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Studies on Preservation of Tender Coconut water

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ABSTRACT

Experiments were conducted during 2006 for preserving the tender coconut water by adding chemical preservatives to increase shelf life. The samples were analyzed for their pH, sugar and microbial count after 2, 5, 10, 15, 20 and 30 days of storage. The preserved samples were analyzed organoleptically for their color, flavor, taste and overall acceptability. The pH of the sample treated with 1000 ppm potassium metabisulphite was found to increase from 4.300 to 6.575 during 20 days of storage period and there was a falling trend at the end of 30 days of storage period. In all the cases, the pH was more than the initial conditions. It was nearer to neutral pH during 15 to 20 days of storage and variation of it was between 6 and 7. It was observed from the results that the sugar content gradually decreased with increase in storage period. It was observed that the microbial count of samples gradually increased with increase in storage period. It was found that microbial count of the control sample increased from 11 x 10^4 to 131 x 10^4 for a storage period of 30 days whereas it increased from 10 x 10^4 to 71 x 10^4 for the sample treated with 1000 ppm potassium metabisulphite. The coconut water treated with 1000 ppm potassium metabisulphite yielded an acceptable product to preserve up to 15 days with a score grade of like moderately.

Key words : Coconut water, Microbial count, pH, Preservatives,Sensory evaluation,Sugars.

Coconut (*Cocus nucifera* L.), an important commercial palm in the tropics of the world, is chiefly grown for its nuts. Coconut water is an important by-product of the coconut processing industry. Raw coconut water is consumed directly. Coconut water is used in the preparation of good quality vinegar. To some extent, coconut is used in the preparation of 'nata de coco', a gelatinous dessert delicacy produced by the action of bacteria. Coconut water is also an important substrate of yeast production. Saccharomyces *fragilis* grows well on matured coconut water, yielding up to 0.54 g of dry yeast per gram of total sugar at 40^{0}C (Krishnankutty, 1995). Coconut water has a number of medicinal properties.

Preservation of coconut water is a difficult process. It spoils rapidly with in 8 h. The literature available is meager in this line of processing. A successful technology by Satin (2000) through microfiltration and German process with spray evaporation are costlier to implement for Indian Food Industry. Hence, in the present study, chemical preservatives were attempted to increase the shelf life of tender coconut water.

Satin (2000) developed a FAO method to process the tender coconut water by using micro filtration technique. The shelf life of the product developed by this method was about 8 months.

Rethinam and Kumar (2001) reviewed the German technology by using spray evaporation technique. The concentrated tender coconut water had a shelf life varied from 6 to 24 months depending upon the degree of concentration.

MATERIAL AND METHODS

Coconuts (*cultivar*. Cheenangi Dwarf) were procured from Yajali village of Guntur district. The experiments are conducted at College of Agricultural Engineering during 2006. The fresh tender coconut water was extracted from tender coconuts. The water was filtered and transferred in to a single container to make it homogenous. Out of the bulk coconut water, 2.5 L of water was separated and added with the specified preservative and agitated. The fresh and pretreated samples were bottled in sterile 200 mL bottles and preserved under refrigerated conditions at 23^{0}C. Soon after the water was transferred in to the bottles, it was corked with a crown by making use of a crown-corking machine. The samples were replicated twice. The following were the chemicals used as preservatives of coconut water.

a. 1000 ppm of calcium hydroxide
b. 1000 ppm of potassium metabisulphite
c. 500 ppm of calcium hydroxide and 500 ppm of potassium metabisulphite
d. 250 ppm of calcium hydroxide and 750 ppm of potassium metabisulphite
e. 750 ppm of calcium hydroxide and 250 ppm of potassium metabisulphite

The samples of coconut water were stored for 2, 5, 10, 15, 20 and 30 days under refrigerated condition. The fresh and stored samples were analyzed for pH, sugar and microbial count.

The pH of fresh and stored coconut water was measured with digital pH meter (Make: Eutech Cybernetics, Singapore) and replicated thrice. The percentage of sugar in samples was measured with hand refractometer.

The microbial count of the samples was measured using microscope (Make: Hardson India, Model: 4517) in conjunction with haemocytometer . The droplets of 0.02 mL volume of spore suspension at least with a graduated 0.1 mL pipette on one of the chambers of the haemocytometer were placed and covered with the cover slip. The microbial count was read from microscope. Each smallest square ruled grid at the center marked R (known as improved Neubauer chamber) was 1/400 mm^2 and the cavity had a depth of 0.1 mm. In case of larger spores, the regions marked W at four corners of the central region were used. The total area of each of these larger squares was 1 mm^2 and the area of the smallest square was 1/16 mm^2 (Dasgupta, 1988).

Based on the larger square (W), the volume = area × height.

$= 1 \times 1 \times 0.1\ mm^3$

$= 10^{-4}\ cm^3$

If the number of spores in a larger square was equal to *n,* then, total number of spores in 1 mL = $n \times 10^4$. The experiments were replicated thrice.

The stored coconut water was served to 3 judges for evaluating the sensory characteristics like color, flavor, taste and overall acceptability and evaluated as per score card (Table 1).

Table 1. Sensory evaluation score card

Attribute	Score
Like extremely	1
Like very much	2
Like moderately	3
Like slightly	4
Neither like nor dislike	5
Dislike slightly	6
Dislike moderately	7
Dislike very much	8
Dislike extremely	9

RESULTS AND DISCUSSION

pH

The variation of pH of samples with storage period for different pretreatments is shown in **Fig. 1**. It could be observed from the graph that the pH of all treatments initially reduced during first 2 days and then gradually increased until 15 days and then decreased with increase in storage period. It was found that the pH of the control sample increased from 4.351 to 6.116 up to storage period of 15 to 20 days and then decreased to 5.811 by the end of storage period of 30 days. This initial increasing trend might be due to release of acids due to fermentation activity of microorganisms by converting sugars into acids. The later increasing trend of pH might be due to conversion of acids into alcohol. The further decrease of pH might be due to domination of acid production than alcohol conversion.

Sugar

The variation of sugar with storage period for different pretreatments is shown in **Fig. 2.** It could be observed from the results that the sugar gradually decreased with increase in storage period. It was found that the sugar of the control sample decreased from 4.50 to 3.50% for a storage period of 30 days. The sugar of the sample treated with 1000 ppm calcium hydroxide was found to decrease from 4.67 to 3.67% by the end of 30 days of storage period. The decrease in sugar content might be due to consumption of sugar by microorganisms for their survival.

Microbial count

The variation of microbial count with storage period for different pretreatments is shown in **Fig. 3.** It could be observed from the results that the microbial count gradually increased with increase in storage period. It was found that the microbial count of the control sample increased from 11×10^4 to 131×10^4 for a storage period of 30 days. The microbial count of the sample treated with 1000 ppm calcium hydroxide was found to increases from 11×10^4 to 117×10^4 by the end of 30 days of storage period.

Sensory evaluation of stored coconut water

The sensory evaluation data are given in Tables 2 to 8 for different storage periods. The samples 1, 2, 3, 4, 5 and 6 represent control, 1000 ppm of calcium hydroxide, 1000 ppm of potassium metabisulphite, 500 ppm of calcium hydroxide and 500 ppm of potassium metabisulphite, 250 ppm of

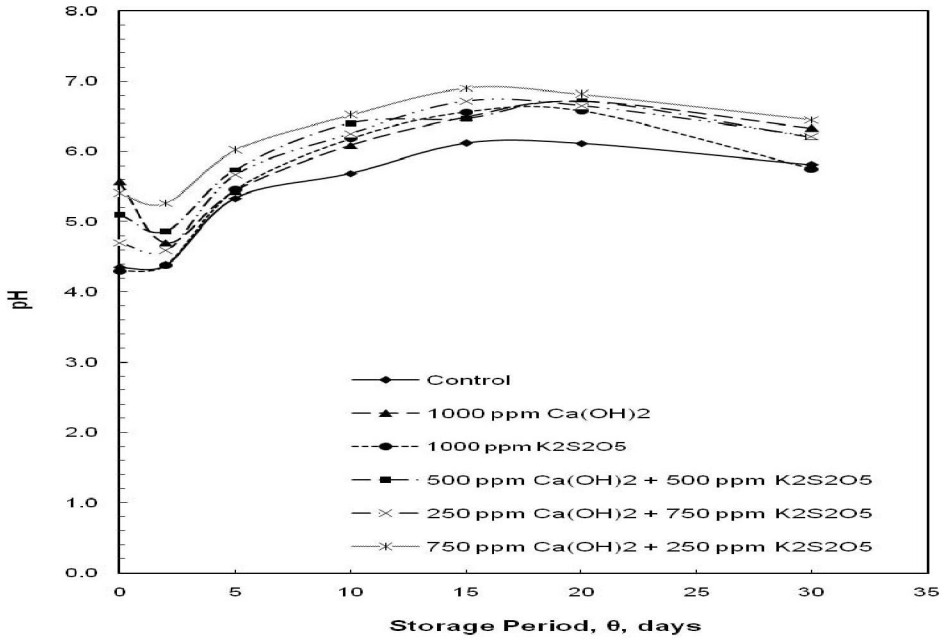

Fig. 1 Variation of pH of coconut water with storage period for different pretreatments

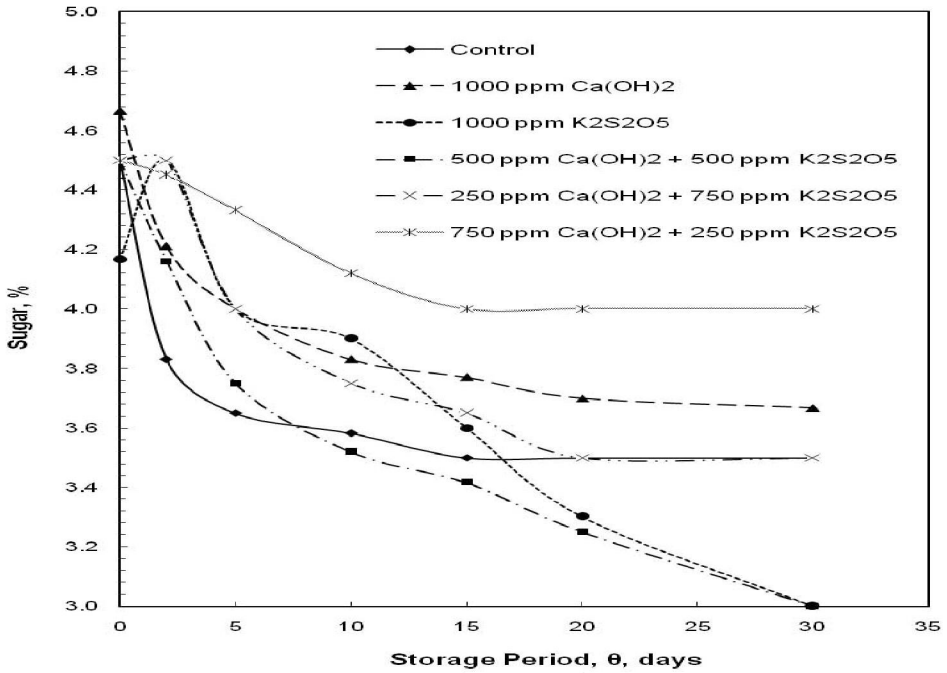

Fig. 2 Variation of sugar of coconut water with storage period for different pretreatments

Table 2. Sensory evaluation of coconut water on initial day

Characteristics	Sample					
	1	2	3	4	5	6
Colour	1	3	2	3	3	4
Flavour	1	4	2	3	3	4
Taste	1	3	2	2	3	5
Overall acceptability	1	3	2	3	3	4

Table 3. Sensory evaluation after 2 days of storage of coconut water

Characteristics	Sample					
	1	2	3	4	5	6
Colour	6	3	2	4	4	6
Flavour	6	5	2	5	4	6
Taste	6	4	3	4	3	6
Overall acceptability	6	4	3	4	4	6

Table 4 Sensory evaluation after 5 days of storage of coconut water

Characteristics	Sample					
	1	2	3	4	5	6
Colour	7	7	3	5	4	6
Flavour	6	7	4	6	5	6
Taste	7	7	3	6	4	7
Overall acceptability	6	7	3	5	4	6

Table 5 Sensory evaluation after 10 days of storage of coconut water

Characteristics	Sample					
	1	2	3	4	5	6
Colour	7	7	3	6	4	6
Flavour	7	7	4	6	5	7
Taste	7	7	3	6	5	7
Overall acceptability	7	8	3	6	5	7

Table 6. Sensory evaluation after 15 days of storage of coconut water

Characteristics	Sample					
	1	2	3	4	5	6
Colour	8	8	3	8	5	6
Flavour	8	8	4	8	6	8
Taste	8	8	3	8	6	7
Overall acceptability	8	8	3	8	6	7

Table 7. Sensory evaluation after 20 days of storage of coconut water

Characteristics	Sample					
	1	2	3	4	5	6
Colour	8	8	3	8	6	8
Flavour	8	9	5	8	7	8
Taste	9	9	5	9	7	8
Overall acceptability	8	9	5	8	7	8

Table 8. Sensory evaluation after 30 days of storage of coconut water

Characteristics	Sample					
	1	2	3	4	5	6
Colour	9	9	8	9	9	9
Flavour	9	9	9	9	9	9
Taste	9	9	9	9	9	9
Overall acceptability	9	9	9	9	9	9

calcium hydroxide and 750 ppm of potassium metabisulphite and 750 ppm of calcium hydroxide and 250 ppm of potassium metabisulphite, respectively.

It was concluded that the in all the cases, the pH was more than the initial condition. It was nearer to neutral pH during 15 to 20 days of storage and variation of it was between 6 and 7. The pH may not be considered for selection of appropriate treatment. It could be observed from the results that the sugar gradually decreased with increase in storage period and the microbial count gradually increased with increase in storage period. Tender coconut water could be treated with 1000 ppm potassium meta bisulphite for shelf life improvement.

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