

Development of Ready to Drink Beverage from Coconut Water of DC Mills

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Introduction

Coconut (*Cocos nucifera* Linn.) is referred to as “Tree of Life”. However, the most used part of the palm is coconut fruit (Damar, 2006). Liquid endosperm is the inner most part of the coconut fruit and it is rich in sugars, vitamins, proteins, antioxidants, minerals etc (Rolle, 2007; Campos *et al.*, 1996; Nadanasabapathy and Kumar, 1999). Although coconut water has numerous nutritional and medicinal properties, mature coconut water is considered as a waste and removed especially from desiccated coconut industries (Damar, 2006). Coconut water discharged from DC mills has a higher biological oxygen demand (BOD) and a chemical oxygen demand (COD) (Kumar *et al.*, 2002). This active pollutant pollutes the surrounding environment mainly by producing bad odours. Growing consumer interest in coconut water as a refreshing beverage and as a sports drink has broadened its market opportunities. The major problem in coconut water beverage is the shorter shelf life. Processing, preservation and proper packaging may be a good solution for extending the shelf life of mature coconut water as a beverage. This study was aimed at developing a processing and preservation method for prolonging the shelf life of coconut water that is discharged from DC mills.

Methodology

Coconut water was collected from DC mills under hygienic conditions. The pH, titratable acidity, total soluble solids (TSS), total sugar and minerals (Ca, Mg, K, Na and Fe) of DC nut water were analyzed. Preliminary studies were carried out to find out the best TSS level (6.0.), the best acidulates (citric acid), the best pH value (pH 4.4), suitable flavor and appropriate flavor concentration (strawberry flavor with 0.2 % v/v). The pH and Brix value adjusted coconut water was pasteurized by heating at 80 C for 5 minutes (T1), heating at 80 C for 10 minutes (T2), heating at 90 C for 5 minutes (T3) and heating at 90 C for 10 minutes (T4). KMS (100 ppm) and 0.05 % CMC were added as preservatives and stabilizers, respectively. The treated nut water with the better flavor was filled into sterilized glass bottles and aluminum pouches. Bottles and aluminum pouches were stored separately at both ambient (30±2 C) and refrigerated (4±2 C) temperature. The processed nut water was analyzed for TSS, titratable acidity, pH, mineral content, microbial infestation and sensory properties once in two weeks for a period of 2 months. Physio-chemical and microbial data were analyzed by SAS computer software. Kruskal Wallis one way ANOVA non-parametric statistical test was performed to analyze sensory data.

Results and Discussion

Nut water discharged from DC mills contains a considerable amount of sugars and minerals. Therefore, mature coconut water has a potential to make a refreshing beverage. Sensory attributes of prepared beverage was evaluated by semi trained panelists.

According to Table 1, higher mean ranks have better sensory attributes. Therefore, T2 was better in colour than the other three treatments. Aroma of the product increases the consumer acceptability as it is a good indicator of spoilage. T1 is better than the other three treatments in

odour, taste and overall acceptability. Overall likeability of treatments varied at different rates during storage. Change in the overall likeability could be possible because of the microbial growth during storage time and it could affect the flavor and aroma (Kincal et al., 2005). However, there was no increment or decline in colour or odour within the test period.

Table 1. Mean rank values for sensory attributes

Treatment	Attributes			
	Colour	Odor	Taste	Overall acceptability
T1	36 ± 0.58	39.9± 0.81	40.9± 0.68	41.3± 0.81
T2	41.8 ± 0.57	33± 0.05	36.8± 0.72	33.9± 0.75
T3	24.6 ± 0.7	26.3± 0.72	22.5± 1.3	23.7± 0.91
T4	27.7 ± 0.86	30.9± 0.62	29.8± 0.63	31.1± 0.93

(T1= pasteurization at 80 °C for 5 minutes, T2 = pasteurization at 80 °C for 10 minutes, T3= pasteurization at 90 °C for 5 minutes, T4= pasteurization at 90 °C for 10 minutes)

The pH of prepared beverage varied with time. However, there was no significant difference in pH values in different treatments and also during storage of eight weeks ($P > 0.05$). The pH value of the DC nut water samples changed from 3.9 to 4.6 during storage. There is a slight increment in pH values with time in T2 and T3. This slight increment may be due to the growth of microorganisms (Rodrigues, 2013). When microorganisms grow in acid media their metabolic activity results in the medium or substrate become less acidic (Jay, 1992). Generally yeast could contribute to the deterioration of coconut water, causing a decrease in the pH value and hence the acidification of the product. The results obtained for pH values are compatible with the results of pasteurized young king coconut water beverage (Rathnayake and Gunathilaka, 2007).

Brix value of initially prepared beverage was 6%. There was no significant difference ($P > 0.05$) in changes in Brix value on storage time period, storage condition, packaging material and pasteurization temperature and time. The maximum change in Brix was 0.15 units. This could be possibly due to sample-to-sample variation. Theoretically, a change in Brix of samples was not expected during storage unless evaporation or fermentation has taken place. Hence microbial data or pH data do not support such changes (Damar, 2006). According to the results, there was no significant difference in titratable acidity on storage condition, packaging material, pasteurization temperature and time ($p > 0.05$).

According to microbiological studies, TPC and yeast and mould count were nil just after preparation of nut water beverage. Heat treatment was sufficient to destroy the initial load of microorganisms in DC nut water. However, TPC and yeast and mould count increased on storage.

They were significantly different on storage time ($P < 0.05$) but there was no significant difference on storage conditions, pasteurization temperature and pasteurization time and packaging materials. There was no interaction effect between storage time vs storage condition, storage time vs packaging material, storage time vs pasteurization temperature and storage time vs pasteurization time period. According to the FAO standards and CROSQ standards (CARICOM Regional Organization for Standards and Quality), 12 products were found within the acceptable level after 8 weeks (TPC $< 5.0 \times 10^6$ colonies ml⁻¹; yeast and mould $< 1.0 \times 10^6$ colonies ml⁻¹). T1 (80 °C for 5 minutes), T4 (90 °C for 10 minutes), T3 (90 °C for 5 minutes) treated samples in aluminum pouches and stored at room temperature were rejected after 30 days, 45 days and 60 days, respectively, because of bulging, bad odor and exceeding of

microbial limits. T2 (80 °C for 10 minutes) treated samples in aluminum pouches and stored at refrigerated temperature were rejected after 60 days due to exceeding microbial limits.

According to the results, though potassium content is greater in the prepared beverage, sodium, calcium and magnesium levels are lower. Higher sodium content leads to undesirable salty taste that disqualifies coconut water from soft drink purpose. Iron level is lower than all the other tested minerals. Total sugar percentage ranged from 4.9 to 5.7 g/100ml and in fresh sample it was 2.4 g/100ml.

Conclusions and Recommendations

The two packaging materials of processed DC nut water had no significant difference on physiochemical parameters on two months of storage period. The optimum pasteurization condition was 80 °C for 10 minutes based on microbiological results and sensory parameters. This pasteurization combination was better in prolonging the shelf life of DC nut water for 8 weeks' period and the products were microbiologically safe for consumption. Glass bottles can be recommended as the better packaging material for pasteurization of coconut water. Refrigerated conditions (4±2 °C) can be recommended as the better storage condition for pasteurization of coconut water.

References

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