Greener Journal of Science, Engineering and Technology Research

ISSN: 2276-7835

ICV 2012: 5.62

Submission Date: 10/03/014

Accepted: 20/08/014

Published: 21/08/014

Effects of Different Packaging Materials on the Shelf Stability of Ginger Juice

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Research Article

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ABSTRACT

Ginger (*Zingiber officinalis roscoe*) is an important spice crop of the world and plays valuable roles as food additives (spices) in foods. Acceptable juice has been produced from ginger. However, there are dearths of information on its shelf life study using appropriate packaging materials. Hence, the aim of this research work is to study the effect of different packaging materials on the shelf stability of ginger juice.

Ginger juice is produced from ginger rhizomes through sorting, washing, peeling, milling, juice extraction, sieving, application of additives (preservatives, sweeteners) and pasteurization. The pasteurized juice was then hot-filled and cooled into the different packaging materials (glass bottle, plastic bottle, low-density polyethylene, high-density polyethylene materials and thin film used as control for the study. The various juice samples were subjected to chemical and microbiological assessment on storage period of twelve (12) weeks.

There is generally a gradual decrease in the PH of the entire sample with storage. The decrease in the pH ranged between 5.03 and 4.72; there are steady (slow) increases in the total titratable acidity in all the samples over the storage time with the maximum increase in sample E (3.30) with sample A having the minimum value (3.10). The Total Soluble Solids (TSS) witnesses drops in values for all the samples with a gentle slope. The value ranges between 27.40 and 27.80. Minimum value range was obtained for sample A which is the glass- packaged sample. The specific gravity followed the same trend (increasing with storage time) in all the samples (ranged between 1.3727 and 1.3731) but sample A glass bottled packaged sample has the minimum reduction or drops. Microbiologically, all the samples showed low microbial load in all the counts (Total viable count, conform count and mould count) carried out. Although, all the counts were within the safe level of juice generally, sample A has the least microbiological load (5.2×10^2 cfu/ml) at the end of the twelve (12) weeks storage period.

Based on the outcome of all the analysis carried out on the juice samples, it can be concluded and recommended that glass bottle be used in the packaging of ginger juice.

Keywords: Effects, Packaging, Shelf life, Ginger and Stability.

INTRODUCTION

The importance of food packaging in food as a unit operation cannot be overemphasized; this is so because, all the technologies imputed into food processing becomes nothing if the food products were not properly and adequately packaged. Ginger (*Zingiber officinalis Roscoe*) is an important spice crop of the world. It is a valuable cash crop and plays important roles as additives (spice) in foods. Generally, ginger contained 8% of crude fiber; 42%, starch; 1%, lime; 12%, cold-water extract; 7%, total ash; 12%, ash insoluble in Hydrochloric acid and 2%, ash soluble in cold-water [1]. Ginger possesses a warm, pungent taste and pleasant smell, hence, its widely used as flavourant in numerous food preparations and beverages, baked food, confectionaries, ginger bread, savory dishes, curry, soup, pickles and many other soft drinks. Ginger tea is regarded as a carminative and in the symptomatic treatment of colds. Dry ginger and ginger products like oil, powder, paste etc. has a very good domestic as well as export market [2]. Ginger juice has been produced using different formulations with very good results. However, there has not been report on its packaging technology. As a result, this report is aimed at studying the effects of different packaging materials on the shelf life stability of ginger juice.

MATERIALS AND METHODS

Materials

The materials used for this project work is ginger tuber crops which was purchased from a local market in Oke, Oyo State. All other wares, equipment and chemicals used were that of Analytical Standard and food grade and were obtained from the Food Science and Engineering Department, LAUTECH, Ogbomoso, Oyo State.

Methods

Production and Packaging of Ginger juice

The ginger rhizomes crops was sorted out and washed with clean water to remove all extraneous materials. Each crop was manually peeled with the use of a clean stainless knife and rewashed. The peeled ginger crops were loaded into a milling machine and milled. The milled product was dissolved in the appropriate quantity of water to leach out the extracts. This was later sieved using a muslin cloth, 0.75g/litre of sodium benzoate was added as a preservative and stirred properly. Sugar was added to make up to the required 22^o brix. The juice sample produced was pasteurized at 63°C for 30 minutes. The product was then hot-filled into the various sterilized packaging materials (Glass bottle (A), plastic packaged (B), Low Density Polyethylene Materials (C), High Density Polyethylene Materials (D), and the Control (E). The packaged drinks were then cooled in a cold-water bath and later stored in a refrigerator.

Figure 1: Flow Chart for the Production and Packaging of Ginger Juice

Analysis

Chemical analysis like: pH, Titratable acidity, Total acidity, Total soluble solid and Specific gravity were carried out on the sample as monitoring indices using the methods of [3]. Microbial analysis (Total plate count, coliform count, mould and yeast count) were also carried out on the samples [4].

RESULTS AND DISCUSSION

Figure 1 represents the effects of different packaging materials on chemical composition of the produced juice. The pH values for all the samples (A, B, C, D and E) ranges between 5.02 and 5.04 during the first week and 4.72-4.95 at the last (twelfth week) of the storage. The recommended pH for most popular juice is between 3.5

and 4.5 as recorded in [5]. The control sample had a higher decreasing pH from the control week to the last week ranging from 4.72-5.03. In contrast, samples A, B, C and D had fairly constant pH values between 4.89 and 5.04 meaning that the samples are within the range of the pH standard for the juice. However, at pH 4.95-5.04 in glass bottle, there was slight difference in variation compared to that of plastic bottle, low density and high-density polyethylene materials. The thin plastic film showed much variation thereby signified its ineffectiveness in keeping the juice products. Thus, glass bottle (sample A) is found to be more effective in keeping the product. The titratable acidity was highest slightly in sample E (3.3) followed by sample D (3.13) and lowest in sample A (3.1). The Total Soluble Solids values fall in between 25.00-29.00 from the second week of storage to the twelfth week. Although, these values are close to the standard values for most fruit juices of between 22^0 to 25^0 [6]. Considering all the values obtained for each sample throughout the storage time, the one that is constant and closest to the common value (i.e. 25^0) is sample A with 26.6^0 , others are with various values. The specific gravity of all the samples during the storage time ranges between 1.3731 and 1.3735. Sample A had a higher and constant specific gravity from week 6 to week 12 of storage, followed by sample C, D, E and B in decreasing orders. For the microbial analysis, the total viable count ranges between 1.0×10^2 to 7.2×10^3 cfu throughout the storage time. All the values obtained show low microbial loads which are below the recommended microbial load for most beverages [7]. These implied that the juices in the various packaging materials aside being produced under hygienic conditions were adequately kept by the packaging materials. Nevertheless, sample A has the least microbial load (1.0×10^2 cfu) throughout the storage time (at the end of the twelfth week). The total coliform counts was increasing throughout the storage time (3.5×10^2 cfu at the second week to 6.2×10^3 cfu in the twelfth week), though, the ranges were still within the limits. Samples B, C and D are safer (with microbial loads of 6.2×10^2 , 9.5×10^2 and 8.5×10^2 respectively) than sample E with 6.2×10^3 cfu microbial loads. However, sample A is more preferable because it has the least microbial load of 2.4×10^2 cfu at the end of the storage time. As for the mould/yeast counts, there are minimal loads throughout the storage period.

Figure 1: Trends of pH With Storage Time on Ginger Juice with Different Packaging Materials.

Figure 2: Trends of Total Titratable Acidity (TTA) with Storage Time for Ginger Juice with Different Packaging Materials.

Figure 3: Trends of Total Soluble Solids (TSS) with Storage Time for Ginger Juice with Different Packaging Materials.

Figure 4: Trends of specific gravity (SG) with Storage Time for Ginger Juice with Different Packaging Materials.

Figure 5: Variation of Total Viable Count with Storage Time on Ginger Juice with Different Packaging Materials.

Figure 6: Variation of total coliform count with storage time on ginger juice with different packaging materials.

Figure 7: Variation of total mould/yeast with storage time on ginger juice with different packaging materials.

CONCLUSION

Owing to the outcome of all the analysis carried out on the juice packaged in different packaging materials, it can be concluded that the ginger juice can best be packaged in a glass bottle (sample A) since it had the best quality combinations chemically and microbiologically.

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Cite this Article: Akande EA, Adeyanju JA, Oladipo OA and Oyetunji FF, 2014. Effects of Different Packaging Materials on the Shelf Stability of Ginger Juice. Greener Journal of Science, Engineering and Technology Research, 4 (2): 038-044.