



Development and Quality Evaluation of Canned Pineapple

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Abstract

The study was done to investigate the chemical constituents of a developed canned pineapple (*Ananas comosus*) product and to evaluate the microbiological quality of the product. A water bath canner and quart glass jars equipped with cap having top rubber were used for canning of pineapple (*A. comosus*). The thermal processing was done for the canning of pineapple. The raw fresh pineapple and canned pineapple were analyzed for their moisture content, ash, fat, crude fiber and protein contents. The moisture content, ash content, fat, crude fiber, protein content of fresh pineapple were 81.5%, 0.38%, 0.2%, 1.4% and 0.5%. The moisture content, ash content, fat, crude fiber and protein content of canned pineapple were 70%, 0.35%, 0.4%, 1.9% and 1.5% respectively. These Chemical constituents of the canned pineapple were almost similar with the raw fresh pineapple except the crude fiber and protein. The yeast and mould present in the product were also counted by using PDA (potato dextrose agar). The yeast and mould count for the product was within the consumer safety limit.

Key words: pineapple, canned pineapple, yeast and mould, chemical analysis, PDA

Introduction

Pineapple (*Ananas comosus*) is one of the most delicious tropical fruits. It belongs to the family of Bromeliaceae. Pineapple is a good source of natural antioxidants (Islam *et al.*, 2015). It has good flavor and taste. It is also high in fiber, minerals, vitamins and other nutrients. Pineapple is acidic food having pH almost 3.5 to 4 (Sairi *et al.*, 2004).

According to Medina and García (2005), Thailand, Philippines, Brazil and China are the main pineapple producers in the world nearly 50 % of the total output (FAO, 2004). Other important producers include India, Nigeria, Kenya, Indonesia, México and Costa Rica and these countries provide most of the remaining fruit available (50%).

In Bangladesh pineapple is highly cultivated in Dhaka, Tangail, Mymensingh, Gazipur, Sylhet, Moulvibazar, Chittagong, Bandarban, Khagrachari and Rangamati districts. The people of Bangladesh like to consume the ripe pineapple and use the pineapple to make jam jelly and pickles (Hossain and Islam, 2017). But the popularity of pineapple products is still low. Most of the people are not familiar to the preservation technique of pineapple. As a result the market of pineapple product is not high. Due to poor keeping quality and lack of processing and preservation most of the pineapples are spoiled in every season.

The preservation of pineapple can be done by canning which is a thermal processing of pineapple in a hermetically sealed container though which the spoilage organism and the enzymes are inactivated (Padmavati and Anandharamakrishnan, 2012).

Canning can be done in the home by using water bath canner. During canning, if the botulinus bacteria cannot be destroyed they can grow and produces neurotoxin in the food. The water bath canner can only heat the can up to the temperature of boiling point of water. At this temperature the botulinus bacteria and their spores cannot be killed unless the product is sufficiently acidic. As pineapple is an acidic fruit having pH 3.5 to 4. So, during canning of pineapple the botulinus bacteria can be destroyed using water bath canner by applying heat treatment for a certain period of time. The thermal processing period of the can should be 25 minutes for quart glass jars (Stanley *et al.*, 1942; USDA, 2015)

Featherstone (2015) argued that the spoilage organisms are yeast, mould and lactic acid bacteria during canning of high acid fruits (pH<3.8) like pineapples. Due to high acidity the fruits are easily softened during heat treatment. So the processors try to make canned product at minimum processing requirement. So the recommended core temperature or can-center temperature (CCT) is over 70°C

holding up to 2-3 min for processing of the acidic fruits. Practically it is done between 80-82°C for those fruits. The processing and preservation of pineapple was carried out by using locally available machineries and technology within minimal capital investment. Then the chemical composition of canned pineapple was studied. The materials and chemicals such as, hot air oven, soxhlet apparatus, muffle furnace, PDA agar, Petri dish, bio-safety cabinet, incubator etc. were provided by the BCSIR laboratories, Chittagong.

Methodologies

Materials

The pineapples were purchased from local market of Chittagong, supplied from the district Rangamati. The other materials and chemicals such as, hot air oven, soxhlet apparatus, muffle furnace, PDA agar, Petri dish, biosafety cabinet, incubator etc. were provided by the BCSIR laboratories, Chittagong.

Development of canned pineapple

The canning of pineapple was done according to the procedure described by USDA (2015) and Stanley *et al.* (1942).

At first, clean, fresh, mature, uniform and good quality pineapples were selected. They were thoroughly washed using a wire basket until there is no trace of soil. The glass jars and caps are examined to make sure that they are in good condition.

The glass jars having crack, chips or dents were discarded. The glass jars and lids were washed in hot soapy water and rinsed. They were placed in a pan of hot water with a rack in the bottom. The jars and caps were sterilized by boiling 15 to 20 minutes and kept hot until required. The sugar and the water were mixed and boiled for 5 minutes to make the syrup. The syrup was made at 80° Brix. The syrup was made in advanced so that it can be used when it is required.

Pineapples were peeled and the eyes were removed. After that they were sliced into round pieces having 4.5 cm diameter and ½ inch thickness. Slices were precooked in the hot sugar syrup for short time to remove the air from the tissues and to inactivate the enzymes. The glass jars were removed one at a time from the hot water bath. Jars were kept hot to prevent breakage at the time of packing and processing.

The jars were packed with slices by using food tong which was previously sterilized. Then the syrup was poured carefully leaving a head space up to ¼ inches. The pineapple slices in the jars were exhausted by

removing air with the help of steam. The cans were sealed with the caps having rubber rings on the top at once after the exhausting. The packed jars were placed in the hot water bath canner and processed at 100°C (212°F) temperature for 25 minutes. The glass jars were cooled in the air. After cooling they were inverted and observed for leakage. The cans were labeled including date by wrapping smoothly around the cans. The canned products were hold at room temperature for a week (7 days). The cans were stored in a dry, cool place and protected from light so that the color would not be faded.

Chemical analysis

The canned pineapples were analyzed to determine their moisture, ash, fat, crude fiber, protein. The parameters were determined by the method described by A.O.A.C (1965), Rangana (2002) and Akhter *et al.*, (2012).

Determination of moisture content

At first, Empty crucible with cover weighed out. About 5-10 grams of sample was taken in a pre-weighted dry crucible. Then the crucible was placed in hot air oven and dried at 105°C for 5 hours under pressure not exceeding about 100mmHg. After drying crucible was removed from the oven and cooled in the desiccator. Sample was dried until two consecutive weights were same and constant weight was observed. Crucible and dried sample were weighted and the loss in moisture was reported.

Calculation of moisture percentage:

$$\% \text{ Moisture} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

W_1 = Initial weight of empty crucible, W_2 = Weight of crucible + sample before drying, W_3 = Final weight of crucible + samples after drying

Determination of ash content

At first, 5 grams of sample was taken in dry clean crucible. Hot air oven was used to remove the moisture at 105°C temperature. After removing the moisture the sample was burned in the muffle furnace at 550°C for 6 hours. The sample was then cooled in the desiccators and weighted.

Calculation of ash percentage:

$$\% \text{ Ash} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100 = \frac{W_3 - W_1}{W_2 - W_1} \times 100$$

W_1 = Initial weight of empty crucible, W_2 = Weight of crucible + sample before burning, W_3 = Weight of crucible + sample after burning

Determination of fat content by Soxhlet extraction

At first, 250 ml clean flasks were dried in an oven at 105-110°C for about 30 minutes. Then, about 2g of sample was weighed accurately into labeled thimbles. After that, Corresponding labeled cooled boiling flasks were weighed. The boiling flasks were filed with about 300ml of petroleum ether (boiling point 40-60°C). The extraction thimble was plugged lightly with cotton wool. The Soxhlet apparatus was assembled and allowed to reflux for about 6 hours. The thimbles were removed with care and petroleum ether was collected in the top container of the setup and drained into a flask for re-use. The flask was removed and dried at 105-110°C for 1 hour. When flask was almost free of petroleum ether the flask was transferred from the oven into a desecrator and allowed to cool, then weighed.

Calculation of fat percentage:

$$\% \text{fat} = \frac{\text{weight of flask with fat} - \text{weight of empty flask}}{\text{weight of sample taken}} \times 100$$

Determination of protein content by isoelectric precipitation

The protein determination was done by the isoelectric precipitation method because the solubility of protein depends on the pH of the solution.

About 5gm of finely ground/paste food sample was dispersed in 150ml of 0.3% NaOH solution at a pH of about 11.6 in a 250ml beaker. The content of the beaker was heated at 50°C on a water bath for 2 hours with occasional stirring. The solids were then separated from dispersion medium by filtration through a nylon cloth and then by centrifugation. Proteins were precipitated by gradual addition of 5% acetic acid at the isoelectric point from the alkali extract. The protein thus precipitated out was then filtered through sintered glass crucible, washed several times with 95% alcohol and finally with acetone. The washed proteins were dried in desiccator at room temperature. The proteins were then weighed.

Calculation of protein percentage:

$$\% \text{ Protein} = \frac{\text{Weight of protein}}{\text{Weight of sample}} \times 100$$

Determination of crude fiber

The suitably weighed sample is successively treated with boiling sulfuric acid solution and sodium hydroxide solution. The residue is separated by

filtration. After filtration it was washed, dried, weighed and then ashed. The loss in mass resulting from ashing is called the crude fiber content. About 0.5gm sample was weighed and taken in a volumetric flask. Then the sample was boiled with 50 ml 0.255N H₂SO₄ for 30 minutes in a reflux condenser. Insoluble residue were then filtered and collected. The obtained residual substances were boiled subsequently with 0.313N NaOH for 30 minutes in a reflux condenser. After that it was chronologically washed and filtered to get the insoluble residue. The residue obtained was then dried for 2 hours at 103±2°C in oven. The weight of the dried residue with filter paper and blank paper was taken. Then the blank paper and the filter paper with residue were ashed in a muffle furnace at 525±25°C for 5hours. After ashing the mass loss of the sample was recorded.

Calculation of crude fiber content:

$$\% \text{ Crude Fiber} = \frac{\text{Weight of Ash}}{\text{Weight of sample taken}} \times 100$$

Microbial analysis**Yeast and mould count**

The yeast and mould count was done by incubating the sample dilutions on the Potato Dextrose Agar (PDA) at 27±2°C for 5days. The sample was applied in the agar using pour plate technique.

Potato Dextrose Agar is recommended by the American Public Health Association for the enumeration of yeasts and moulds in examination of dairy products, soft drinks, dried and frozen foods and other types of product. The yeast and mould count was done by following the method described by Ediriweera *et al.* (2012). A 10⁻² dilution of the sample was prepared by serial decimal dilution. 500µl of aliquots from above 10⁻² dilution were used for enumerating total yeast and mould with 15ml of molten Potato Dextrose Agar. The sample and Potato Dextrose Agar were mixed gently after plating in sterile petri dishes. After a few minutes the PDA media and sample became solid. Plates were incubated at 27±2°C for 5 days. After incubation the number of yeast and mould were determined.

$$\text{cfu/g} = \frac{\text{no. of colony}}{(\text{diluton factor} \times \text{sample taken})}$$

Results**Chemical composition of canned pineapples**

The developed canned pineapples were analyzed for their nutrient contents like moisture, ash fat, protein

and crude fiber content. The results are shown in Table 1.

The moisture content observed in the canned pineapple was 70%. The fresh pineapple contains about (81.2-86.2) % of moisture. It was observed that the canned pineapple contains less moisture and more solids than the fresh pineapple. The moisture percentage was slightly lower possibly due the incorporation of sugar solution.

The ash percentage observed in the canned pineapple was 0.35%. The fresh pineapple contains about 0.38% ash content. It was observed that the canned and fresh pineapple contains almost similar ash percentage.

The fat percentage of canned pineapple observed was 0.4%. The fresh pineapple contains 0.2% of fat. It was observed that the canned pineapple contain slightly higher fat% than the fresh pineapple.

The crude fiber content observed in canned pineapple was 1.9%. On the other hand the fresh pineapple contains 1.4%. It seems that canned pineapple contains higher amount of crude fiber than fresh pineapple.

The protein content in canned pineapple was found 1.5%. In the fresh pineapple the protein percentage was 0.5%. It was observed that the protein percentage of canned pineapple was higher than the fresh pineapple.

As the Canning process does not deteriorate the nutritional composition of pineapple except vitamin C (Darroch and Gortner, 1965), all the chemical components of canned pineapple are almost similar. The protein percentage and crude fiber content is little higher as the product is slightly lower in moisture content than fresh pineapple.

Table 1. Composition of canned pineapple and fresh pineapple.

Composition	Canned Pineapple	Fresh Pineapple
Moisture percentage	70%	81.5%
Ash percentage	0.35%	0.38%
Fat percentage	0.4%	0.2%
Crude fiber percentage	1.9%	1.4%
Protein percentage	1.5%	0.5%

Microbial quality (yeast and mould count) of canned pineapples

The average yeast and mould count enumerated in canned pineapple sample varied from 0-300 cfu/g from day 0 to day 7. The negative control was not contaminated as there was no growth of yeast and

mould from day 0 to 7. From the observation the average yeast and mould enumerated was 300 cfu/g. As the recommended yeast and mould count is less than 3.0 log₁₀ cfu/g or <1000 cfu/g (Tournas *et al.*, 2006), the result of microbial count enumerated was within the accepted safe-to-consume limits.

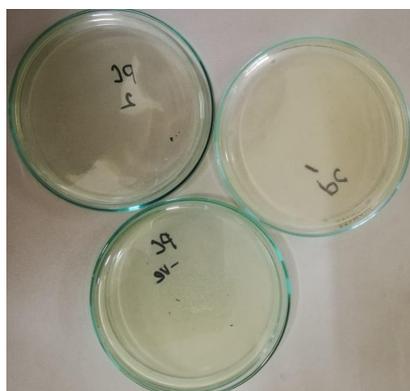


Fig. 1. yeast and mould count at 5th day.

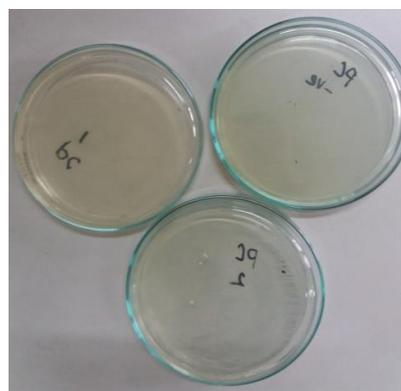


Fig. 2. yeast and mould count at 7th day.

Table 2. Yeast and mould count enumerated on PDA for canned pineapple sample from 0 to 7 days.

Days	-ve Control (cfu/g)	Sample 1 (cfu/g)	Sample 2 (cfu/g)
0	0	0	0
1	0	0	0
2	0	0	0
3	0	0	0
4	0	0	0
5	0	0	0
6	0	0	400
7	0	0	600

Acknowledgements

The authors are grateful to the chemical Research Division, BCSIR Laboratories, Chittagong for the support to complete this research work under their R&D project.

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