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Impact of Chemical Preservatives on Chemical, Microbial and Sensorial Quality of Mango pulp during storage

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Abstract: The research was carried out to investigate the effect of chemical stabilizers on the chemical, microbial and sensorial quality of mango pulp during storage in the year 2011-12. For this reason, mango fruits (cv. Sindhri) were obtained from orchard near Tandojam and brought to the Institute of Food Sciences and Technology, Faculty of Crop Production, Sindh Agriculture University, Tandojam. Mango pulp was prepared and distributed into three equal parts (two parts were used for treatments and one for control). During storage (90 days) the pulp was examined for chemical, microbial and sensorial characteristics after an interval of every 15 days. The results revealed that mango pulp treated with KMS (0.35g /500g) showed significantly higher score for pH, TSS, color, taste, texture, flavor, overall acceptability and in TVC comparatively to mango pulp treated with SB (0.35g/500g). It is further determined that samples of mango pulp treated with preservatives (KMS and SB) were obtained most suitable in pH, TSS, color, taste, texture, flavor overall acceptability and in TVC as compare to mango pulp without preservatives. Therefore, it is concluded from the present study that KMS is more effective for storing mango pulp than SB and also preservatives (KMS and SB) have strong impact in retaining the quality characteristics of mango pulp during storage.

Keywords: KMS (Potassium metabisulphite), SB (Sodium benzoate), mango pulp, TVC (Total viable count).

1. INTRODUCTION

Mango (*Mangifera indica L.)* is a climacteric fruit cultivated in 90 countries all over the world with a production rate of about 25.1 million tones. Asia ranks first in the production of mango (76.9%) followed by America (13.38%), Africa (9%) and then Oceania and European countries (>1%). Mango cultivated at largest scale in Pakistan. Different varieties of mango namely, Anwar Ratual, Almas, Sindhri, Langra, Dusehri, Totapari, Bangan phalli, Saroli, Chaunsa, Desi, Ting, Fajri etc are grown on a wide scale in Pakistan as cited by Iagtiani *et al.*, (1988).

Mango is highly perishable seasoned fruit and does not placed in cold storage space. Hence, it is required to process mango as soon as possible after the harvest into different products. Hence, mango pulp is preserved by various industries in Pakistan for the manufacturing of different value added products such as fillings for jams, sauces, pastries, fruit juices and drinks throughout the year as cited by Hussain *et al.*, (2003). The most common practice adopted in Pakistan to preserve mango pulp is through chemicals which help to prevent the spoilage microbe's thereby increasing shelf life of the pulp. The most common preservatives used as an anti-microbial agent in mango pulp are sodium benzoate, potassium sorbate and potassium meta bisulphite which help to increase its shelf life during storage as cited by LuEcK, (1990). The chemical agent SB ($NaC_6H_5Co_2$) has shown broad specificity against microorganisms as cited by Ogiehor and Ikenebomehclearly, (2004) especially against the species of *Aspergillus* as cited by Gould, (1989; Ogunrinola *et al.*, (1996). The chemical agents including 1000- ppm of KMS ($K_2O_5S_2$)and 500-ppm of SB ($NaC_6H_5Co_2$) displayed no indication of microbes till 90 days of storage.The quality characteristics such as acidity, pulp color, flavor and TSS depends solely upon the variety of mango and consumer preference as cited by Kader, (2002).

The present study planned to examine the suitability of the preservatives (KMS and SB 0.35 g/500 ml of mango pulp) with maximum keeping quality during storage at ambient temperature (30-36 ^{o}C).

2. MATERIALS AND METHODS

The study was demeanor to determined the impact of chemical preservatives (KMS and SB) on the chemical, microbial and sensorial quality of mango pulp during storage at Institute of Food Sciences and Technology (IFST), Faculty of Crop Production, Sindh Agriculture University, Tandojam.

2.1. Sample preparation : Fully ripe mature Sindhri mango fruits were obtained from orchard near Tandojam. Mango fruits of uniform size, color and weight were **selected** and transported to the working lab of IFST. The mangoes were thoroughly rinsed and washed with running tap water for few minutes to eliminate dust, dirt, microbes and pesticide residues from the surface.

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2.2. Pulp preparation method: The fruits were peeled, destoned and flesh was cut into pieces with stainless steel knives. Mango pulp was blended in blender machine (homogenized) mixture.

2.3. Pasteurization: Pulp of the mango was subjected to pasteurization at temperature of 82±2°C for 30 minutes in water bath to minimize the load of microbes.

2.4. Addition of preservatives: Whole pulp was distributed into three equal portions and used for following treatments; Control without preservative (T1), Pulp with 0.35g/500-ml SB (T2) and Pulp with 0.35g/500-ml KMS (T3).

2.5. Packing and storage: The mango pulp (samples) were poured into sterilized glass bottles, labelled and kept for storage up to 90 days at ambient temperature (30-36° C) laboratory of IFST.

2.6. Evaluation of stored processed pulp: Pulp was examined for physicochemical analysis (TSS of mango pulp (T1, T2, and T3) were examined according to the procedures of Association of Official Analytical Chemists (AOAC, 2000). The pH value was assessed by using pH meter (Model HI, Hanna Instruments, Italy). However samples were evaluated by panelist for the determination of sensory characteristics like color, flavor, taste, texture and overall acceptability as described by Larmond (1977).

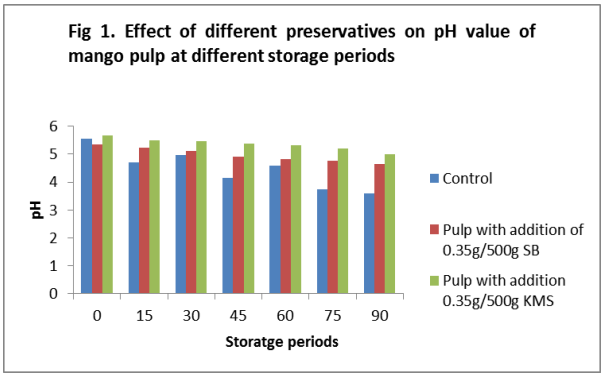
2.7. Sensory evaluation of mango pulp: During storage sensorial analysis of samples (T1, T2, and T3) was carried out after every 15 days of interval up to 90 days of storage (i.e. 0, 15, 30, 45, 60, 75, and 90 days). Mango juice was prepared from all treatments, ready to serve up and by panel of judges evaluated the sensorial characters such as taste, flavor, color, texture and overall acceptability as cited by Larmond (1977).

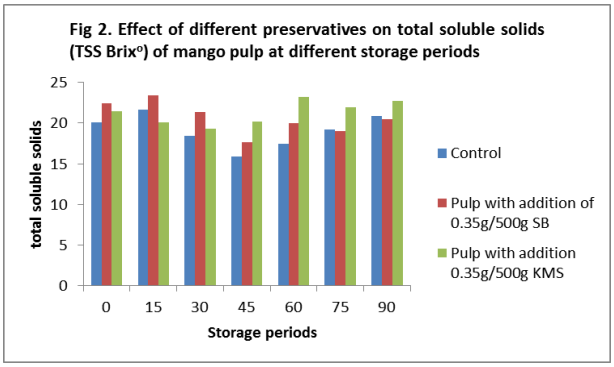
2.8. Statistical analysis: The all outcome were manipulate statistically by using Randomized Complete Block Design as recommended by Steel and Torrie (1980).

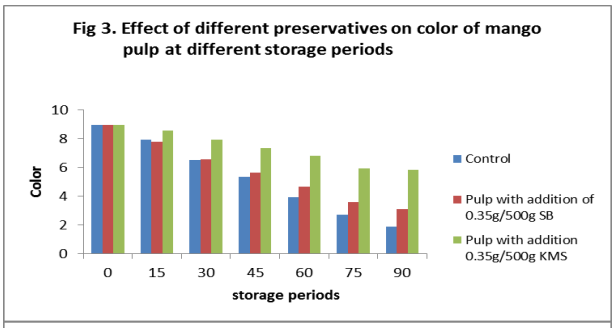
3. RESULTS AND DISCUSSION

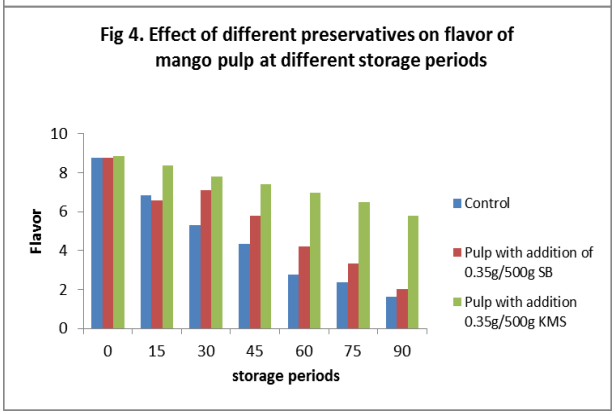
Results presented in **(Fig-1)** regarding average pH in mango pulp T3 and T2 (i.e. 5.36 and 4.97, respectively) remained significantly higher (P<0.01) than T1 (i.e. 4.47). Among the preservatives the average pH of mango pulp treated with KMS (T3) was significantly higher (P<0.01) than SB (T2). However, it was detected that the pH of mango pulp stayed higher at 0 day of storage and remained declining with the passage of time up to 90th day of storage in all T1, T2, and T3 (i.e.5.56 ,5.35, and 5.66, respectively). It has been confirmed by several researchers that reduction in pH of the fruit pulp is related directly with rise in acidity might be due to SB in the mango samples (Bajwa *et al*., 2002; Hussain *et al*., 2008). Malik *et al.* (1994) noted that the value of pulp pH reduced with the storage time. The results for total soluble solids are presented in **(Fig-2),** the average total soluble solids (°Brix) in mango pulp T3 and T2 (i.e. 21.301 and 20.619°Brix, respectively) remained significantly higher (P<0.01) than T1 (i.e.19.095°Brix). Among the preservatives the average total soluble solids of mango pulp treated with KMS (T3) was significantly higher (P<0.01) than SB (T2). However, it was observed that the total soluble solids of mango pulp remained higher at 15th day of storage in T1 and T2 (i.e. 21.647 and 23.43°Brix, respectively) while at 60th day of storage in T3 (i.e. 23.22°Brix). A slight variation in total soluble solids (°Brix) was also noticeable from 0 day to onward up to 90th day of storage in all T1, T2, and T3. The minor alteration in TSS due to storage condition; preservatives used or due to the modification occurred in cell wall structure during ripening process. The results are in consistency with Manzano *et al.,* (1997) reported that temperature of storage also affect on TSS. The contents of TSS was found low at higher temperature as compared with high TSS values at low temperature during storage. The results of the study is also related with the results of Islam (1986) who observed the effects of different preservatives on stored mango pulp and concluded that ºBrix was almost equal in all treatments which increased after 3 months of storage that is up to 14.4% in the sample without preservatives. Similarly, slight alteration was recorded in the sample treated with 1000 ppm potassium metabisulphite which at the end of 3 months storage showed different ºBrix values. The average color **(Fig-3)** in mango pulp T3 and T2 (i.e. 7.33 and 5.76, respectively) remained significantly higher (P<0.01) than T1 (i.e. 5.32). Among the preservatives the average color of mango pulp treated with KMS (T3) was significantly higher (P<0.01) than SB (T2). However, it was noticed that the color of mango pulp stayed best at 0 day of storage and remained declining with the passage of time up to 90th day of storage in all T1, T2, and T3 (i.e. 8.97, 8.97 and 8.97, respectively). Aina and Oladunjoye, (1993) studied color changes in mangoes and explained that these changes are basically related with various chemical changes including degradation and synthesis of other different molecules including carotenoids etc. Study of Saini *et al,* (2000) explained that the milliard reaction occurs up to 83.33% which tends to reduce with the application of potassium metabisulphite. The results for flavor are presented in **(Fig-4).**The average flavor in mango pulp T3 and T2 (i.e. 7.38 and 5.39, respectively) remained significantly higher (P<0.01) than T1 (i.e. 4.57). Among the preservatives the average flavor of mango pulp treated with KMS (T3) was significantly higher (P<0.01) than SB (T2). However, it was observed that the flavor of mango pulp stayed best at 0 day of storage and a regular pattern of decline was seen with the passage of time up

to 90th day of storage in all T1, T2, and T3(i.e. 8.78,8.76 and 8.87, respectively). The results are also associated with Hayat *et al.*, (2005) and Raje *et al.*, (1997) who stated that the sensory attributes such as flavor of Banky apple or Alphanso mangoes illustrate the trend of lessening with increase of storage time at 32-36ºC. These flavor compounds are affected by different state of affairs of pre and post-harvest, packaging material, time of storage conditions. The changes in flavor content are basically due to mutation in the fatty acid profile i.e. during maturation process palmitic acid changed into palmitoleic acid. The harvesting of mango at the beginning of ripen gives an outstanding profile of flavor to the mango (Lalel *et al*., 2003b). The average taste in mango pulp T3 and T2 (i.e. 7.38 and 5.41, respectively) remained significantly higher (P<0.01) than T1 (i.e. 4.49). Among the preservatives the average taste of mango pulp treated with KMS (T3) was significantly higher (P<0.01) than SB (T2). Though, it was observed that at 0 day of storage the taste of mango pulp stayed best and a regular pattern of decline was seen with the passage of time up to 90th day of storage in all T1, T2, and T3(i.e. 8.97,8.81 and 8.96, respectively). The present study results are not agreement with findings of Abbasi *et al*., (2009) who reported that increased in taste score of mango from 3.54 to 8.42 after four weeks of storage. The results for texture are presented in (fig-6), the average texture in mango pulp T3 and T2 (i.e. 7.20 and 5.94, respectively) remained considerably higher (P<0.01) than T1 (i.e. 5.92). Among the preservatives the average texture of mango pulp treated with KMS (T3) was considerably higher (P<0.01) than SB (T2). However, it was detected that the texture of mango pulp remained higher at 15th day of storage in T1 and T2 (i.e. 7.65 and 7.59, respectively) whilst at 60th day of storage in T3 (i.e. 6.80). A minor variation in texture was also noticeable from 0 day to onward up to 90th day of storage in all T1, T2, and T3. (i.e. 7.54 and 5.52, respectively) remained significantly higher (P<0.01) than T1 (i.e. 4.55). Among the preservatives the average overall acceptability of mango pulp treated with KMS (T3) was significantly higher (P<0.01) than SB (T2). However, it was noticed that the overall acceptability of mango pulp stayed best at 0 day of storage and remained declining with the passage of time up to 90th day of storage in all T1, T2, and T3 (i.e. 8.74, 8.62 and 8.85, respectively) which are in agreement with results of Saini *et al*., (2000) who experiential in similar study that preserved pulp with KMS also individually or in amalgamation with additional preservatives retains overall utmost acceptability, sustain highest stability of nutrients and negligible microbes. indicate that there was significant increase in TVC (2.38-7.26 cfu/g) of mango pulp during storage without addition of any chemical preservatives (Control). In pulp of mango samples the maximum inhibitory effects on bacterial growth was exerted by KMS. The pulp with KMS as chemical preservative reported minimum TVC values 2.52 cfu/g (T3) and the mango pulp preserved with SB showed maximum TVC values i.e. 3.12cfu/g (T2). The mean values recorded were 2.74, 3.12 and 6.34 for T3, T2 and T1, respectively.









4. CONCLUSIONS

It is concluded from the present study that:

1) Mango pulp treated with KMS retained best in all chemical, microbial and sensorial attributes comparatively to SB.

2) Mango pulp treated with KMS and SB exhibited utmost superiority in all chemical, microbial and sensorial parameters than control.

3) A gradual decline was noticed in keeping quality of mango pulp with the passage of storage life from 0 to 90th day of storage.

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