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Effect of Potassium Meta-bisulphite on Quality and Acceptability of Formulated Green Mango Pulp During Freezing

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ABSTRACT

The study was performed to evaluate the effect of different concentrations of potassium meta-bisulphite (KMS) as preservative on nutritional and sensory quality of formulated green mango pulp stored at -20°C for 120 days. The mango pulp was formulated with the addition of sugar, salt, chilli powder, citric acid and KMS at various concentrations such as 250, 500 and 1000 ppm. The formulated pulp was intended to use as ready to drink green mango juice by diluting with three fourths to half part of water so that the final concentration of preservatives remained within the safe level (350 mg/Kg). Moisture, percent acidity and vitamin C content of all the treatments decreased slightly during storage for 120 days but ash content remained almost unchanged. During storage period, TSS, total sugar and pH of the samples increased while non-reducing sugar decreased. With regard to color parameters, L* values of the extracted green mango pulp (S_1) and the formulated pulps (S_2, S_3, S_4 and S_5) were found quite close but they increased with time during storage. All the results of a* value (greenness to redness) were observed negative, which indicated the absence of red hue in all the samples till 120 days. The b* value (blueness to yellowness) was decreased with time which indicated also of yellowness of the samples during storage. The optical density of all the samples was increased with time which indicated the occurrence of non-enzymatic browning during storage. Samples treated with KMS (S_3, S_4 and S_5) had the lower microbial load than that of unformulated samples. All the samples were found acceptable up to 120 days of storage. KMS as preservative showed no significant effect on the proximate composition of formulated green mango pulp. Regarding organoleptic taste testing, samples preserved with different concentration of KMS did not show any significant difference in terms of color, flavor, taste and overall acceptability. In conclusion, formulated green mango pulp can be used as refreshing drinks after diluting with water by storing at freezing condition for four months.

Introduction

Mango (*Mangifera indica* L.) is one of the most popular and profitable fruits in tropical and subtropical regions in the world. It is renowned for its excellent flavor, attractive color, good taste, fragrance and high nutritional value. Mango can play an important role in balancing human diet by providing about 64-86 calories of energy per 100 g and can be a valuable dietary source of many phytochemical compounds and vitamin C (Pleguezuelo *et al.*, 2012). There are about 1600 varieties found in all over the world while around 100 in Bangladesh (Jaman *et al.*, 2017). In Bangladesh, it occupies an area of 1, 02, 939 acres of land with an annual production of 13, 21, 685 metric ton (BBS, 2017).

Mango is mostly consumed as fresh fruit. A far more surplus is spoiled every year due to the lack of proper handling, processing and storage condition which causes a great economic loss (Nisar *et al.,* 2015). Food processing industries preserve mangoes by producing mango pulp, juices and squashes with the addition of different chemical preservatives and make it available whole the year around. Mango juices and squashes have been becoming more popular in the recent years comparing to other synthetic beverages because of their taste, flavor, and nutritive value. The extracted mango pulp is increasingly used in beverage, confectionery and dairy industries, where fruit purees and concentrates are the major intermediates. Generally, partially processed mango as an industrial viable raw material is used the whole year as the base for the production of nectar and other beverages (Sakhale *et al.,* 2012a). The unripe, raw, green mango has been used in the preparation of pickles and chutney in the Asian countries. Raw mango is an

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excellent source of vitamin C, which is comparatively more than ripe mangoes; due to which it is highly beneficial in strengthening immune health. The acids contained in the unripe, green mango pulp triggers the secretion of bile and act as intestinal antiseptic (Ajila *et al*., 2007; Masibo and He, 2009). So, preservation of green mango pulp is a very crucial in this case for further use.

Food preservatives are extensively added to many foods to control the biochemical changes, including the growth of microorganisms, oxidation of vitamins, colorants, flavor etc. according to the amounts specified in food additives legislation which helps to increase the keeping quality of products (Sakhale *et al.,* 2012). Therefore, the efforts have been given in the present investigation to preserve formulated green mango pulp in frozen condition using different concentration of potassium meta-bisulphite with an aim to make the pulp available in off season by increasing product shelf-life. This effort will also make convenient the process of preparing ready to drink juice by diluting equal amount of pulp with water. Keeping in view of the above circumstances the present investigation was planned to analyze the effect of potassium meta-bisulphite on the physiochemical properties of formulated pulp as well as to assess the nutritional quality and consumer's acceptability of the formulated green mango pulp.

Materials and Methods

The fresh green mangoes of Ashhwina variety were collected from germplasm centre of Bangladesh Agricultural University, Mymensingh-2202. Green chilli powder used as an ingredient in pulp formulation was prepared in the laboratory. Chemicals and solvents used in the study were of analytical grade. Water was glass distilled unless specified otherwise. Sugar, potassium meta-bisulphite (KMS) and citric acid were used from the laboratory stock.

Preparation of green chilli powder

Fresh green chillies were taken and washed properly. The seeds and petioles were removed. Then they were dried in a cabinet dryer at 50°C. After drying they were ground by using a grinder and stored in an airtight bag.

Preparation of green mango pulp

The fresh, firm and unripe mangoes were sorted and washed with clean water. Then these were peeled and cut into pieces using a clean table knife and washed. The pieces were blended with a blender machine at room temperature. After then, required pulp was obtained.

Formulation of pulp

The prepared mango pulp was grouped into five parts. The 1st part was pulp after extraction (no ingredient addition). The 2nd part was the addition of sugar, salt, chilli powder, citric acid with the pulp (no addition of KMS). The 3rd, 4th and 5th part were the addition of sugar, salt, chilli powder, citric acid and KMS at various concentration such as 250, 500 and 1000 ppm, respectively. The prepared samples were then bottled and pasteurized in a water bath at a temperature of 82 ± 2°C for 30 minutes to reduce the microbial load. Finally, the five bottles containing samples were capped, labelled and stored for further studies. Chemical, sensory evaluation, and microbial status of the formulated pulp were observed during 120 days storage at -20°C at 30 days interval. Pulp formulation for storage conditions studies were given in Figure 1 and Table 1.

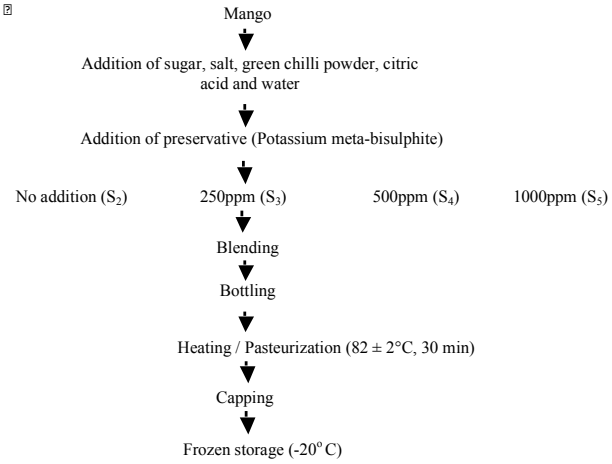

Figure 1. Flow Diagram for the formulation of pulp

Table 1. Formulation of the pulp (per 100 ml)

Ingredient	Samples				
	S_1	S_2	S_3	S_4	S_5
Pulp	100	30	30	30	30
Chilli powder	0.00	0.02	0.02	0.02	0.02
Salt	0.00	0.60	0.60	0.60	0.60
Preservative (KMS)	0.00	0.00	0.025	0.05	0.10
Sugar	0.00	23.61	23.55	23.47	23.39
Acid (Citric acid)	0.00	0.22	0.22	0.22	0.22
Water	0.00	45.55	45.585	45.64	45.67

Chemical analysis of formulated pulp

Moisture, ash and acidity content of the samples were determined according to the methods of AOAC (2009). Vitamin C (ascorbic acid) was determined by the method of Ranganna (2003). The pH of the pulp was measured by using a PERKINFLMER Merion-V pH meter at an ambient temperature. TSS (Total soluble solids) was measured by using a refractometer (Model No. 8987, Puji Kuki Ltd., Tokio). Reducing sugar, non-reducing sugar and total sugar were estimated by Lane and Eynon (1923) method.

Enumeration of total viable count

0.1 ml of each 10-fold dilution was transferred and spread duplicate onto PCA using a micropipette. The

inoculated samples were spread on to the entire surface of the agar plate with a sterile glass spreader. The plates were kept in an incubator at 37°C for 24-48 hrs. After incubation, plates with exhibited 30-300 colonies were counted. The average number of colonies in particular dilution was multiplied by the dilution to obtain the total viable count. The total viable count was calculated according to the method of ISO (1995). The result of the total bacterial count was expressed as mean log Colony Forming Unit (CFU) per gram.

Colour measurements

Colour measurements were conducted in six replicates using a Minolta Chroma MeterCR-400 colorimeter (Konica Minolta Sensing Inc., Osaka, Japan) (8 mm Ø contact area). Before taking reading the Chroma meter was calibrated properly using white calibration plate (CR-A43, Japan at a standard value of L=35.81, a= 4.92, b= 9.28, Δa= -16.25, Δb= -2.40, Δb=-6.60 and ΔE= 17.70). Samples were taken and put on the top of the Glass Light-Projection tube (CR- A33f, KONICA MINOLTA, Japan) through which the reading was taken. The obtained results were reported according to the CIE Lab colour system and were expressed in terms of Lightness (L*), green to red (a*), blue to yellow (b*) values.

Browning index

The samples for browning were centrifuged for 15 minutes at 4000 rpm. For 10 ml of centrifugation 15 ml of alcohol was added to make 60% aqueous solution and kept for an hour. Then it was filtered through Whatman filter paper No.1 to obtain clear solution. Color was measured at 420 nm using 60% aqueous alcohol as blank. The increase in absorbance of a sample at 420 nm was taken as a measure of non-enzymatic browning. Then Absorbance at 420 nm was measured using a UV visible spectrophotometer (ThermoSpectronic, UK) (Manisha *et al*., 2017).

Sensory evaluation

The consumer acceptability of the mango pulp samples was evaluated by a taste-testing panel. The 1 to 9 point hedonic scale was used to determine this acceptability. The panelists were selected from among the teachers and students of the Department of Food Technology and Rural Industries, Bangladesh Agricultural University, Mymensingh. Ready to serve mango juices were prepared from the formulated pulp and were served to ten (10) trained panelists. Panelists were asked to assign appropriate score for characteristic color, flavor, texture and overall acceptability of the juices. The scale was arranged as 9 for like extremely, 8 for like very much, 7 for like moderately, 6 for like slightly, 5 for neither like nor dislike, 4 for dislike slightly, 3 for dislike moderately, 2 for dislike very much, and 1 for dislike extremely. The results were evaluated by ANOVA (analysis of variance) for significant variation and DMRT (Duncan's Multiple Range Test) to select the best formulation (Gomez and Gomez, 1984).

Results and Discussion

Effect of concentration of KMS on chemical compositions

The chemical compositions of control and formulated green mango pulps as affected by the different concentration of KMS were analyzed initially as well as at an interval of 30 days for 120 days. The chemical compositions such as moisture content, TSS, ash content, acidity, pH, reducing sugar, non-reducing sugar and total sugar of green mango pulp (controlled and formulated) are given in Table 2 and Table 3.

Moisture content of all the formulated samples decreased slightly during the storage for120 days. Moisture content was lowered gradually due to slow evaporation of moisture from the pulp. TSS (%) of the extracted pulp and the formulated pulp showed a negligible change throughout the storage period as given in Table 2. The increase of TSS and reducing sugar and the decrease of non-reducing sugar of the pulp samples might due to the conversion of sucrose into glucose and fructose (Reddy and Reddy, 2012; Tefera *et al.,* 2008). Ash content did not show any appreciable change during storage among the treatments. Ash content found in pulp was closed to the data reported by Jaman *et al*. (2017). This slight variation might happen due to the effect of different factors like mango variety, storage time or temperature. Slight variation in acidity and pH was observed over the 120 days storage in control as well as formulated stored pulp. Table 2 also shows that % acidity decreased with time while pH increased. Results suggested that both storage time and treatments have statistically significant effect on the acidity and pH. The rate of pH change was slower in formulated stored pulp containing preservatives (S_3, S_4 and S_5) than without preservatives (S_1 and S_2). The result was in agreement with the report by Abbasi *et al.* (2009) correlating the fluctuation in lipid profile of mango pulp.

The sugar content of the formulation is presented in Table 3. During the storage period, the total sugar as well as the reducing sugar of the pulp was increased gradually while the non-reducing sugar was decreased due to conversion of sucrose added for the formulation of the pulp. The increased reducing sugar in stored pulp might due to the hydrolysis of fruit sugar and/or added sugar. The result is also supported by Reddy and Reddy (2012), who reported that the reducing sugar increased in fruit juice during storage. According to Jaman *et al.* (2017), the reducing sugar content of mango pulp ranged

between 3.90-7.64% at different maturity stages and a gradual increase in reducing sugar was observed with the increase time. The mean values for non-reducing sugar of stored mango juice was decreased from 6.86 to 4.35% (Jaman *et al*., 2017). A negligible variation in total sugar was observed over the 120 days of frozen storage. Among formulated samples, the maximum rate of change in total sugar was observed in sample stored without preservative (S_2) (14.05±0.06 to 14.78±0.11).

Effect of concentration of KMS on ascorbic acid (Vitamin-C) retention

Vitamin C or ascorbic acid of control and formulated pulp was determined. Vitamin C is water soluble and decreased with increase time of storage. From Figure 2, it has been seen that the vitamin C concentration of the samples have an exponential relationship with the storage time. At the early stage of storage, the rate of destruction of vitamin C was higher which became slower later on. The degradation rate of vitamin C was the highest in the sample S_1 (pulp as it is) and the slowest in the sample stored with 1000 ppm KMS (S_5). Jacobi *et al.* (2000) observed that the vitamin C content during postharvest treated mango pulp was decreased by oxidation reaction occurred during heat application.

Effect of concentrations of KMS on color parameters

Table 4 illustrates the effect of different concentration of KMS on the values of lightness (L*), redness (a*) and yellowness (b*) of the five sample (S_1, S_2, S_3, S_4, and S_5) throughout the 120 days of storage. A decrease in L* value is an indicator of flesh browning (Dea *et al.,* 2010). Table 4 shows that the L* value of mango pulp continuously was decreased with storage days. The L* value was found high (51±0.03) in green mango pulp right after extraction (S_1). The highest rate of change in L* value was observed at pulp as it is (S_1) (from 51.0 to 40.1) and the lowest was found in the sample stored with 500 ppm KMS (from 37.03 to 34.19). The observed data indicated that the KMS treatment retarded the change in the lightness of the mango pulp. As the decrease in L* value is an indicator of color change and non-enzymatic browning, so it can be said that the rate of color change or non-enzymatic browning was higher in controlled sample than formulated samples due to action of preservatives. Manisha *et al.* (2017) studied on carotenoid content, color and browning of stored mango pulp for processed products where the value is gradually decreased with time. The a* and b* values demonstrate red color and yellow color of the mango pulp. Both a* and b* values decreased with the increase of storage period. The negative a* value (Table 4) indicates that there was no redness in the samples. The results shows that the pulp without formulation (S_1) possessed the highest a* (-ve) value among the samples at the beginning of the storage which is an indication of the reduction of the greenness due to pulp formulation. The formulated samples which are different from each other for different KMS concentrations didn't show any considerable variation in a* values on day first. At 120th day of storage, sample stored with 500 ppm KMS (S_4) shows the minimum decrease of a* value (from -2.51 to -2.17) among the formulated samples. From Table 4, it is seen that the intensity of yellowness of the samples was decreased with time. The b* value was found the highest in the pulp without formulation (S_1) on first day of storage. After 120 day of storage, the maximum reduction of b* value was occurred in pulp without formulation (S_1) and the minimum was found in sample stored with 1000 ppm KMS (S_5) among the formulated samples. Boonyaritthongchai *et al.* (2017) assessed the effect of methyl jasmonate on the skin and pulp color of mango for 18 days with a tristimulus color different meter (Minolta CR300) and expressed as L^*, a^*, and b^* values. They found the value of a* as -7 initially which gradually increased to -3 with a duration of 18 days. In the study, the b* value were observed with a change from 25 to 56. The value of the coordinate b* decreases with storage time, indicating a loss of yellow color of the mango cubes (de Sousa *et al.,* 2017).

Effect of concentration of KMS on browning intensity of formulated mango pulp

All the samples with 10 times dilution were observed for optical density at 420 nm wavelength in a spectrophotometer. The intensity of browning (optical density) of the samples are shown in Figure 3. The OD (optical density) value of all the samples increased with time period resulting in the development of brown color in the stored pulp. It was noticeable that the KMS inhibited the formation of brown color in the formulated pulp. Pulp without formulation (S_1) showed the maximum increase (0.36 to 1.98) of OD, while the minimum change was found at sample stored with 1000 ppm KMS (S_5) among the formulated samples (0.47 to 0.98). So, it can be said that the maximum browning was observed in pulp without formulation (S_1) and minimum in sample stored with 1000 ppm KMS (S_5). The non-enzymatic browning in the pulp was determined by measuring optical density (OD) of at 420 nm in UV-VIS spectrophotometer (Manisha *et al.,* 2017). Manisha *et al.* (2017) found that the non-enzymatic browning of preserved mango pulp increased with the advancement of storage duration. The reaction of organic acids with sugar or oxidation of phenols leads to the formation of brown pigment which causes non enzymatic browning.

Table 2. Effect of concentration of KMS on chemical compositions of formulated green mango pulp during storage at -20° C

Samples	Parameters	Storage duration in days				
		0	30	60	90	120
S_1	Moisture%	78.90±0.89*	78.50±0.75	78.50±0.65	78.40±0.91	76.90±0.93
	TSS%	12.00	12.00	12.10	12.20	12.20
	Ash%	0.39±0.02	0.39±0.01	0.41±0.02	0.41±0.03	0.10±0.01
	Acidity%	1.34±0.07	1.30±0.05	1.31±0.07	1.26±0.09	1.21±0.07
	pH	3.68±0.02	3.71±0.02	3.77±0.01	3.79±0.02	3.82±0.01
S_2	Moisture%	68.70±0.64	67.36±0.78	66.40±0.91	65.87±0.44	65.00±0.58
	TSS%	28.00	28.00	28.10	28.20	28.20
	Ash%	0.40±0.02	0.41±0.02	0.41±0.03	0.43±0.02	0.44±0.02
	Acidity%	1.50±0.08	1.46±0.04	1.46±0.07	1.41±0.08	1.32±0.06
	pH	3.39±0.00	3.42±0.00	3.49±0.01	3.54±0.01	3.59±0.01
S_3	Moisture%	70.26±0.47	68.40±0.94	68.39±0.68	67.07±0.62	66.00±0.48
	TSS%	28.00	28.00	28.10	28.10	28.10
	Ash%	0.40±0.04	0.41±0.2	0.41±0.02	0.42±0.01	0.43±0.01
	Acidity%	1.50±0.04	1.45±0.08	1.40±0.05	1.28±0.07	1.15±0.05
	pH	3.30±0.01	3.41±0.01	3.44±0.02	3.49±0.01	3.53±0.01
S_4	Moisture%	68.83±0.54	67.86±0.34	66.93±0.82	66.16±0.56	65.00±0.68
	TSS%	28.00	28.00	28.00	28.10	28.20
	Ash%	0.41±0.03	0.43±0.02	0.43±0.05	0.43±0.03	0.44±0.01
	Acidity%	1.50±0.05	1.48±0.03	1.48±0.03	1.45±0.07	1.42±007
	pH	3.17±0.01	3.21±0.01	3.26±0.01	3.27±0.01	3.29±0.0
S_5	Moisture%	68.70±0.44	67.36±0.62	66.04±0.67	65.87±0.85	65.00±0.47
	TSS%	28.00	28.00	28.10	28.10	28.10
	Ash%	0.40±0.07	0.41±0.04	0.41±0.01	0.43±0.03	0.43±0.01
	Acidity%	1.50±0.06	1.50±0.05	1.50±0.06	1.48±0.05	1.45±0.03
	pH	3.10±0.10	3.10±0.00	3.10±0.00	3.11±0.01	3.15±0.00

Values are mean ± SD

Table 3. Effect of concentration of KMS on sugar content of formulated green mango pulp during storage at -20° C

Samples	Parameters	Storage duration in days				
		0	30	60	90	120
S_1	RS	3.92± 0.03*	3.92±0.06	3.98±0.03	3.99±0.02	4.09±0.03
	Non-RS	4.98±0.04	4.98±0.01	4.95±0.02	4.95±0.04	4.90±0.03
	Total Sugar	8.90±0.04	8.90±0.04	8.93±0.02	8.94±0.03	8.99±0.03
S_2	RS	5.05±0.03	5.1±0.04	5.4±0.09	6.23±0.10	7.13±0.08
	Non-RS	8.98±0.04	8.93±0.05	8.65±0.02	8.01±0.03	7.65±0.06
	Total Sugar	14.05±0.06	14.03±0.04	14.05±0.04	14.24±0.05	14.78±0.11
S_3	RS	4.71±0.03	5.25±0.04	5.55±0.03	5.72±0.02	6.32±0.01
	Non-RS	9.43±0.04	9.01±0.01	8.77±0.04	8.54±0.09	8.04±0.06
	Total Sugar	14.14±0.02	14.26±0.05	14.32±0.04	14.26±0.03	14.36±0.03
S_4	RS	4.04±0.06	4.66±0.03	4.85±0.03	5.07±0.04	5.33±0.05
	Non-RS	9.99±0.03	9.37±0.03	9.24±0.02	9.02±0.02	8.78±0.03
	Total Sugar	14.03±0.03	14.03±0.03	14.09±0.04	14.09±0.04	14.11±0.04
S_5	RS	4.01±0.06	4.15±0.07	4.61±0.02	4.72±0.03	4.75±0.08
	Non-RS	10.02±0.09	10.02±0.07	9.67±0.05	9.61±0.09	9.58±0.05
	Total Sugar	14.03±0.05	14.17±0.04	14.28±0.03	14.33±0.07	14.33±0.04

Values are mean ± SD

Effect of concentrations of KMS on total viable count of formulated mango pulp

The total bacterial growth in different samples after 120 day of storage has been shown in the Figure 4. All the samples were also analysed for total bacterial count (CFU/ml) at the beginning and after 120th days of storage. On day first, there was no growth of bacteria. It was noticeable that KMS was most efficient in reducing microbial growth (Figure 4). After 120 days of storage, the maximum bacterial growth was observed in pulp without formulation (S_1) and the minimum was observed in sample stored with 1000 ppm KMS (S_5). The lowest linear growth of MOs was observed in the formulated sample while the contrary trend was observed in pulp without formulation (S_1). Among formulated samples, the S_2 showed the highest growth of bacteria that was stored without any chemical preservative.

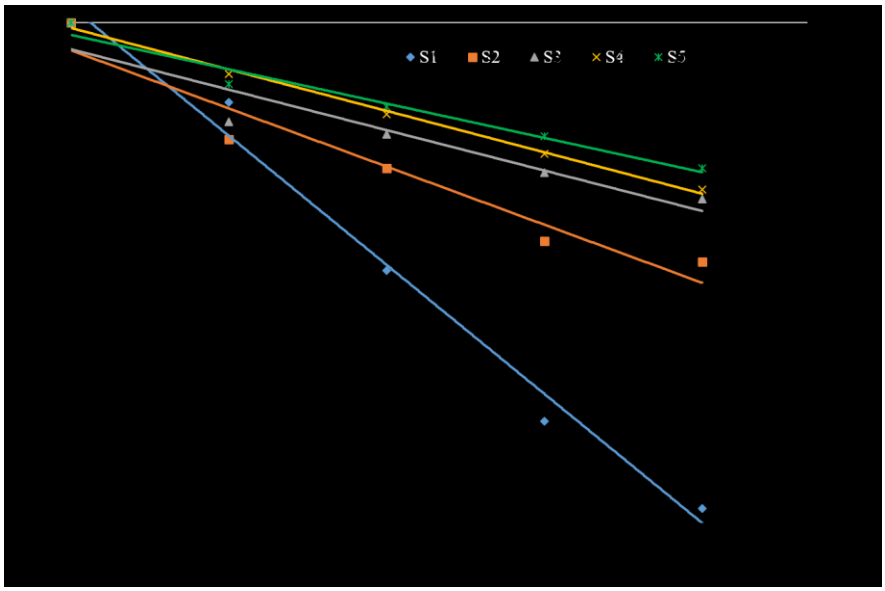

Figure 2. Degradation of Ascorbic acid (Vit-C) of stored pulp during 120 days of storage period

Table 4. Color parameters: L*, a* and b* of formulated mango pulp treated by different concentrations of KMS during storage at -20˚C for 120 days

	Day of storage (DAS)	Treatments				
		S_1	S_2	S_3	S_4	S_5
L*	0	51.00±0.03	38.03±0.04	37.19±0.05	37.03±0.03	37.92±0.09
	30	48.19±0.04	35.77±0.02	36.53±0.92	36.92±0.04	37.93±0.04
	60	42.9±0.03	35.19±0.06	36.09±0.03	35.62±0.67	35.99±0.06
	90	41.3±0.02	35.09±0.02	35.92±0.05	35.47±0.09	35.97±0.02
	120	40.03±0.03	33.12±0.02	33.17±0.07	3.19±0.01	35.82±008
a*	0	-5.88±0.06	-2.37±0.02	-2.34±0.08	-2.52±0.05	-2.56±0.03
	30	-4.62±0.01	-2.25±0.01	-2.3±0.07	-2.16±0.09	-2.52±0.07
	60	-3.07±0.03	-2.21±0.05	-2.23±0.05	-2.16±0.04	-2.49±0.02
	90	-2.19±0.01	-2.21±0.05	-2.21±0.06	-2.13±0.02	-2.38±0.07
	120	-2.61±0.08	-2.17±0.07	-2.17±0.05	-2.12±0.01	-2.21±0.03
b*	0	11.61±0.03	5.08±0.04	5.58±0.01	5.53±0.03	5.72±0.08
	30	9.12±0.07	4.79±0.04	4.72±0.02	5.11±0.04	5.19±0.01
	60	6.62±0.09	4.54±0.03	4.63±0.07	5.09±0.02	5.01±0.02
	90	4.09±0.03	4.33±0.03	4.52±0.01	4.82±0.05	4.97±0.09
	120	3.31±0.08	4.03±0.03	4.38±0.03	4.53±0.02	4.71±0.01

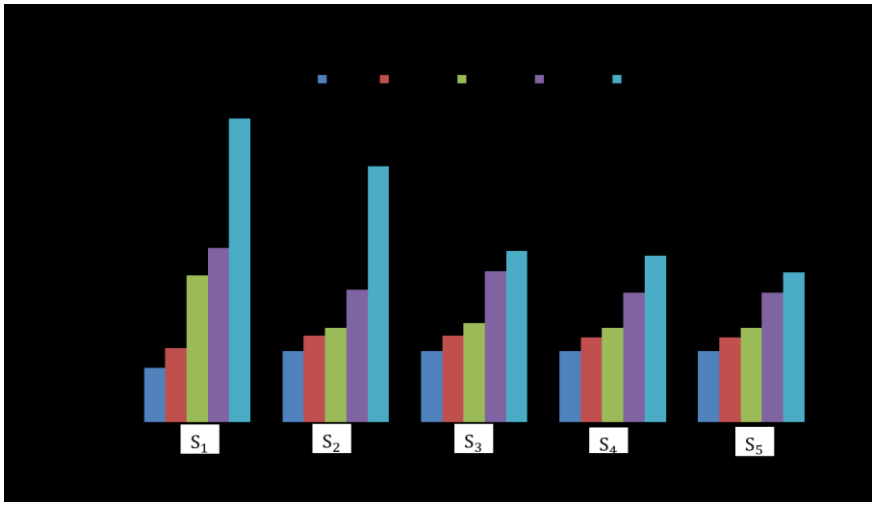

Figure 3. Browning index of stored green mango pulp

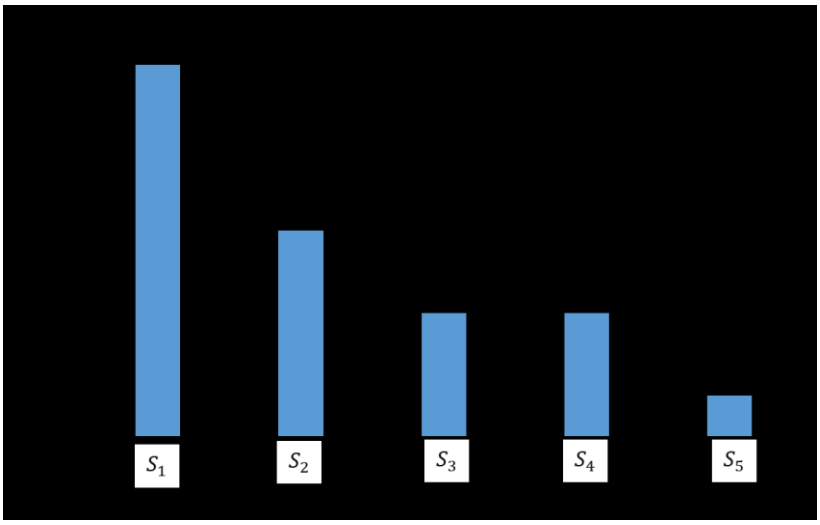

Figure 4. Total bacterial count (CFU/ml) of stored pulp after 120 days storage period

Table 5: Mean score for color, flavor, texture and overall acceptability of mango juice

Samples	Sensory attributes			
	Color	Flavor	Taste	Overall acceptability
S_1	3.0^c	2.1^c	0.6^c	2.4^c
S_2	3.9^b	3.2^b	3.5^b	3.2^b
S_3	6.8^a	5.4^a	6.4^a	6.9^a
S_4	7.0^a	6.0^a	7.2^a	7.6^a
S_5	7.2^a	6.1^a	7.6^a	8.2^a

*Sample having the same component ratio do not differ at 5% (P<0.05) level of significance.

Effect of KMS on sensory evaluation

The mean score for color, flavor, taste and overall acceptability of the green mango juice prepared with formulated pulp after 120 days of storage has been given in the Table 5. In case of color, flavor, taste and overall acceptability, a two way analysis of variance (ANOVA) showed that there was significant difference (P<0.01) among the samples with respect to the attributes. It indicated that the formulated samples were not the same. Sample stored with 1000 ppm KMS (S_5) secured the highest color score (7.2) while sample without formulation (S_1) scored the lowest value (3.0). There was no significant difference among the sample of S_3, S_4 and S_5 in terms of color. DMRT test revealed that samples preserved with highest concentration of preservative scored the highest value and preferred the most. Sample S_2 and S_1 have shown the least colour acceptability comparing with others. In case of flavor, sample stored with 1000 ppm KMS (S_5) secured the highest flavor score (6.1) while sample without formulation (S_1) secured the lowest score (2.1). This difference was due to the presence or absence of several ingredients used in the samples during formulation. There was no significant difference among the samples preserved with various concentration of KMS. In case of taste, sample stored with 1000 ppm KMS (S_5) secured the highest score (7.6) which has no significant variation with sample S_4 (7.2) and S_3 (6.4) in terms of acceptance. Samples S_2 and S_1 secured the lowest score 3.9 and 3.0 respectively with minimum acceptability. For overall acceptability of green mango juice prepared from stored formulated pulp after 120 days storage, it was apparent from the result that there was no significant difference (P<0.05) in overall acceptability among the samples S_5, S_4, S_3 securing the score 8.2, 7.6 and 6.9 respectively. Samples S_2 and S_1 obtained the scores 3.2 and 2.4 and disliked by the panellists.

Conclusion

Potassium meta-bisulphite (KMS) is the most effective for retention of nutritional value, and color of mango pulp and prevention of browning intensity and microbial growth. Potassium meta-bisulphite provided a high quality of fresh mango juice for a longer period of storage. Chemical analysis supported that KMS had promising effect to retain ascorbic acid, acidity and total sugar of mango pulp. From the obtained results, it is proved that KMS treatments with 250 ppm, 500 ppm and 1000 ppm don't show any significant variation in the overall quality parameters and acceptability of mango pulp. Finally, it can be recommended that the use of formulation containing KMS proved to be best in preventing physiochemical properties and maintaining nutritional quality of mango pulp.

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Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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