

**DETERMINATION OF FRYING TEMPERATURE AND VACUUM PRESSURE
TO PRODUCE PINEAPPLE CHIPS USING SIMPLE VACUUM FRIER^{*)}**

Yuniarti¹, Susinggih W², Nur Hidayat² and Anang L².

1. Dept. of Postharvest Handling & Processing, Assessment Institute for Agricultural Technology East Java, Jl. Karangploso, PO Box 188, Malang, East Java, Indonesia.

2. Dept. of Food Technology, Faculty of Agricultural Technology, Brawijaya University, Jl. Veteran, Malang, East Java, Indonesia.

ABSTRACT

Pineapple is a very cheap fruit and easily to be found throughout the year in Indonesia. Fruit processed as crispy chips is mostly preferred by the consumers. Jackfruit and pineapple crispy chips are popular processed fruit in East Java. These two kinds of fruit have high reducing sugar, so that they must be fried by vacuum frier. For this time being, simple vacuum frier have been successfully produced by some local workshops in relatively cheap price. It is a benefit for the farmers and home industry owners to increase the added value of pineapple fruits. Unfortunately, the proper technology for producing pineapple chips using this simple frier is still unknown. The aim of this research was to determine the frying oil temperature and vacuum pressure of the simple frier used to produce qualified pineapple chips which was preferred by the consumers. Research was designed in a factorial randomized block with the first factor frying temperature 1. e. 1) 90 °C, 2) 100 °C and 3) 110°C, while the second factor was vacuum pressure of the fryer 1. e. 1) -500 mm Hg, 2) -600 mm Hg and 3) -700 mm Hg, replicated 3 times. Pineapple variety used was Queen, harvested at farmer's orchard in Kedawung, Blitar regency, East Java at 70-80% ripe. Each combination treatment used 3 kg of fruit flesh slices of 2 cm x 2 cm on 2 mm thickness. Total fruit flesh needed was 81 kg. Observation was done on water, reducing sugar and starch content of the chips produced. Preference test was done using hedonic scale scoring to evaluate preference's consumer to the crispiness, colour, taste and flavour of the product. Collected data was then analyzed using LSD test. Result showed that the best temperature for frying oil was 90°C, while the best vacuum pressure for frier was -700 mm Hg. Using this method, pineapple chips which were produced had water content 4.85%, reducing sugar content 20.52% and starch content 4.22%. Scores result for preference test were 5.7 (like) for crispiness, 6.20 (like) for colour, 5.60 (like) for taste and 6.30 (like) for flavour.

Keywords: Pineapple, simple vacuumfrier, frying temperature, vacuum pressure.

^{*)}Based on a paper presented at the “7th ASEAN Food Conference 2000” in Manila, Philippines, 19 - 22 November 2000.

INTRODUCTION

Pineapple is a cheap fruit and easily to be found throughout the year in Indonesia. Popular processed fruits which usually found are juice dehydrated fruit, jam, jelly and wine (Mulyohardjo, 1984). Lately, fruit crispy is mostly preferred by the consumers in East Java, especially jackfruit and pineapple chips. These two kinds of fruit have high reducing sugar, so that they must be fried by vacuum frier. In this time being, simple vacuum friers have been successfully produced by some local

workshops with relatively cheap price. It is a benefit for the farmers and home industry owners to increase the added value of pineapple fruit. Unfortunately, proper technology for producing pineapple chips using this simple frier is still unknown.

To develop processing industries in farmer's scale in East Java, the proper processing technology is needed to gain qualified chips which are preferred by the consumers. Two main factors determine fruit chips quality are temperature of frying

oil and the pressure of vacuum frier. For producing jackfruit chips, oil temperature and vacuum pressure needed are 90°C and - 600 mm Hg. The aim of this research was to determine temperature of frying oil and vacuum pressure of the simple vacuum frier to be used in producing pineapple chips.

MATERIALS AND METHODS

Research was conducted from July 1995 to January 1996, at Postharvest Laboratory of Institute of Agriculture Technology Assessment Karangploso and Agriculture Product Processing Laboratory of Brawijaya University, in Malang. Pineapple fruits of Queen variety were picked at farmer's field in Kedawung, Blitar regency, at 75-85% ripe.

The used vacuum frier was made by local workshop, consisted of frying tank, cooling tank, water pump, water tank, thermocontrol, ejector and gas stove. The capacity of this frier was 3 kg of fruit flesh sliced as raw material. Every frying process needed around 60 - 90 minutes for fl-ying the material.

This research used a factorial randomized block design with the first factor frying temperature i. e.: 1) 90°C, 2) 100°C and 3) 110°C, while the second factor was vacuum pressure i. e.: 1) - 500 mm Hg, 2) - 600 mm Hg and 3) - 700 mm Hg, replicated three times. Harvested pineapple fruits were then peeled, their eyes and hearts removed, then cut into slices of 2 cm x 2 cm with 2 min on thickness. For each one combined treatment needed 3 kg of sliced fruit, which was then fried using simple frier. Total fruit flesh needed was 27 x 3 kg of sliced fruit = 81 kg. Pineapple chips produced was then observed on it's quality including:

- Water content using oven method by Rangana, 1979
- Reducing sugar content using spectrophotometer by Nelson Somogyi method, in Sudarmadji *et. al*, 1984
- Starch content using direct acid hydrolysis according to AOAC method, 1970.

Preference test was also done including:

- Stage of crispiness, colour, taste and flavour of chips produced using hedonic scale scoring method, with scores criteria as follows:
7 = like very much
6 = like
5 = like mildly
4 = neither like or dislike
3 = dislike mildly
2 = dislike
1 = dislike very much.

RESULT AND DISCUSSION

Result on quality evaluation and consumer's preference test towards pineapple chips are presented in Table 1.

Frying temperature showed a significant effect to reducing sugar content of pineapple chips produced, but were not significantly different to the water and starch content. It was proved that higher frying temperature would resulted lower reducing sugar content. It might be caused by Maillard reaction during frying process, which resulted high loss of sugar.

Frying temperature was not significantly affect to the consumer's preference, but vacuum pressure would affect scores of crispiness, colour and flavour. The use of lower pressure would shorten frying time so that better colour and flavour of the product will be obtained. It was similar with it's water content, product with lower water content would have better crispiness.

For combination treatment, Table 1 showed that lower water content of chips were resulted by the use of lower pressure. Lower pressure of the frier would resulted faster water loss, consequently water content of the product would be lower. In general, reducing sugar lowered in lowering pressure from - 500 mm Hg to - 700 mm Hg. During the decrease of water content, the certain Aw would be reached. This specific Aw might be enhance Maillard reaction, so that the sugar would be damaged. According to Loncin *et. al.*, 1968, Maillard reaction will reach a maximum rate at Aw 0.6 to 0.7.

The analysis result showed, that the best combined treatment was the use of 90°C frying temperature and - 700 mm Hg vacuum pressure. By using this method, pineapple chips produced would have preference's score as much as 5.70 (like) for crispiness, 6.20 (like) for colour, 5.60 (like) for taste and 6.30 (like) for flavour.

CONCLUSION

The best flying temperature and vacuum pressure which were needed to produce pineapple crispy chips using simple vacuum frier were 90°C and - 700 mm Hg.

ACKNOWLEDGMENT

The authors wish to thank DR. Rogetio A. Panlasigui and the Committee of the 7th ASEAN Food Conference who financially supported the presentation of this paper.

REFERENCES

- A. O. A. C., 1970. Official Methods of Analysis of the AOAC (Association of Official Analytical Chemists). The AOAC, Washington, D. C.
- Lonci, M., Bimbenet, J. J. and Lenges, 1, 1968. Influences of the activity of water on the spoilage of foodstuffs. J. Food Technol. 3, 131-142.
- Mulyohardjo, M., 1984. Nenas dan Teknologi Pengolahannya. Penerbit Liberty. Yogyakarta.
- Rangana, S., 1979. Manual of Analysis of Fruit and Vegetable Products. Tata-Me Graw Hill. New Delhi, India.
- Sudarmadji, S., Haryono, B. dan Subardi, 1989. Analisa Bahan Makanan dan Pertanian. Penerbit Liberty. Yogyakarta.

Table 1. Pineapple Chip Characteristics Produced By Different Frying Temperature and Vacuum Pressure of Simple Vacuum Frier

Frying Temperatur (°C)	Vacuum Pressure (mm Hg)	Water Content (%)	Sugar Content (%)	Starch Content (%)	Crispiness	Colour	Taste	Flavour
90		5.64 a	21.37 a	4.12 a	5.33 a	5.50 a	5.40 a	5.77 a
100		5.50 a	20.72 b	4.34 a	5.37 a	5.27 a	5.40 a	5.53 a
110	-	5.03 a	19.98 c	4.22 a	5.43 a	5.07 a	5.17 a	5.47 a
-	-500	4.08 a	20.97 a	4.86 c	4.66 c	4.66 c	5.00 a	5.21 b
-	-600	4.46 a	21.04 a	5.36 b	5.23 b	5.23 b	5.36 a	5.55 ab
-	-700	4.15 a	20.07 b	5.90 a	5.93 a	5.93 a	5.60 a	6.00 a
90	-500	6.16 a	21.92 a	3.70 a	4.78 a	4.78 a	5.11 a	5.33 a
	-600	5.91 a	21.67 a	4.43 a	5.46 a	5.46 a	5.46 a	5.64 a
	-700	4.85 ab	20.52 b	4.22 a	5.70 a	6.20 a	5.60 a	6.30 a
100	-500	8.83 a	21.28 a	4.44 a	4.90 a	4.70 a	5.20 a	5.20 a
	-600	4.26 ab	21.21 a	4.61 a	5.20 a	5.20 a	5.40 a	5.40 a
	-700	3.40 b	19.69 c	3.98 a	6.00 a	5.90 a	5.60 a	6.00 a
110	-500	6.44 a	19.71 c	4.10 a	4.90 a	4.50 a	5.70 a	5.10 a
	-600	4.38 ab	20.23 b	4.32 a	5.40 a	5.00 a	5.20 a	5.60 a
	-700	4.28 ab	19.99 bc	4.23 a	6.00 a	5.70 a	5.60 a	5.70 a

Note: Any two means having the same letters in the same column are not significantly different at 5% level of LSDt

Table 1. Pineapple Chip Characteristics Produced By Different Frying Temperature and Vacuum Pressure of Simple Vacuum Frier

Frying Temperatur (°C)	Vacuum Pressure (mm Hg)	Water Content (%)	Sugar Content (%)	Starch Content (%)	Crispiness	Colour	Taste	Flavour
90	-	5.64 a	21.37 a	4.12 a	5.33 a	5.50 a	5.40 a	5.77 a
100		5.50 a	20.72 b	4.34 a	5.37 a	5.27 a	5.40 a	5.53 a
110		5.03 a	19.98 c	4.22 a	5.43 a	5.07 a	5.17 a	5.47 a
-	-500	4.08 a	20.97 a	4.86 c	4.66 c	4.66 c	5.00 a	5.21 b
-	-600	4.46 a	21.04 a	5.36 b	5.23 b	5.23 b	5.36 a	5.55 ab
-	-700	4.15 a	20.07 b	5.90 a	5.93 a	5.93 a	5.60 a	6.00 a
90	-500	6.16 a	21.92 a	3.70 a	4.78 a	4.78 a	5.11 a	5.33 a
	-600	5.91 a	21.67 a	4.43 a	5.46 a	5.46 a	5.46 a	5.64 a
	-700	4.85 ab	20.52 b	4.22 a	5.70 a	6.20 a	5.60 a	6.30 a
100	-500	8.83 a	21.28 a	4.44 a	4.90 a	4.70 a	5.20 a	5.20 a
	-600	4.26 ab	21.21 a	4.61 a	5.20 a	5.20 a	5.40 a	5.40 a
	-700	3.40 b	19.69 c	3.98 a	6.00 a	5.90 a	5.60 a	6.00 a
110	-500	6.44 a	19.71 c	4.10 a	4.90 a	4.50 a	5.70 a	5.10 a
	-600	4.38 ab	20.23 b	4.32 a	5.40 a	5.00 a	5.20 a	5.60 a
	-700	4.28 ab	19.99 bc	4.23 a	6.00 a	5.70 a	5.60 a	5.70 a

Note: Any two means having the same letters in the same column are not significantly different at 5% level of LSD t

