Pertanika 8(1), 127 – 130 (1985)

Production of Spray-Dried Coconut Milk Powder

MOHD ALI HASSAN
Department of Food Technology,
Faculty of Food Science and Technology,
Universiti Pertanian Malaysia,
Serdang, Selangor, Malaysia.

Key words: coconut; cocos nucifera, spray drying; powder.

ABSTRAK

Pengeluaran serbuk santan boleh dilakukan walaupun kandungan lemak bagi santan segar melebihi 30%. Proses yang digunakan ialah pengeringan sembur, dengan suhu udara masuk 190°C dan suhu udara keluar 90°C. Bahan tambahan perlu digunakan bagi proses ini dan bahan yang sesuai serta dikenalpasti dalam kertas ini ialah susu skim dan dekstrin, masing-masing dalam lingkungan 10% – 15% b/b dan 5% – 7% b/b. Hasil serbuk yang didapati menyerupai susu lembu dan mudah untuk dijadikan santan cair dengan mencampurkan air sama ada pada suhu 30°C atau 100°C, serta menghasilkan larutan dan homogenis. Serbuk santan tersebut didapati stabil jika disimpan di dalam bungkusan plastik pada keadaan bilik. Ia masih dapat menghasilkan larutan santan yang baik, walaupun setelah tiga bulan disimpan dalam keadaan begini.

ABSTRACT

The production of coconut milk powder could be carried out, even though the fat content of fresh coconut milk is above 30%. The spray drying process was used with an air inlet and outlet temperatures of 190°C and 90°C respectively. Additives were found to be necessary and suitable ones identified in this study are skim milk and dextrin in the range of 10% – 15% w/w and 5% – 7% w/w respectively. The product obtained resembles cow milk and can easily be reconstituted with water either at 30°C or 100°C giving a homogeneous solution. The spray dried powder is stable during storage in polyethylene package under room conditions even after three months, giving a satisfactory reconstituted product.

INTRODUCTION

Coconut milk is an oil or fat emulsion in water (Clement and Villacorte, 1933), the fat content being 31 – 35% as compared to 3 – 4% in cow milk (Table 1). The composition of fat and oil in coconut milk has a high percentage of saturated fatty acids such as lauric acid and myristic acid and a low percentage of unsaturated fatty acids such as linoleic acid (Table 2).

Production of coconut milk powder by spray drying was first reported by Bundus and Noznick (1970). The report indicated that production of coconut milk powder is not suitable in tropical countries. This is because coconut milk has a high short-chained triglycerides content of 50% with a low melting point and exists in a liquid state even at 23°C. Ragab (1971) supported this view and adds that in Malaysia where the average room temperature is around 30°C, it would be difficult to produce the coconut milk in the form of a powder. Indeed early attempts to spray dry the fresh coconut milk resulted in the formation of coconut oil.

TABLE 1
Composition of Coconut Milk and Cow Milk

	Coconut Milk*	Cow Milk**
Protein %	3.5 – 4.0	3.5
Fat %	31 – 35	3.5
Water %	50 – 56	87.3

*Source: Mohd. Nordin (1977)
**Source: Desrosier (1970)

TABLE 2
Composition of Free Fatty Acids in Coconut Milk

	%
Caprylic acid	7.6
Capric acid	7.3
Lauric acid	48.2
Myristic acid	16.6
Palmitic acid	8.0
Palmitoleic acid	1.0
Stearic acid	3.8
Oleic acid	5.0
Linoleic acid	2.5

Source: Weiss (1970)

However in Phillipines, Hagenmair (1983) who was working with the Coconut Research Institute reported that coconut milk powder could be produced by adding suitable additives prior to spray drying. In his paper, he gave an indication that casein and corn syrup solids were suitable additives, without mentioning the processing parameters for the production of the coconut milk powder.

In Malaysia, research on the production of spray dried coconut milk is still at an early stage. At Universiti Pertanian Malaysia, attempts at producing the coconut milk powder were based on the production of spray dried cow's milk. This paper outlines the methods, the additives used and the processing parameters necessary for the production of spray dried coconut milk powder.

MATERIALS AND METHODS

Due to the high fat content of coconut milk as compared to cow milk it was felt necessary to add protein and carbohydrate components to reduce the fat content in order to resemble cow milk which allows for spray drying. Though skim milk powder (1.0% fat) was added at various compositions from 5 – 15% w/w, the powder still could not be produced. Attempts were then made to simulate the production of spray dried coffee whiteners which have a high fat content of 35 – 40%. For the coffee whiteners, in addition to protein components in the form of sodium caseinate, corn syrup solids or dextrin was added to function as a matrix for carrying the water insoluble oils and fat (Furia, 1975). In this work, the percentage of dextrin used was from 3 – 7% w/w.

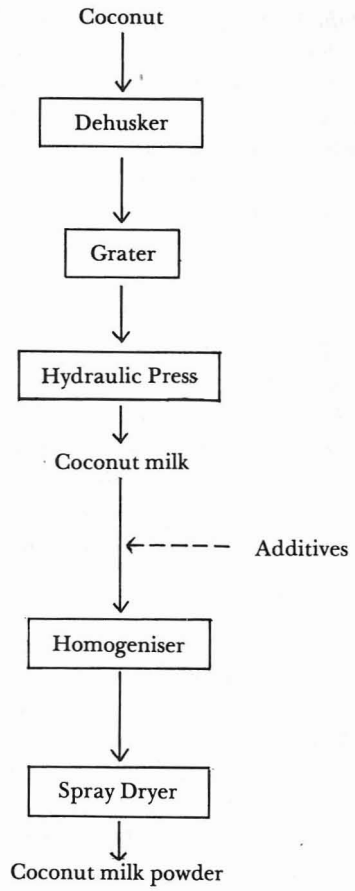

Fig. 1. Flow chart for the production of spray dried coconut milk powder

The stages in the production of the coconut milk powder are shown in *Fig. 1*. The fresh

coconut was first dehusked and grated. The grated coconut was then placed in a muslin cloth and pressed hydraulically with an Apex Hydraulic Press at 543 psi (37 bars) to obtain the coconut milk. Skim milk and dextrin were added at various compositions, and the mixture was then stirred and homogenized using a Silverson Mixer at 13,000 revs. per minute for 15 minutes to obtain a homogeneous solution. The solution was then spray dried using the Anhydro Spray Dryer at 190°C inlet air temperature and 90°C outlet air temperature, coconut milk flowrate of $3.3 \times 10^{-6} m^3/s$ and compresed air pressure of 30 psi (2.0 bar). The product which was a white powder was then collected, packed using a polyethylene plastic material and stored at room temperature for two weeks before solubility tests were done.

The powdered product was examined visually and solubility tests using water was done where 10 gram coconut milk powder was mixed with 50 cm^3 water at 30°C and 100°C.

RESULTS AND DISCUSSION

The dehydrated and the reconstituted products obtained by adding different combinations of skim milk and dextrin were examined visually. Some of these combinations were chosen for comparison as shown in Table 3. The results suggest that the optimum amount of skim milk and dextrin added should be between 10% – 15% w/w and 5% – 7% w/w respectively to produce a satisfactory dehydrated coconut milk and more importantly the reconstituted product. Preliminary storage studies indicate that after storage for three months in ordinary polyethylene packaging under room conditions, samples 1 and 3 were found to be stable and no separation of phases was detected. Further storage studies is being conducted presently.

The percentage of skim milk and dextrin could be increased further but due to the current prevalent sensitivity among the public about high percentages of additives in foods, the range

TABLE 3
Summary of results on coconut milk powder prepared using skim milk and dextrin
(Comparisons made are based on fresh coconut milk)

Sample	% Skim Milk	% Dextrin	Solubility in water at 30°C and 100°C (Comparative)	Observations	
				Powdered product	Solution prepared by adding water
1	15	5	very soluble	White powder and non-oily	White colour. Taste and odour closely resembles fresh coconut milk.
2	15	3	slightly soluble	White powder and non-oily	White colour. Acceptable taste and odour.
3	15	7	very soluble	White powder and non-oily	White colour. Acceptable taste and odour.
4	13	5	soluble	Creamish powder and non-oily	Brown colour. Acceptable taste and odour.
5	10	5	slightly soluble	Brownish powder slightly oily	Brown colour. Acceptable taste and odour.
6	7	3	insoluble	Brown powder oily	—
7	5	5	insoluble	Brown powder very oily	—

TABLE 4
Summary of parameters for the production of coconut milk powder

Basic equipment		Spray drier
Operating Temperature		
: inlet		190°C
: outlet		90°C
Feedrate		3.3 × 10^{-6} m^3/s
Compressed air pressure		2.0 bar
Additives:	skim milk	10% – 15% w/w
	dextrin	5% – 7% w/w

given have is deemed as optimum. This level also meets the target of using the minimum amount of additives to produce a satisfactory and acceptable product. A summary of the requirements for the production of spray dried coconut milk powder is given in Table 4.

CONCLUSION

Coconut milk can be produced in powdered form with the aid of additives. Suitable additives that have been identified in this paper are skim milk and dextrin, the percentages being 10% – 15% w/w and 5% – 7% w/w respectively. In view of these findings, the food industry should follow up by establishing an industrial scale plant for the production of spray dried coconut milk. Judging by the inquiries and interest shown by the public in this product, it is envisaged that it will sell well.

ACKNOWLEDGEMENTS

The writers wish to thank Universiti Pertanian Malaysia for granting financial aid for this project; the academic staff of the Faculty of Food Science and Technology for their encouragement and support, the laboratory staff at the Department of Food Technology especially Amran Suratman and Azhariah Hj. Ahmad and Naimah Ahmad for typing the manuscript.

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(Received 17 October, 1984)