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Effect of Sodium Metabisulphite on the Nutritional Characteristics of Palmyra Fruit Pulp

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Abstract:*The study presents the effect of the chemical preservative, sodium metabisulphite (SMS) on the nutritional characteristics of the pulp with time. Palmyrah fruits of same maturity and size from the same palm were subjected to manual extraction of pulp. pH of the pulp was measured and it was adjusted to 3.8 using food grade citric acid. The pH adjusted pulp was then heated to 90° C for 30 minutes using open pan heating and was allowed to cool down to 60°C. Food grade SMSwas added to one portion of the pulp in the ratio of 0.4 gram per litre and the other portion of the pulp was not mixed with SMS. Both pulp portions were hot filled into sterilized glass bottles and stored at 4°C in a refrigerator. Continuous nutrient analysis was carried out and the results were subjected to two way ANOVA using Minitab 16 software. Results of the study exhibits that within two months there is a decline in titrable acidity, Na level, and there is a rise in pH in the pulp with SMS. In the pulp without SMS, there is an increase of reducing sugars and titrable acidity and a decline in pH with time and the differences between the values obtained periodically were significant. Moreover, the microbial colony count shows that the chemical preservation treatment is effective since the colony count is zero in the pulp with SMS at the end of 2nd month, whereas pulp without SMS shows prominent growth of microorganisms and the total plate count here is 55 CFU/ ml at the end of 2nd month. Based on the results of this study there is no adverse effect of SMS on the nutritional composition of the pulp. Addition of SMS shows a strong preservation activity when combined with refrigeration whereas refrigeration alone can be employed to preserve the pulp for up to one month.*

Keywords:*chemical additive, nutrient profile, Palmyrah fruit pulp*

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I. Introduction

Palmyrah pulp obtained from the ripen fruits has several desirable physical and functional properties namely bright yellow colour, considerable amount of pectin, water soluble carotenoids, anti-cancer properties, anti-inflammatory effects and immunosuppressant effects. Seasonality of palmyrah fruits restricts the availability of the pulp throughout the year. It is only available from August to October. It is stated that 10 000 tons of palmyrah fruits are wasted annually within the country.[1] To reduce the wastage of palmyrah fruits, a better preservation technique is needed. Palmyrah fruit pulp is persevered with sodium benzoate, sodium metabisulphite(SMS) or combination of both preservatives to make it readily available in off seasons. However the overall characteristic of the pulp should be maintained in a good level even after preservation treatment. The chemically preserved pulp turns brown during storage; the pulp preserved with sodium benzoate in particular shows prominent discolouration during storage.[2] Moreover, people tend to compare fresh pulp with preserved pulp in terms of nutritional level and prefer it without the addition of artificial preservatives due to the possible adverse health effects of chemical additives. The study done by Kailayalingam*et al*., (2016) [3] states that the best treatment for palmyrah fruit pulp preservation is sodium metabisulphite (0.4 gram per litre) based on the microbial, physiochemical and sensory evaluation, but the nutritional changes after the preservation is unknown and yet to be researched. Considering the health concerns of the consumers and as a continuation of the study by Kailayalingam et al., (2016) [2] in terms of filling the research gap regarding the nutritional value, this study aims to analyze the nutrition composition of preserved pulp using SMS at the ratio of 0.4 gram per litre and to check whether there is any significant change in nutrition profile due to the best preservation treatment mentioned above with the course of time.General objective of the study is to determine and compare the nutrient composition of chemically preserved pulp against the pulp without artificial preservative. Specific objective is to determine the changes of nutritional level of the chemically preserved pulp with the course of time.

II. Materials And Methods

The research work was carried out at Palmyrah Research Institute, Kaithadi,Jaffna.Black skinned Palmyrah fruits of the same maturity, variety and size were taken from selected palm from 'Ariyalai'. Only fruits free of pest and disease damages and mechanical damages were selected for this study.

2.1 Pulp Extraction

The selected fruits were washed with tap water and then submerged in hot water for one hour. Then, the black outermost pericarp was peeled off and the pulp was extracted manually. The extracted pulp was filtered through a muslin cloth and the initial pH of the pulp was measured. The pH of the pulp was adjusted to 3.8 with concentrated food grade citric acid. The pulp was then heated at 90^{o} C for 30 minutes and cooled down to 60^{o} C. The heated pulp was divided into two portions. Sodium metabisulphite was added to one portion at the ratio of 0.4 g L^{-1} ; for the other portion no preservatives were added. Both portions of pulp were hot filled into sterilized bottles and stored at 4°C in the refrigerator. The following tests were carried out on both portions periodically for the consecutive two months.

Table 1: Methods Used to Perform the Tests

Tests	**Methods**
Fat	Solvent extraction method (AOAC,2006)[3]
Protein	Kjeldahl method (AOAC, 2005)[4]
Na, K level	Flame photometry method [5]
Reducing sugar level	DNS – spectrometer Miller, 1959 [6]
Total sugar level	DNS – spectrometer (Pearson, 1976 [7]and Miller, 1959)[6]
FreeSO_2 level	Redox titration method (Ripper Method) [8]
Acidity	Titration (SLS: 729:1985) [9]
pH	pH meter (digital pH meter Sension PH 31-Spain, at room temperature)
Total phenolic content	Spectrometry using Gallic acid standard (Singleton and Rossi, 1965)[10]
Total Plate Count	Sri Lankan Standard: 516 Part 1: 1991[11]

2.2 Statistical Analysis

In this study all the data obtained from the physicochemical, nutrient and microbial analysis were subjected to two – way ANOVA test using Minitab 16 software.

III. Results And Discussion

Table 2: Results obtained from two – way ANOVA analysis

Parameters	Without Preservative		With preservative	
	1st month	2nd month	1st month	2nd month
Fat (g/100g)	0.248 ^{a} ± 0.010	0.250 ^{a} ± 0.014	0.264 ^{a} ± 0.026	0.262 ^{a} ± 0.013
Protein (g/100g)	0.135 ^{a} ± 0.011	0.139 ^{a} ± 0.017	0.141 ^{a} ± 0.016	0.138 ^{a} ± 0.005
Reducing sugar (g/100g)	3.094 ^{a} ± 0.201	3.564^{c} ±0.108	3.382 ^{b} ± 0.085	3.382 ^{b} ± 0.059
Total sugar (g/100g)	5.796 ^{a} ± 0.146	6.042 ^{a} ± 0.471	5.786 ^{a}± 0.407	5.714 ^{a} ± 0.439
Na level (mg/100g)	0.011 ^{a} ± 0.001	0.009 ^{b} ± 0.000	0.014 ^{c} ± 0.001	0.011 ^{a} ± 0.000
K level (mg/100g)	0.044 ^{a} ± 0.005	0.045 ^{a} ± 0.003	0.047 ^{a} ± 0.004	0.0443 ^{a} ± 0.002
Total phenolic content (mg/100 g)	9.681^{a} ±0.035	9.720 ^{a} ± 0.015	9.720 ^{a} ± 0.030	9.707 ^{a} ± 0.010
Titrable acidity (% w/w)	0.2^{a} ± 0.000	0.29^{c} ± 0.028	0.2^{a} ± 0.000	0.1^{b} ± 0.000
pH	3.8 ^{a} ± 0.000	3.75 ^{b} ± 0.015	3.8 ^{a} ± 0.000	3.91 ^{c} ± 0.005
*Values with same letters are not significantly differ from each other				

3.1 Reducing Sugar

In preserved fruit pulp, the reducing sugar level did not significantly change with time but in pulp without SMS, the reducing sugar level increased with time (Table 2). This might be due to the microbial activity; the microbes act on the pulp and convert the polysaccharides into monosaccharide. [12] The total plate count proves that there is microbial activity in pulp without SMS (Table 3).

Table 3: Total Plate Count

Total Plate Count	1st month		2nd month	
Sample	Dilution	No. Of colony	Dilution	No. Of colony
Pulp with preservative	10-^{1}	0	10-^{1}	2
	10^{-2}	0	10^{-2}	0
	10-^{3}	0	10-^{3}	0
Pulp without preservative	10^{-1}	1	10^{-1}	71
	10^{-2}	0	10^{-2}	38
	10^{-3}	0	10^{-3}	12

3.2 Na Level

The Na level was higher in preserved pulp (Table 2) as it contains sodium metabisulphite which reacts with water and releases sodium ions (Na+). It might be the reason for the difference in sodium ion between the chemically preserved and unpreserved pulp. In both cases the sodium ion levels decreased with time (Table 2) as it might have reacted with other molecules like water and undergone further reactions [13]

3.3 pH and Titrable acidity

In is stated that pH and the acidity share an inverse relationship [14]The pulp without SMS shows a decline in pH with time (Table 2). It is mainly due to the incensement in the concentration of weakly ionized acid and their salts during storage and also due to formation of acid by degradation of polysaccharides and oxidation of reducing sugars or by breakdown of pectin substances and uronic acid [15] In pulp preserved with SMS the pH level slightly increased (Table 2) due to the decline in acidity (Table 2). Decrease in acidity may be attributed to the involvement of organic acids in the hydrolysis of sugars and their interactions with other constituents of the pulp, resulting in neutralization of acids during storage. Shaklani and Sharma (2009) and Anwar *et al*. (1999) [16], [17] showed that acidity of some orange varieties decreases with time and this is attributed to accumulation of sugars in the juice.

3.4 Free SO_2 Level

Free SO_2 level was measured by ripper method which represents the decline initially and then the incensement (Fig. 1). It might be due to the reversible reaction as sulfur dioxide reacts with a wide range of food components. It forms adducts with aldehydes and ketones (including reducing sugars, acetaldehyde, quinones, and ketoacids), with anthocyanins, and with cysteine residues in proteins by reversible action. [18], [19]

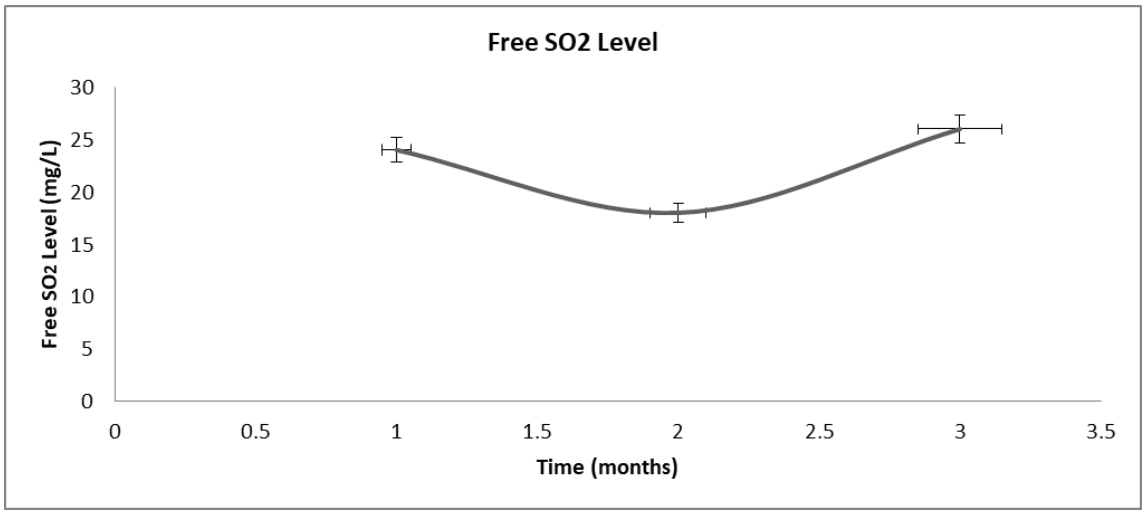

Figure 1: Change in free SO_2 level with time

IV. Conclusion

Based on the results of this study there is no adverse effect of sodium metabisulphite (SMS) on the nutritional composition of the pulp. Addition of SMS shows a strong preservation capacity when combined with refrigeration whereas refrigeration alone can be employed to preserve the pulp for up to one month based on the results of two consecutive months of analysis. To get a stronger conclusion, this study should be continued for a longer period of time.

It would be beneficial to use multi hurdle techniques such as refrigeration, freezing, drying and chemical preservation; this could make it possible to preserve effectively with less amount of chemical additives. In this study chemical preservation and refrigeration method are used as combined hurdles and the preservation is ensured by conditions such as appropriate pH, temperature and the chemical sodium metabisulphite in pulp treated with SMS. In the pulp without chemical preservative pH and the temperature ensure the preservation.

Future works are recommended to study the effective refrigeration temperature for preservation of pulp. Moreover works related to preserving the pulp without SMS addition using freeze drying and vacuum packing methods should be conducted in future.

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