Ceylon Cocon. Q. (1974) **25**, 109-115
Printed in Sri Lanka.

PRESERVATION, BOTTLING AND KEEPING QUALITIES OF FRESH COCONUT SAP (SWEET TODDY)

S. MOHANADAS
Coconut Research Institute, Lunuwila Sri Lanka.

SUMMARY

The method of preserving and bottling fresh coconut sap (sweet toddy) is described. Heat sterilization at 80°C for 25 minutes for the particular type of container used (Lanka Glass Co. bottles, capacity about 200 ml and weighing about 235 g.) is found to be most satisfactory for preservation. Samples could be kept for six months without change of quality or flavour characteristics.

INTRODUCTION

The fresh and unfermented sap that drips from the spathe of the coconut palm, to which no preservative or antiferment has been added will be referred to hereafter in this paper as sweet toddy. This sap is the raw material for the palm sugar and fermentation industries. Sweet toddy has been found to have the following analytical characteristics. (Table 1).

Sterile sweet toddy could be used as

(*a*) a medium (with or without agar) for culturing micro-organisms,

(*b*) a substitute sugar solution for the preparation of beverages,

(*c*) toddy by inducing fermentation,

in addition to its normal uses as a base for the preparation of treacle and jaggery. Work along these lines is being conducted in our laboratories.

Sweet toddy when left exposed to the atmosphere undergoes first alcoholic and then acetic fermentation consequent on the action of micro-organisms. The need therefore arises to preserve the sweet toddy. The aim of this paper is to discuss the method by which a sterile bottled product with good keeping qualities could be prepared.

EXPERIMENTAL

Materials:

Samples of sweet toddy from selected coconut palms were collected in polythene bags at three hourly and 12 hourly intervals. Their flavour and analytical characteristics are reported in table number 1. The samples collected at 12 hourly intervals have been used throughout in these studies.

Preservation:

Chemical food preservatives permissible for use under the Food and Drugs Act were found ineffective at their maximum concentrations in preserving the product. Freeze-drying also gave negative results. The method of Heat Sterilization was found to be most satisfactory in destroying the micro-organisms and enzymes.

Bottling, sterilization and keeping qualities:

The raw material for bottling was first examined for taste, flavour, alcohol and acidity. It was filtered through nylon net to remove the coarser impurities and poured into the bottles, leaving an air space of about 10 ml. The bottles were hand-corked and sterilized by immersing in a heated waterbath at a pre-determined temperature. At the end of sterilization, the bottles were removed from the water bath and allowed to cool in the air.

The samples were bottled at 60°C, 70°C, 80°C and 90°C with exposure times at each temperature of 5, 10, 15, 20, 25 and 30 minutes (Table 2).

These could be reckoned to constitute *one set*, comprising 24 samples. Six such sets ($6 \times 24 = 144$ samples) in all were bottled to facilitate examination over a period of six months.

At the end of the first month, 24 samples (a set) were opened and examined for taste, flavour, alcohol and acidity. Observations were also made on signs of latent fermentation. This was similarly repeated with the other five sets covering the six month period of study. It should be mentioned at this stage that some samples were lost with explosive violence consequent on fermentation. In view of this, it was not possible to make observations on the samples bottled at 60°C (5 and 10 min.) and 70°C (5 min.). Tables 3, 4, 5 and 6 give a summary of the results.

It was found that the samples bottled at 80°C for 25 minutes and at 90°C for 20 min. gave satisfactory results. In other words, their characteristics in relation to the original sweet toddy were very much the same. This was actually confirmed subsequently by analysing samples before and after effective heat sterilization for the characters indicated in Table 1.

Examination for micro-organisms:

Since all the samples sterilized at 60°C (5 and 10 minutes) and 70°C (5 min.) were not lost, it was possible to examine some of them for micro-organisms. The presence of living micro-organisms was evident in these samples. However, no living organisms were found in any of the samples described in Tables 3, 4, 5 and 6 at the end of six months.

Discolouration:

It was observed that on keeping the heat treated samples, a yellowish discolouration appeared which darkened to a brownish tint after six months.

CONCLUSION

The study has shown that fresh coconut sap (sweet toddy) can be satisfactorily bottled and kept for a period of six months. Heat sterilization at 80°C for 25 minutes (and at 90°C for 20 minutes) for the particular type of container used has given the best results.

In spite of the fact that the micro-organisms were dead, in some of the samples the evidence of latent fermentation would seem to indicate the activity of enzymes, co-enzymes and/or co-factors. This would imply that sterilization should be effective enough to destroy not only the organisms but also the above factors.

The observation that has been made regarding the darkening in colour may be caused by the oxidation of poly-phenols as recorded by Jeya Raj and Jansz (1971 CAAS) in their studies on young coconut water.

I wish to record my sincere thanks to Messrs M. C. P. Wijeratne, M. P. Tissera, Mrs. J. D. Atputharajah, Technical Assistants, Chemistry Division for their help in connection with some aspects of the laboratory studies.

REFERENCES

Mohanadas, S. (1974) Proc. Ins. of Chemistry.
Jeya Raj, E. E. (1961) Proc. Cey. Ass. Advmt. Sci.
Jeya Raj, E. E., Jansz, E. R. (1971) Proc. Cey. Ass. Advmt. Sci.

TABLE 1

3 hours and 12 hours respectively from the time the receiving vessel is attached to the spathe.

Examined for	3 *hours*	12 *hours*
1. Colour	Light Amber	Whitish
2. Taste	Very Sweet	Sweet and Agreeable
3. Flavour	Pleasant	Very Pleasant
4. Density (t/t)	1.09	1.08
5. % Total Solids	18.90	18.40
6. % Total Sugars (as sucrose)	15.40	9.80
7. % Invert Sugars	0.70	5.47
8. % Alcohol (v/v)	Nil	Trace
9 % Acidity (as Acetic)	Trace	0.25
10. pH	7.2	3.80
11. % Nitrogen (as N)	0.03	0.03
12. % Phosphorus (as P_2O_5)	0.02	0.02
13. % Potassium (as K_2O)	0.16	0.16
14. % Calcium (as Ca)	0.002	0.002
15. % Magnesium (as Mg)	0.004	0.004

TABLE 2

Details of a set comprising 24 samples

°C	*Exposure time in minutes*					
60	5	10	15	20	25	30
70	5	10	15	20	25	30
80	5	10	15	20	25	30
90	5	10	15	20	25	30

TABLE 3

Sterilization at 60°C

Exposure time (Minutes)	*Examined for*	*1st Month*	*2nd Month*	*3rd Month*	*4th Month*	*5th Month*	*6th Month*
15	(*a*) Observation	Mild Effervescence	Brisk Effervescence	B.E.	B.E.	B.E.	B.E.
	(*b*) Taste (Original Sweet)	Slightly Sour	S.S.	S.S.	Sour	S.	S.
	(*c*) % increase in Alchohol (Over Original)	1.10	2.0	3.20	3.90	4.20	4.50
	(*d*) % increase in Acidity (Over Original)	0.73	0.87	1.00	1.12	1.28	1.41
20	(*a*)	Effervescence	B.E.	B.E.	B.E.	B.E.	B.E.
	(*b*)	Very slightly sour	S.S.	S.S.	S.	S.	S.
	(*c*)	—	1.40	1.60	1.60	2.30	3.50
	(*d*)	0.67	0.75	0.86	0.90	1.10	1.20
25	(*a*)	—	—	E	B.E.	B.E.	B.E.
	(*b*)	V.S.S.	V.S.S.	V.S.S.	S.S.	S.S.	S.
	(*c*)	—	- -	—	0.30	0.40	1.50
	(*d*)	0.59	0.60	0.71	0.75	0.90	1.04
30	(*a*)	—	—	—	—	E	E
	(*b*)	—	—	V.S.S.	S.S.	S.S.	S.S.
	(*c*)	—	—	—	0.20	0.50	1.45
	(*d*)	0.46	0.54	0.60	0.62	0.75	0.83
35	(*a*)	—	—	—	—	—	—
	(*b*)	—	—	V.S.S.	V.S.S.	V.S.S.	V.S.S.
	(*c*)	—	—	—	—	0.10	0.60
	(*d*)	0.39	0.47	0.49	0.50	0.56	0.60
40	(*a*)	—	—	—	—	—	—
	(*b*)	—	—	V.S.S.	V.S.S.	V.S.S.	V.S.S.
	(*c*)	—	—	—	- -	0.10	0.40
	(*d*)	0.31	0.32	0.34	0.36	0.38	0.40

TABLE 4

Sterilization at 70°C

Exposure Time (Minutes)	*Examined for*	*1st Month*	*2nd Month*	*3rd Month*	*4th Month*	*5th Month*	*6th Month*
10	(*a*) Observation	—	—	—	—	M.E.	M.E.
	(*b*) Taste (Original Sweet)	V.S.S.	V.S.S.	V.S.S.	S.S.	S.S.	S.S.
	(*c*) % increase in Alcohol (Over Original)	—	—	—	—	0.10	0.10
	(*d*) % increase in Acidity (Over Original)	0.18	0.32	0.46	0.60	0.75	0.90
15	(*a*)	—	—	—	—	M.E.	M.E.
	(*b*)	—	—	V.S.S.	V.S.S.	S.S.	S.S.
	(*c*)	—	—	—	—	—	—
	(*d*)	0.16	0.26	0.38	0.50	0·62	0.74
20	(*a*)	—	—	—	—	—	M.E.
	(*b*)	—	—	V.S.S.	V.S.S.	V.S.S.	S.S.
	(*c*)	—	—	—	—	—	—
	(*d*)	0.12	0.21	0.29	0.39	0.50	0.59
25	(*a*)	—	—	—	—	—	M.E.
	(*b*)	—	—	—	V.S.S.	V.S.S.	S.S.
	(*c*)	—	—	—	—	—	—
	(*d*)	0.10	0.15	0.20	0.27	0.35	0.43
30	(*a*)	—	—	—	—	—	M.E.
	(*b*)	—	—	—	—	—	V.S.S.
	(*c*)	—	—	—	—	—	—
	(*d*)	0.06	0.10	0.14	0.18	0.20	0.28
35	(*a*)	—	—	—	—	—	M.E.
	(*b*)	—	—	—	—	—	V.S.S.
	(*c*)	—	—	—	—	—	—
	(*d*)	0.02	0.04	0.05	0.07	0.10	0.12

TABLE 5

Sterilization at 80°C

Exposure time (Minutes)	*Examined for*	*1st Month*	*2nd Month*	*3rd Month*	*4th Month*	*5th Month*	*6th Month*
5	(*a*) Observation	—	—	—	—	—	—
	(*b*) Taste (Original Sweet)	—	—	V.S.S.	V.S.S.	V.S.S.	S.S.
	(*c*) % increase in Alcohol (Over Original)	—	—	—	—	—	—
	(*d*) % increase in Acidity (Over Original)	—	0.02	0.02	0.04	0.04	0.06
10	(*a*)	—	—	—	—	—	—
	(*b*)	—	—	V.S.S.	V.S.S.	V.S.S.	V.S.S.
	(*c*)	—	—	—	—	—	—
	(*d*)	—	—	0.02	0.02	0.02	0.04
15	(*a*)	—	—	—	—	—	—
	(*b*)	—	—	—	—	V.S.S.	S.S.
	(*c*)	—	—	—	—	—	—
	(*d*)	—	—	—	—	—	0.02
20	(*a*)	—	—	—	—	—	—
	(*b*)	—	—	—	—	—	—
	(*c*)	—	—	—	—	—	—
	(*d*)	—	—	—	—	—	—
25	(*a*)	—	—	—	—	—	—
	(*b*)	—	—	—	—	—	—
	(*c*)	—	—	—	—	—	—
	(*d*)	—	—	—	—	—	—
30	(*a*)	—	—	—	—	—	—
	(*b*)	—	—	—	—	—	—
	(*c*)	—	—	—	—	—	—
	(*d*)	—	—	—	—	—	—

TABLE 6

Sterilization at 90°C

Exposure time (Minutes)	*Examined for*	1*st* *Month*	2*nd* *Month*	3*rd* *Month*	4*th* *Month*	5*th* *Month*	6*th* *Month*
5	(*a*) Observation	—	—	—	—	—	—
	(*b*) Taste (Original Sweet)		—	—	—	—	V.S.S.
	(*c*) % increase in Alcohol (Over Original)	—	—	—	—	—	—
	(*d*) % increase in Acidity (Over Original)	0.01	0.02	0.02	—	0.02	—
10	(*a*)	—	—	—	—	—	—
	(*b*)	—	—	—	—	—	—
	(*c*)	—	—	—	—	—	—
	(*d*)	—	—	—	—	—	—
15	(*a*)	—	—	—	—	—	—
	(*b*)	—	—	—	—	—	—
	(*c*)	—	—	—	—	—	—
	(*d*)	—	—	—	—	—	—
20	(*a*)	—	—	—	—	—	—
	(*b*)	—	—	—	—	—	—
	(*c*)	—	—	—	—	—	—
	(*d*)	—	—	—	—	—	—
25	(*a*)	—	—	—	—	—	—
	(*b*)	—	—	—	—	—	—
	(*c*)	—	—	—	—	—	—
	(*d*)	—	—	—	—	—	—
30	(*a*)	—	—	—	—	—	—
	(*b*)	—	—	—	—	—	—
	(*c*)	—	—	—	—	—	—
	(*d*)	—	—	—	—	—	—