Shelf Life of Pineapples Stored in Syrup (*Ananas cosmos L.*)

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ABSTRACT--- Large quantities of pineapples produced in Nigeria are wasted during postharvest handling and storage leading to reduction in value and nutrient content. Lack of canning and bottling technology made storage and extension of shelf life fruits and vegetable difficult in Nigeria. This study attempts to store cubed pineapple in syrup packaged in plastic jars. Quality parameters monitored were total soluble sugars, total reducing sugar, soluble protein, titratable acidity, ash content and vitamin C. Slight decrease were observed in all the parameters mean values during storage period. Analysis of variance was significant ($P \leq 0.05$) at the end of the sixth month. Sensory evaluation of aroma, sweetness, colour and physical appearance were rated very good. The storage of cubed pineapples in syrup packaged in plastic jars would in no small measure reduce waste and increase the economy of pineapple farmers, marketer and consumer.

Keywords--- pineapple, plastic jars, chemicals analysis, shelf life and sensory evaluation

1. INTRODUCTION

Pineapple is a xerophyte, succulent, herbaceous and perennial plant (Paul1, 2002). There are several varieties of pineapples bearing fruits during the rainy season. Pineapples are the third most important tropical fruit in world production after banana and citrus. They are harvested between March and July but are available all year round. Pineapples contain 81.2 to 86.2% moisture and 13-19% total solids of which sucrose, glucose and fructose are main component, vitamins and minerals (Medina and Garcia, 2005). As much as 70% of pineapples produced in the world are consumed fresh (Mohammed, 2005; Reinhardt and Rodriquez, 2001). Fruits and vegetables are perishables; suffer huge losses between 25-80% as a result of bad handling, method of transportation, packaging and diseases (Thirupathi *et al.*, 2006; Kalusan, 2014). Transportation of harvested pineapples to markets in the cities is usually long and difficult due to bad roads. Three main factors of fruits storage are of importance in preventing spoilage. These include storage temperature, relative humidity, and composition of the atmosphere within the chamber. The control of the parameters within accepted units would ensure long term storage stability. Food packaging is also a method of food preservation which eliminates physical contact between produce and contaminants (Sivasakcar, 2010). Wax treatment and de-greening technologies are not available in Nigeria. In developed countries the treatments last for weeks inside refrigerator or cooling houses. Canning technology is not available in Nigeria and more so electricity supply is a challenge. Nigerian Stored Products Research Institute (2010) developed techniques for the production of dried pineapple, mango and okra but the technology was not readily accepted as many prefer fresh succulent, yellow – gold pineapples. The main objective of this study is to develop a method of preserving/extending pineapples in cube for without preservatives and assess quality parameters.

2. MATERIALS AND METHODS

2.1. Samples Collection

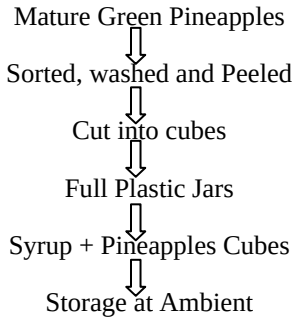
Fresh pineapples were purchased in bulk from Agege market, Lagos state. 250 ml plastic jars were locally purchased; other materials include Steamer and commercial granulated sugar.

2.2. Experiment

Plastic jars were washed with detergent and rinsed with potable water.
Pineapple (Smooth Cayenne cultivar) fruits were cleaned, sorted, peeled and cut into cubes.
The main packing medium was syrup of 30% sugar solution. The jars were filled with 200grammes of pineapple cubes then syrup and simmer in a steamer for five minutes and placed on the shelf at ambient temperature (27- 30°C, 70-90% Relative humidity.).

2.3. Assessment of the physico-chemical parameters

A jar was taken on a monthly interval until deterioration sets in. The quality parameters monitored for six months were total soluble solids, total reducing sugars, total titratable acidity soluble proteins and vitamin c. Control was also set up.



Flow chart for the packaging of cubed pineapples stored in syrup

2.4. Ash content determination

Five grams (5g) of the sample was weighed into a porcelain crucible, previously ignited and weighed. Organic matter was charred by igniting the material on a hot plate in the fume cupboard. The crucible was later placed in the muffle furnace and maintained at 600°C for six hours. It was then cooled in a dessicator and weighed immediately. The percentage ash was calculated Ash (%) = $\frac{ash\ weight\ (gm) \times 100}{sample\ \ weight(gm)}$

Total Reducing Sugar determination was carried out according to McCaseady (1970) and Dubious *et al.*, (1956)

Soluble Protein and Total Soluble Solids were determined as described by (AOAC, 1990)

Vitamin C determined using the titrimetric method as described by AOAC (1990) and Pearson (1976).

Sensory Evaluation was determined visually. Parameters like appearance, colour, firmness, and taste were graded using Hedonic scale: 5 = very good, 4 = good, 3 = fair, 2 = poor and 1 = bad.

Evaluation was assessed by ten panellists who are familiar with sensory assessment

2.5. Data Analysis

The results were statistically evaluated by two-way analysis of variance (ANOVA).Statistical differences with p value under 0.05 were considered significant, Means and standard deviation considered using SPSS Program.

3. RESULT AND DISCUSSION

From Table 1, Total Soluble Solids of fresh pineapples to sixth month decreased from 15.82±0.11 to 12.37±0.20% which was significantly different ($P<0.05$). Kader (1996), Dull (1971) reported acceptance of a minimal level of TSS of 12% for matured pineapples. Medina and Garcia (2005) reported acceptable reducing sugar limit between 11-18%. In this study, slight decrease in total reducing sugar was recorded 14.25±0.05 to 12.68±0.07mg/100mg but it was not significant ($P\leq0.05$). This result was also in accordance to Kemasha *et al.*, (1987). Total titratable acidity decreased, the result ranged between 1.130±0.02-1.023± 0.06 % but it was not significant ($P\leq0.05$). This is in agreement to Dull, (1971). Medina and Garcia (2005), they reported 0.5-1.69% as acceptable level. Soluble protein decreased from 0.63±0.02 to 0.49±0.06% ($P\leq0.05$).The soluble protein content decreased from0.63±0.02 to 0.49±0.06% Increase in protein content was recorded for effect on location, maturity and ripening stages of pineapples reported by Jirapa *et al.*, 2011.Vitamin c content also decreased from 25.20±0.05 t0 19.40±0.02mg/100g.The ash content also decreased from1.29±0.035 to1.25±0.05. The result was significant ($P\leq0.05$) in accordance to Jirapa *et al.*, (2011) on maturity effect on pineapples.

Moneruzzaman *et al.*, (2008), reported that the acid content in pineapple fruits was found to be lower in immature fruit and it was highest at the stages when colour appeared with a rapid decrease as the fruit ripened at ambient condition. They also reported that citric acid was the major constituent of total acidity and malic acid occurred in small concentration and decrease as the fruit ripen. Palatability of fruits depends on total soluble solids and acidity ratio of pineapple fruits increased gradually during the storage period. Reducing sugar play a great role in food preservation, sugar contributes to the flavour and aids in holding the shape of the fruit (Dhar *et al.*, 2008; Lamikaran, 2013). Fruits in sugar solution keep their bright colour and firm texture, it is also necessary to prevent fruits from moulds. Ripening conditions (temperature and relative humidity) affect the ascorbic acid content in storage conditions, acid concentrations

decreased linearly with the increase in temperature. Sabahelkheir *et al., (2010),* reported soluble protein increases with days of maturity. The juice of pineapple fruit contain five proteolytic enzymes collectively known as bromelain. Bromelain possess medicinal properties. The net protein utilization refers to the percentage of ingested and utilized protein for growth and maintenance (Sabahelher *et al.,* 2010). The ash content also decreased from 1.29±0.035 to 1.25±0.05. The results were significant (P≤0.05) in accordance to Jirapa *et al.,* 2011, on maturity effect on pineapples. The ash content of fruits during ripening indicated that there was a gradual decrease which is significant, enhanced ash content is usually due to the release of minerals and ions from the fruit, because of the acidic nature of the sample (Adekalu *et al.,* 2011). A significant decrease (P≤0.05) was observed between the fresh and the six month storage.

A significant decrease in levels of vitamin C throughout the storage periods was observed. Ripening conditions such as temperature and relative humidity affect the ascorbic acid content. Moneruzzaman *et al.,* 2008, reported decrease in vitamin C linearly with the increase in temperature during storage condition. Canning has been known to preserve nutrient value as loss of nutrients during storage can be due to oxidation (edu/safepreserving/2013).

From Table 2, sensory evaluation showed that peculiar yellow-gold, colour, sweetness, aroma and juicy texture were maintained throughout the six month storage. All the parameters were rated very good at the end of the storage period. No symptoms of microbial deterioration or internal browning and yeasty fermentation were observed. This study shows that fresh cubed pineapple can be preserved by semi processing for six months without preservatives. Refrigerated jars samples stored well for a year. Control only store for a day or two days in agreement with (Pineapple selection and storage). Important information has been generated on nutritional properties of cubed pineapples in syrup packaged in plastic jars. Fresh pineapples waxed with fungicide treatment only store for 6-7 days (Paul and Durte, 2011). Cubed pineapple pieces can be mixed with other fruits to prepare fruit cocktails, this entail another commercial alternative.

Heart and peels from canning operations can be used to produce foods for goats and pigs (FAO, 2004). The waste parts left from processing plants include the skin core and ends used to make alcohol, vinegar and feeds for livestock (Medina and Garcia, 2009). Nigerian farmers continue to register high post harvest losses in the trade of fresh, fruits and vegetables in both domestic and export markets. This new technique can extend shelf- life of fresh pineapples, leading to reduction of post-harvest losses. It also gives value addition and improves post harvest handling knowledge which is an important aspect of the Nigerian Government Policy of transforming agriculture into viable business scheme. This will lead to establishment of small cottage industries.

Table 1: Proximate Analysis of Fresh Chunks Stored in Syrup Packaged in Plastic Jars

MONTHLY	TSS%	TRS mg/100g	TTA%	S/PROTEIN%	ASH%	VIT.C mg/100g
0	15.82±0.11	14.25±0.05	1.130±0.02	0.63±0.02	1.29±0.035	25.22±0.04
1	13.81±0.23	13.90±0.10	1.056±0.05	0.60±0.005	1.27±0.026	22.03±0.05
2	13.61±0.20	13.50±0.10	1.056±0.05	0.58±0.10	1.24±0.04	20.05±0.07
3	13.23±0.20	13.20±0.20	1.033±0.06	0.55±0.01	1.25±0.02	20.03±0.02
4	12.50±0.10	12.90±0.01	1.036±0.15	0.54±0.01	1.26±0.01	19.03±0.04
5	12.50±0.10	12.80±0.10	1.033±0.033	0.52±0.05	1.28±0.03	19.02±0.02
6	12.35±0.20	12.69±0.07	1.023±0.06	0.49±0.06	1.25±0.05	19.03±0.04

Means ± SEM (P≥0.05) at 95% confidence limit

Table 2: Sensory Evaluation of cubed pineapple stored in syrup

MONTHS	AROMA	SWEETNESS	COLOUR	PHYSICAL APPEARANCE
0	5	5	5	5
1	5	5	5	5
2	5	5	5	5
3	5	5	5	5
4	5	5	5	5
5	5	5	5	5
6	5	5	5	5

HEDONIC SCALE: 1= BAD, 2 = POOR, 3 = FAIR, 4= GOOD, 5 = VERY GOOD

4. CONCLUSION

This is a promising research breakthrough for adoption by small scale industries in developing countries. This basic information would be of importance to food engineers, food scientist and processors, farmers and other scientist.

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