Novelty Journals

International Journal of Novel Research in Life Sciences
Vol. 1, Issue 2, pp: (17-23), Month: November-December 2014, Available at: www.noveltyjournals.com

Analysis of Physicochemical Stability of Apricot Pulp Stored With Chemical Preservatives

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Abstract: **Apricot pulp is a perishable product and the pulp has a short shelf life (3-5 days) at ambient temperature, and hardly 2-4 weeks at cold storage. Hence, the preservation of the pulp for quality retention and to extend the storage shelf life is important consideration. In this work Storage stability of Apricot pulp (Ap) was determined at room temperature (30-42ºC in the dark), with the addition of Sodium benzoate (SB) and Potassium Meta bi-sulphite (PMS) at various concentrations during storage. The Apricot variety (Halman) was selected for the present study. Apricot was uniformly ripened. Pulp was extracted and preserved by chemical preservatives such as Sodium Benzoate (SB), and Potassium Meta-Bisulphate (PMS) at different concentrations. The physic chemical parameters (pH, TSS, Acidity, Reducing sugar and Ash) were analyzed periodically for a period of 60 days. The experiments were carried out with seven treatments. Among the chemical preservatives evaluated, the pulp samples treated with sodium benzoate and potassium meta bisulphate shows stability for physicochemical analysis in comparison to controlled treatments where pH, TSS, Reducing Sugar and Ash content were significantly increased while acidity decreased during storage period of 60 days. The pulp samples treated with these preservatives delayed the increase in reducing sugars and thus prevented browning of pulp during storage. This study confirmed that both Sodium benzoate and potassium metabisulphite (at 500 ppm concentration) were identified as suitable preservatives to retain the quality and extend the storage shelf life of apricot pulp up to 60 days.**

Keywords: **Apricot, Pulp, Chemical preservatives, Physicochemical analysis, Storage, Spoilage.**

I. INTRODUCTION

Apricot (*Prunus armeniaca*) is one of the stone fruit belongs to the family Rosaceae. The edible portion of apricot fruit is the expanded mesocarp of the ovary wall. The pit or stone is its endocarp and the skin is exocarp. Endocarp contains stone or the true seed of apricot. The fruit is smooth, orange or yellow which can be eaten raw as well as canned and dried (Hudson *et al*. 1981). It is one the precious fruits and its World annual production is 12%, (579,000 tones) (Anonymous 2003). Production of Apricot is extended almost all over the world, but turkey and Iran, are the world's largest producers of apricot with 20% and 10% of world apricot production. The United States of America having 3% of world production and ranks 9th after Pakistan (5%), Italy (5%), Syria (4%), Spain (4%), France and Morocco (3%).

Production of apricot in Pakistan is 1, 29,652 tones on area of 13,758 hectares and accounts 5% production ranking 4th largest apricot producing country in the world. In Pakistan apricot grown have very shorter shelf life due to higher moisture content, which cannot be easily extended with different techniques even with cold storage.

Being perishable fruit Apricot have storage life of (3-5 days) at ambient temperature, and hardly 2-4 weeks at cold storage. The short storage life of apricot is due to short time period from commercial ripening to the degradation process

characteristic like senescence (Egea *et al*., 2007). Calcium (such as Calcium Chloride) keeps up the qualities of fruits. It prevents physiological disorders, lessens the solubilization of pectic substance, reduced the rate of respiration, and slows down the ripening process maintaining the firmness (Salunkhe and Desai 1984). Different value added products can be manufactured with apricot like frozen apricot, jam, nectar, jelly, marmalade, juice, extrusion products etc. Moreover, kernel is the important part of apricot which can be used in the production of different oils, cosmetics, and aroma perfumes (Yıldız, 1994).

There exist numerous methods to preserve apricot pulp however chemical preservation is considered to be the economical among all methods of preservation and is general in Pakistan. Chemical preservatives are used to prevent food spoilage due to microbial attack and besides that preservatives especially (SB & PMS) may sometimes disapprovingly effect its physico chemical features and sensory sketch (Saeed Akhter *et al*, 2010).

Researchers found that addition of preservatives have influence on physico chemical characteristics of mango pulp caused an increase in acidity, TSS (Brix), Reducing sugars and decrease in sucrose (Hussain *et al*, 2003).

The supreme usage levels of these chemical preservatives in fruit products like pulp, jam, purees, and squashes should be followed by the recommendations 1000mg/kg SB as benzoic acid and 500mg/kg PMS as residual SO2 described in a Codex Standards in 2001 and 2006 (Codex Standards, 1995). Careless and inappropriate use of these preservatives is alarming to the health and wellbeing of users and also causes the appearance of resistant microorganisms leading to initializing food borne diseases (Gibbons, 1992, Kaur & Arora, 1999, Akinpelu, 2001).

Therefore a study was conducted in the Department of Agriculture and Food Technology Karakorum international university, Gilgit. Apricot is one of the major fruits of Pakistan particularly in Gilgit-Baltistan. This fruit is important nutritionally, economically and health point of sight. Having high moisture content and with much juicy nature apricot pulp has considered to be shortest shelf life. So, struggle has been made in the present inquiry to check the physico chemical attributes of apricot pulp by employing nontoxic preservatives.

II. METHOD AND MATERIAL

Materials Requirements:

Ripened Apricot fruit (Halman) uniform in size, color and weight was obtained from Shigar valley of Gilgit Baltistan and brought to food science laboratory of the institute. Fore mostly unwanted particles like dust, dirt, pesticides residues and micro flora on the surface of fruit was removed. The fruit was placed and washed in water filled pre-heated trays and washed thoroughly. Two preservatives including) potassium Metabisulphite ($K_2S_2O_5$) (Merck 106357) and sodium benzoate ($NaC_6H_5CO_2$) (Merck 6290 were obtained from local market.

Extraction Packaging and Storage of pulp:

The washed apricots were dried and then processed immediately for extraction of pulp. For pulp extraction electric blender of good quality was used, pulp was separated from the stones of fruit. The extracted pulp was then pasteurized. Pulp was placed in water bath at a temperature of 82^{o}C for 30 minutes as described by Ahmad *et al* 2014, to reduce the microbial load. After pasteurization chemical preservatives as per treatment combination presented in (Table1) was mixed with extracted pulp. Sterilized glass bottles were filled with treated pulp samples (250mg each) and stored under ambient conditions (30-40^{o}C) in the dark for 60 days of storage. The stored pulp samples were evaluated periodically for physico-chemical properties with 20 days of interval.

Analysis of Physico-Chemical Parameters:

For the Analysis of Physico-Chemical Parameters (TSS, pH, Reducing sugars, and Acidity) of stored apricot pulp, following methods (Anon, 2003) were employed. TSS were determined directly in each sample by using Refracto meter (Atago 3810-Japan) and expressed as Brix. pH was determined (Jenway 3510-UK), (Anon 2000) using digital pH meter following the method of AOAC. Reducing Sugars of stored apricot pulp was determined by adopting the method of AOAC. Acidity was determined by preparing normal solution of 0.1 NaOH and titrated against base (Anon, 2000).

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Statistical Analysis:

Data were statistically analyzed with variance analysis as described by (Steel *et al*., 1997). The differences between means were check by Duncan's Multiple Range test (Duncan, 1955) and significance was defined at $p \leq 0.05$.

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

Treatments	Sodium Benzoate (SB)	Potassium Metabisulphite (PMS)
T0	---	---
T1	500mg	
T2	---	500mg
T3	250mg	---
T4	---	250mg
T5	125mg	---
T6	---	125mg

III. RESULTS AND DISCUSSION

The present study was conducted to examine effect of different preservatives in retaining physico chemical attributes of stored apricot pulp. For these reasons different concentrations of each preservative (125mg, 250mg and 500mg) were investigated with Controlled samples (without preservatives) for assessment. This study revealed that addition of chemical preservatives exhibited a significant ($p<0.05$) effect on physico-chemical properties of apricot pulp. During the first day, addition of preservatives in all the treated samples showed slight decrease in TSS of apricot pulp, where Sodium Benzoate and Potassium Metabisulphite at the concentration of 125ppm showed maximum decrease in Total Soluble Solids (TSS) of the chemically treated pulp samples as shown in (Table 2). Addition of preservatives in all the treated samples showed no effect on pH of the samples during initial day of treatment as shown in (Table 3). Nevertheless treatment effect showed slight decrease in acidity in all samples where Sodium Benzoate at concentration of 500ppm and Potassium Metabisulphite at 125ppm showed maximum decrease in acidity (Table 4). Treatment effect showed decrease in reducing sugar of the samples (Table 5) where maximum decrease was shown by samples treated with 125ppm PMS, while minimum decrease were noticed in samples treated with 500ppm PMS and SB. None of the preservatives showed significant effect on ash content of the samples during initial day of treatment (Table 6).

Storage time had shown a speaking effect on physico-chemical properties of chemically preserved apricot pulp. Progressive rise in Total Soluble Solids, pH, Reducing sugar, and Ash content of chemically preserved apricot pulp was observed during the entire period of 60 days with decreased acidity. It could be evident from the results that the control sample T0 (no preservatives added) showed highest level of spoilage among the apricot pulp samples after 60 days, whereas, no spoilage was observed in the presence of both Sodium Benzoate and Potassium Metabisulphite at various concentrations in stored apricot pulp.

Treatment effect and Storage time both showed a speaking effect on physico chemical properties of chemically preserved apricot pulp. Preservatives showed slight decrease in Total Soluble Solids of all samples during the initial day of treatment while increase in TSS of pulp samples was observed over the entire storage period of 60 days. Increase in TSS of fruits during storage was confirmed by several researchers (Arthey & Phillip 2005; Saeed Akhter *et al*., 2010).

Upper level holding of Total Soluble Solids is owing to unhurried alteration in cell wall arrangement and breakdown in to simple sugars (Arthey & Phillip 2005). Due to higher temperature and reverse of sucrose in to glucose and fructose may cause the rise in TSS in pulp. On the other hand the high sugar content of pulps from ripe fruits might be associated with the conversion of starch into soluble sugars by phosphorylase enzyme during the process of ripening (Germain & Linden, 1981; Favier *et al*., 1993).

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Another study shows that the increase of TSS in fruits might be associated with delay in ripening process in modified atmosphere having lower ethylene level and decrease in respiration or other metabolic processes during storage (Saira Ishaq *et al*., 2009).

Addition of preservatives did not showed any effect on pH of pulp during the initial day of treatment while preservatives showed increase in pH of apricot pulp during storage of 60 days (Table 3). These results relating to increase in pH of apricot pulp is complete agreement with (M. Ayub *et al*., 2007) that checked the effect of sucrose and potassium metabisulfite on the physico chemical and microbiological analysis of apricot pulp. Studies revealed that pH plays an important role in fruits by acting as a flavor up gradation and preservative element. Our results are also same with Anwar *et al* who noticed increase in pH of some orange varieties with time. Cepeda *et al*., 1993 also reported increased pH in Valencia late orange variety.

It is confirmed from our investigation that preservatives greatly affect acidity of apricot pulp. Our studies shows decrease in acidity of apricot pulp during initial day of treatment and storage period of 60 days (Table 4) Results fo the present investigation are complete agreement with M. Ayub *et al.*, 2007 that showed decrease in acidity of apricot pulp during storage. The rise in pH of fruit pulp samples proportional to fall in acidity has been confirmed by several researchers. (M. Ayub *et al*., 2007). Our results are also an agreement with Shipra Shaklani and H.R Sharma 2009, who also showed decrease in acidity while describing the formulation of squash developed from sea buckthorn and mango pulp. Decrease in acidity may be attributed to the involvement of organic acids in the hydrolysis of sugars and its interactions with other constituents of the squash there by resulting in neutralization of acids during storage (ShipraShaklani and H.R Sharma 2009). Anwar, *et al* showed that acidity of some orange varieties decreases with time that is attributed to accumulation of sugars in the juice.

Addition of preservatives greatly affects reducing sugar of apricot pulp. Our studies revealed slight decrease in reducing sugar during the initial day of treatment while increase in reducing sugar in all samples of apricot pulp were noticed during storage period of 60 days (Table 5). Results of the present study are completely agreement with M. Ayub *et al*., 2007. Increase in reducing sugars of fruits pulp and juices during storage were confirmed by several researchers. (Islam, 1986; Iqbal, 1993).

Our results are also agreement with Ruiz Nieto *et al*., 1997 who showed an increase in glucose and fructose and the increase in reducing sugar is due to the conversion of sucrose to reducing sugars (glucose & fructose etc. Another study suggests increase in reducing sugar may be due to acids and higher temperature in mango pulp (Islam, 1986). Studies of (Iqbal, 1993) also showed that increase in reducing sugars was due to the conversion of sucrose to glucose and fructose and so on.

Addition of preservatives did not showed any effect on ash content during the initial day of treatment while preservatives to a great extent affects ash content of apricot pulp during storage. Our studies showed increased ash content in apricot pulp during storage period of 60 days (Table 6). Similar results were obtained by Saeed Akhter *et al*., 2010 showed increase in ash content of chemically preserved mango pulp stored under ambient temperature for 90 days.

(Table: 2) Treatment and storage effect of preservatives on TSS (Brix) of apricot pulp

Treatments		**Days**			
	Initial	**20**	**40**	**60**	**Mean**
T0	**12.5**	**13.5**	**15.6**	**17.6**	**14.67**
T1	**12.2**	**12.5**	**13**	**13.5**	**12.8**
T2	**12.3**	**12.9**	**13**	**13.5**	**12.92**
T3	**11.9**	**12.5**	**13**	**13.5**	**12.72**
T4	**11.5**	**12.9**	**13**	**13.5**	**12.72**
T5	**12.1**	**11**	**11**	**11.5**	**11.4**
T6	**10.5**	**11**	**11**	**11.5**	**11**
Mean	**11.85**	**11.32**	**12.8**	**13.51**	

T0=control, T1= 500ppm SB, T2=500 ppm PMS, T3=250 ppm SB, T4=250 ppm PMS, T5=125 ppm SB, T6=125ppm PMS.

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(Table: 3) Treatment and storage effect of preservatives on pH of apricot pulp

Treatments		Days			
	Initial	20	40	60	Mean
T0	4.43	5.33	6.55	6.95	5.81
T1	4.44	4.54	4.8	5.1	4.72
T2	4.46	4.52	4.83	5.11	4.73
T3	4.44	4.55	4.81	5.15	4.73
T4	4.45	4.57	4.85	5.16	4.75
T5	4.46	4.59	4.87	5.15	4.76
T6	4.47	4.58	4.88	5.17	4.77
Mean	4.45	4.66	5.08	5.39	

T0=control, T1= 500ppm SB, T2=500 ppm PMS, T3=250 ppm SB, T4=250 ppm PMS, T5=125 ppm SB, T6=125ppm PMS.

(Table: 4) Treatment and storage effect of preservatives on total titratable acidity of apricot pulp

Treatments		Days			
	Initial	20	40	60	Mean
T0	0.24	0.22	0.19	0.17	0.21
T1	0.24	0.19	0.15	0.13	0.17
T2	0.24	0.18	0.17	0.16	0.18
T3	0.23	0.19	0.16	0.14	0.18
T4	0.23	0.19	0.15	0.14	0.18
T5	0.23	0.18	0.16	0.14	0.18
T6	0.22	0.17	0.14	0.14	0.17
Mean	0.23	0.18	0.16	0.14	

T0=control, T1= 500ppm SB, T2=500 ppm PMS, T3=250 ppm SB, T4=250 ppm PMS, T5=125 ppm SB, T6=125ppm PMS.

(Table: 5) Treatment and storage effect of preservatives on reducing sugar of apricot pulp

Treatments		Days			
	Initial	20	40	60	Mean
T0	6.66	10.52	15.01	18.76	12.73
T1	6.88	7.56	8.1	9.2	7.93
T2	6.89	7.88	8.55	9.22	8.13
T3	6.84	7.68	7.88	12.5	8.72
T4	6.84	8.1	8.1	12	8.76
T5	6.8	8.32	7.68	10.7	8.37
T6	6.75	7.88	8.68	9.38	9.92
Mean	6.80	8.27	9.14	11.68	

T0=control, T1= 500ppm SB, T2=500 ppm PMS, T3=250 ppm SB, T4=250 ppm PMS, T5=125 ppm SB, T6=125ppm PMS.

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(Table: 6) Treatment and storage effect of preservatives on ash content of apricot pulp

Treatments		Days			
	Initial	20	40	60	Mean
T0	0.68	0.82	0.93	0.99	0.85
T1	0.68	0.74	0.82	0.89	0.78
T2	0.68	0.72	0.78	0.86	0.76
T3	0.69	0.74	0.77	0.93	0.78
T4	0.69	0.74	0.79	0.83	0.76
T5	0.68	0.75	0.78	0.82	0.76
T6	0.68	0.78	0.82	0.84	0.78
Mean	0.68	0.76	0.81	0.88	

T0=control, T1= 500ppm SB, T2=500 ppm PMS, T3=250 ppm SB, T4=250 ppm PMS, T5=125 ppm SB, T6=125ppm PMS.

IV. CONCLUSION

Efforts made in the present investigation depict effects of two chemical preservatives i.e., Sodium Benzoate (SB) and potassium metabisulphite (PMS) on physico chemical properties in the apricot pulp stored under ambient temperature for 60 days. It was concluded from this research that both PMS and SB should be used in apricot pulp for longer storage, because these two preservatives significantly helped in maintaining quality attributes. The work done in this research may facilitate development of environmental and health friendly storage of apricot pulp at industrial scale. Both Sodium benzoate and potassium metabisulphite (at 500 ppm concentration) were identified as suitable preservatives to retain the quality and extend the storage shelf life of apricot pulp up to 60 days. This study suggests that utilization of these preservatives may be also helpful to further retain microbial and organoleptic attributes of apricot pulp and other value added products like apricot wine, necters, jams, purees and squashes.

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