot pulp.

Treatments	Days				
	Initial	20	40	60	Mean
To	8.73	6.25	3.24	00	4.55^{d}
T1	8.25	8.18	7.92	7.83	8.04^{b}
T2	8.27	7.72	7.47	7.32	7.69^{bc}
T3	8.12	7.76	7.45	7.25	7.64^{bc}
T4	8.11	7.67	7.35	7.22	7.58^{c}
T5	8.15	8.11	8.4	8.2	8.21^{a}
Mean	8.27^{a}	7.61^{ab}	6.97^{b}	6.30^{c}	

To=control, T1=500mg PMS, T2=500mg SB, T3=250mg PMS, T4=250mg SB, T5=250mg PMS+250mg SB**.** The data shown in the table represents in triplicate. Means (± SD) sharing similar superscripts are statistically non-significant ($p<0.05$).

The experimental outcomes indicated Potassium Metabisulphite at the concentration of 500 mg showed minimum decrease in colour pulp samples, these are followed by 250mg SB+250 mg PMB as shown in (Table 2). The similar results concerning decline in colour of pulp were also obtained by Durrani *et al.* (2011), Akhter *et al.* (2010) and Hashmi *et al.* (2007) in mango pulp, Gliemmo *et al.*, (2009) in pumpkin puree, Kotecha and Kadam (2003) in tamarind pulp and Barmanray (1998) in mango RTS beverage blended in cold extracted pear juice/pulp.

The colour of the pulp may be dwindled due to Maillard reaction during storage (Saini *et al.* 2000) or due to carotenoid content and its disappearance in slow rate (Shinde *et al.* 2012). According to Heikal and El-Sidawi (1972), reducing sugars and amino acids assists browning of fruit pulp during storage.

Table 3. Effect of preservatives on texture of apricot pulp.

Treatments	Days				
	Initial	20	40	60	Mean
To	7.51	6.24	3.43	00	4.29^{c}
T1	7.51	7.43	7.32	7.29	7.38^{b}
T2	7.45	7.41	7.37	7.27	7.37^{b}
T3	7.43	7.39	7.25	7.11	7.29^{b}
T4	7.47	7.31	7.29	7.22	7.32^{b}
T5	7.49	7.41	7.36	7.31	7.39^{a}
Mean	7.47^{a}	7.19^{a}	6.67^{ba}	6.03^{c}	

To=control, T1=500mg PMS, T2=500mg SB, T3=250mg PMS, T4=250mg SB, T5=250mg PMS+250mg SB**.** The data shown in the table represents in triplicate. Means (± SD) sharing similar superscripts are statistically non-significant ($p<0.05$).

Effect of preservatives on texture of apricot pulp

Other than colour, another prime quality parameter to entice the consumers is texture of a product. Statistical inquiry of the present investigation revealed that treatment and storage outcomes on textural properties of all the samples were significant ($p<0.05$).

Together the treatment and storage time showed a decreasing trend in texture scores of apricot pulp. Highest mean treatment score was attained by T5 (7.39) and T1 (7.38) these are followed by T2 (7.37), T4 (7.32), and T3 (7.29) while minimum was recorded for To (4.29). A gradual decrease in texture score ranging 7.47 to 6.03 was observed periodically during storage period of 60 days.

Table 4. Effect of preservatives on taste of apricot pulp.

Treatments	Days				
	Initial	20	40	60	Mean
To	9.73	6.25	3.12	00	4.77^{d}
T1	9.65	9.4	9.12	8.45	9.15^{a}
T2	9.67	8.65	7.45	7.35	8.28^{b}
T3	8.95	7.71	7.4	7.25	7.82^{cb}
T4	8.17	7.69	7.5	7.22	7.64^{c}
T5	9.67	9.35	8.96	8.35	9.08^{a}
Mean	9.30^{a}	8.17^{a}	7.25^{b}	6.43^{c}	

To=control, T1=500mg PMS, T2=500mg SB, T3=250mg PMS, T4=250mg SB, T5=250mg PMS+250mg SB**.** The data shown in the table represents in triplicate. Means (± SD) sharing similar superscripts are statistically non-significant ($p<0.05$).

The experimental outcomes indicated that both Potassium metabisulphite and sodium benzoate at different concentrations showed minimum decrease in texture scores as compared to the controlled samples of stored apricot pulp. These findings pertaining to decrease in texture were also obtained by Shinde *et al.* (2012), in mango pulp, Deka *et al.* (2005) in mango pineapple and Deka *et al.* (2004) in lime aonla RTS beverages which were stored for six months.

Effect of preservatives on taste of apricot pulp

A sense of taste is principally associated with organic acid and sugars ratio. Taste is apparent by specific taste buds which are present in tongue.

Statistical investigation of this examination revealed that treatment and storage effect on taste of all the samples were also significant ($p<0.05$). Both treatment and storage effect of chemical preservatives showed decrease in taste scores of apricot pulp**.**

Maximum decrease in taste was found in controlled samples while minimum decrease was found in samples treated with chemical preservatives during 60 days of storage where T1 (9.15), T2 (8.28) and T5 (9.08) showed minimum decrease and To (4.77) showed maximum decrease in taste scores of apricot pulp.

Table 5. Effect of preservatives on flavour of apricot pulp.

Treatments	Days				
	Initial	20	40	60	Mean
To	9.41	7.13	4.11	00	5.16^{c}
T1	9.12	9.1	8.76	8.48	8.86^{a}
T2	8.91	7.76	7.22	7.11	7.75^{ba}
T3	8.95	7.77	7.12	7.1	7.73^{ba}
T4	9.12	7.59	7.32	7.14	7.79^{ba}
T5	9.35	9.15	8.87	8.38	8.93^{a}
Mean	9.14^{a}	8.08^{b}	7.23^{c}	6.36^{d}	

To=control, T1=500mg PMS, T2=500mg SB, T3=250mg PMS, T4=250mg SB, T5=250mg PMS+250mg SB**.** The data shown in the table represents in triplicate. Means (± SD) sharing similar superscripts are statistically non-significant ($p<0.05$).

Table 6. Effect of preservatives on overall acceptability of apricot pulp.

Treatments	Days				
	Initial	20	40	60	Mean
To	9.82	6.11	3.12	00	4.76^{c}
T1	9.75	9.43	9.21	9.17	9.39^{a}
T2	9.56	9.31	9.17	8.98	9.25^{a}
T3	9.67	9.44	9.21	8.95	9.31^{a}
T4	9.45	9.12	8.88	8.52	8.99^{b}
T5	9.71	9.62	9.44	9.17	9.48^{a}
Mean	9.66^{a}	8.83^{a}	8.17^{b}	7.46^{c}	

To=control, T1=500mg PMS, T2=500mg SB, T3=250mg PMS, T4=250mg SB, T5=250mg PMS+250mg SB**.** The data shown in the table represents in triplicate. Means (± SD) sharing similar superscripts are statistically non-significant ($p<0.05$).

The experimental results indicated both Potassium Metabisulphite and sodium benzoate both at the concentration of 500 mg showed minimum decrease in taste of the chemically treated pulp samples, these are followed by 250mg SB+250 mg PMB as shown in (Table 4). Similar findings regarding decrease in taste were obtained by Shinde *et al.* (2012), Akhter *et al.* (2010) in mango pulp, Deka *et al.* (2005) in mango pineapple and Deka *et al.* (2004) in lime-aonla RTS beverages stored for six months.

Effect of preservatives on flavour of apricot pulp

The chemical sense or combination of taste and aroma gives flavour which is important sensory impression of food and other products. Results of this enquiry indicated that both treatment and storage effect of chemical preservatives showed decrease in flavour of apricot pulp (Table 5)**.** Mean treatment scores for flavour of apricot pulp ranged from 5.16 to

8.93 and mean storage scores were ranged from 9.14 to 6.36. Maximum decrease in flavour was found in controlled samples while minimum decrease was found in samples treated with chemical preservatives during the entire storage period of 60 days where T1 (8.86), and T5 (8.93) showed minimum decrease in taste and To (5.93) showed maximum decrease in flavour of apricot pulp.

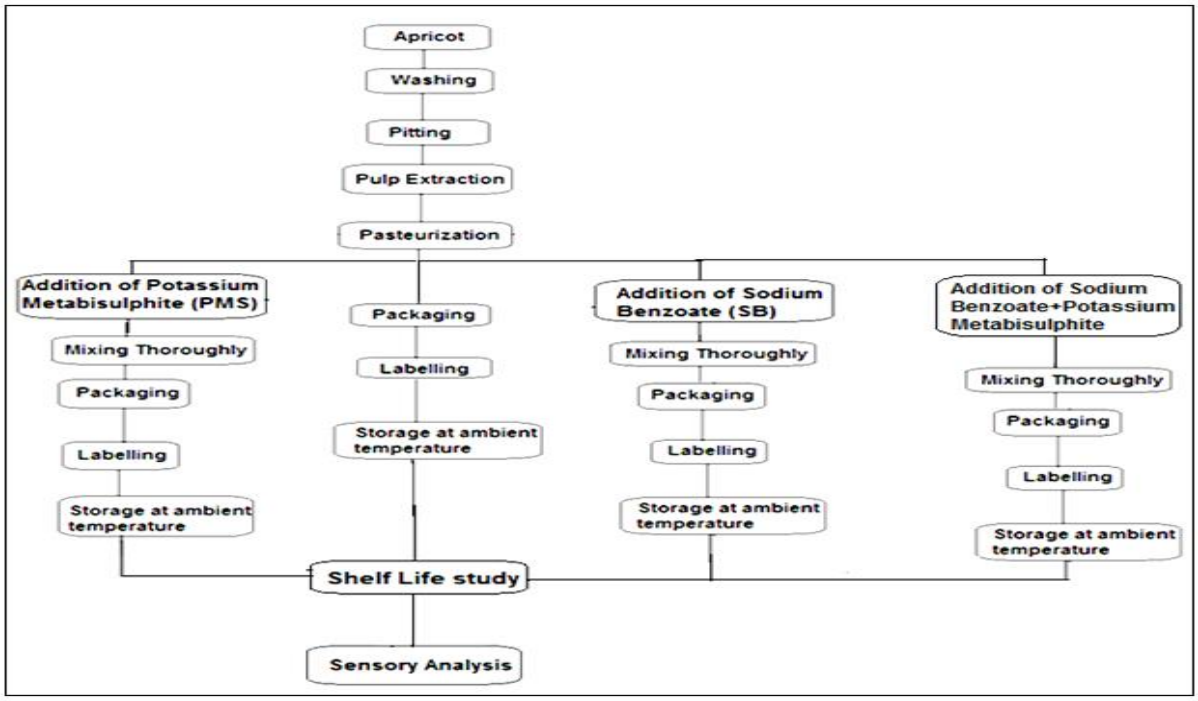

Fig. 1. Flow chart for the preparation of apricot pulp.

The experimental results indicated Potassium Metabisulphite and sodium benzoate at the concentration of 500mg showed minimum decrease in flavour of the chemically treated pulp samples, these are followed by 250mg SB+250mg PMB.

Decrease in flavour is due to oxidation process of some flavour enhancing compounds like, aldehydes, ketones, acids, tannins and ethers (Shinde *et al.* 2012). Similar results of decrease in flavour were found by Hussain *et al.* (2003), Hashmi *et al.* (2007) in mango pulp, Ledekar (2008) in mango puree and sorbet, Correa *et al.* (2010) in guava nectar and Durrani *et al.* (2011).

Effect of preservatives on overall acceptability of apricot pulp

Storage period and treatment had a significant ($p<0.05$) effect on over all acceptability of apricot pulp which indicates the magnitude of the acceptability difference (Table 6).

The mean scores for overall acceptability of controlled apricot pulp samples decreased highly during storage while decreased slightly in chemically treated samples during storage as presented in table 5. Overall acceptability of pulp treated with T1 (9.39), T2 (9.25), T3 (9.31), and T5 (9.48) showed maximum scores while To (4.76) showed minimum scores respectively that indicates both Potassium Metabisulphite and sodium benzoate at different concentrations to be best in retaining overall acceptability of apricot pulp during storage. These results are in complete agreement with Ayub *et al.* (2010); Akhter *et al.* (2010) and Kinh *et al.* (2001). Saini *et al.* (2000) observed that pulp preserved with potassium metabisulphite either individual or in combination with other preservatives upholds overall acceptability, nutrient constancy and insufficient amount of microbes. In one study pulp of chunsa mango tested for various sensory attributes was given with high acceptability scores by the judges after 90 days of storage (Akhtar *et al.* 2010).

In another study mango pulp samples were also suitable up to 270 days of storage at ambient temperature (Hussain *et al.* 2003). Studies of Durrani *et al.* (2011) confirms that pulp preserved with addition of KMS, PS or the combination of both in addition with CA are best to retain colour, flavour and odour during storage period of 40 and 60 days.

The literature studied from different investigations carried out globally is in complete agreement with the findings of this study about the effect of chemical preservatives on the sensorial parameters of apricot pulp. However, there might be possibility of some variation in these results due to climatic conditions.

Conclusion

From the present study it is reasonable to conclude that potassium metabisulphite and sodium benzoate alone or in combination with each other impeded the declining of sensorial attributes of apricot pulp to some extent and the pulp was remained accepted for the consumer even after 60 days at ambient temperature (28–32°C). Both potassium metabisulphite (PMS) and sodium benzoate (SB) should be used in apricot pulp for longer storage, for the reason that these two preservatives significantly helped in upholding quality attributes. It is advocated that potassium metabisulphite and sodium benzoate at a concentration of 500mg individually or in amalgamation with each other (250mg SB+250mg PMS) are preeminent in retaining sensory attributes of apricot pulp during storage.

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