COCONUT OIL QUALITY IMPROVEMENT - BLENDING

S U M M A R Y

Crystallisation of Coconut Oil in air-conditioned shops, affects the consumer-appeal of the product. In the absence of Winterisation fascilities, a blending method with an oil of greater unsaturated acid content has been examined. Results have shown that a 50/50 mixture of groundnut oil and coconut oil remain stable in air-conditioned temperatures down to 20°Centigrade.

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INTRODUCTION

(1) The Quality of Oil:

Vegetable oil quality is usually described in terms of free fatty acid, which is an indication of the extent to which the fat has been split by lipolysis, and by peroxide or benzidine values, indicating the extent to which the fat has been oxidised. For frying fats, melting point is important in relation to the temperature of the enviroment. Margarines and other solid fat formulation, would require dilatometric and other fat indices. In all forms of edible fats, the organoleptic quality criteria, e.g., blandness of the taste and colour appeal are the most important.

Though the nutritional quality of oils and fats is one of the most widely discussed topics in medical nutrition especially concerning the relationship of cholesterol content and the absence of essential unsaturated fatty acids, especially of the linoteic acid type, to the incidence of arteriosclerosis in human, this does not seem to have played a very significant role in the production of edible fats. For example in the manufacture of margarine and shortenings, hydrogenation is a key process, applied to obtain good handling and performing characteristics of the product though this will naturally reduce the nutritional value of the fat with respect to the presence of essential fatty acids.

In Ghana, 5 main types of oils are available: Coconut Oil, Palm Oil, Groundnut Oil, Palm Kernel Oil and Shea Butter. Shea fat has a high melting point range of 34-40° Centigrade and hence remains relatively soild even at Tropical temperatures of 25-30° Centigrade. Palm oil usually remains in a solid/liquid equilibrium at the tropical temperatures and changes its state depending upon the direction of temperature change. Groundnut oil always remains a liquid oil also due to the fact that it has a high unsaturation and a solidification point of 0-3° Centigrade. Coconut oil, with melting point 23-27° Centigrade and Palm kernel oil with melting point 22-25° Centigrade usually exhibit crystallisation when the temperature drops and remain liquid when the temperature goes up.

Crystallisation of an oil below its melting point does not necessarily change the chemical constitution of the oil nor does it affect the nutritional quality but it involves only physical behaviour which creates a poor consumer appeal. In temperate climates, solidificat ion of an oil at decreasing temperatures is disliked by housewives and other consumers since it places an extra and risky burden of re-melting the solidified oil. The oil industries in these areas have responded to this by applying either of the techniques of Hydrogenation or Winterisation.

(2) INDUSTRIAL METHODS USED TO COMBAT CRYSTALLISATION

Hydrogenation is the process by which Hydrogen is injected into a liquid oil in the presence of a catalyst to reduce the iodine number and raise the melting point. In this process, an oil liquid at 25° Centigrade will attain a solid state at the same temperatures and only melt at a higher temperature, e.g. 33°C, depending upon the degree of hydrogenation. This process is a chemical process in which the unsaturated fatty acids are changed to saturated acids and the nutritional value of the oil as a source of the unsaturated acids is consequently greatly reduced.

Winterisation on the other hand is a physical process in which solid glyceride portions are separated by centrifuge or pressing from liquid glyceride portions, at reduced temperatures, leaving a product which remains clear and liquid despite temperature changes. In this process, the consumer appeal of the oil is not only improved but the unsaturated acid content of the oil is even concentrated. The solid glyceride portions of this process, which can be considered as bye-products, are utilised fully in margarine and shortening formulations.

It is very understandable, therefore, that in temperate climates, these processes are widely-applied operations in edible oil and fat processing. The situation, however, changes when tropical climates of average temperatures of 26°-30° Centigrade are under consideration: In Ghana, temperatures below 25° Centigrade are not too commonly encountered except on a rainy night or in artificially air cooled rooms. Coconut oil and Palm Kernel oils begin to

crystalise below 25°C.

(3) MARKETING & DISTRIBUTION OF OIL:

The marketing and distribution system of oils in Ghana takes two basic forms.

(1) Retail Sale of oil by decantation in the local markets.

(2) The sale of packaged oil in shops and supermarkets.

In the local markets, t emperatures are normal atmospheric of 26-30° Centigrade and the sale of products occurs from sunrise to sunset. Coconut oil especially therefore, is always in its liquid state. In the shops and supermarkets, refrigirated and air-conditioning fascilities reduce the temperature of the shops to 23/24°Centigrade during the day when trading activity is at its peak and 20-23°Centigrade during the night when the shops are closed. Coconut oil which may assume a liquid state during the peak of the day would be found as a solid when the shops open the following morning due to crystallisation over the night period.

Our observations have shown that when solidified coconut oil is purchased from the shops by a customer, the product would have changed to the liquid state by the time it has reached the home. The problem is, therefore, very minor and temporal in tropical climates and its seriousness is only in so far as it affects the marketing appeal of the product. In this respect the natural product may be placed in a poor competitive position in the presence of imported oil varieties which may have a fair amount of unsaturated acids and the physical characteristics of which are not subject to the changes mentioned above.

The solution to this problem is not an industrial difficulty but the economics of it in the present industrial circumstance is crucial.

The state of the oil industry in Ghana at the moment is one of inadequate production of edible oil thereby resulting in large annual imports.

There is no hydrogenation plant and there is not yet a margarine factory. The production of a hydrogenated solid cooking fat in Ghana is a luxury in the Ghanaian oil industry since most oils are considered to be more easily handled in their liquid form for frying

purposes, and are, therefore, preferred. Observation has also shown that the use of solid fats for frying by housewives is on the decline since foods prepared from solid fats are less palatable when cold than those from liquid fats.

The aim of this work, therefore, was to experiment on a new blend of oil which will have improved market appeal as well as improved nutritional characteristics.

Experimental

Various mixtures of de-odourised peanut oil and de-odourised coconut oil were made: 100% peanut oil and 100% coconut oil were used as controls and all the oil samples were placed in an air conditioned room. The temperature of the air conditioned room varied from 24° Centigrade in the day time to about 22° centigrade in the early morning after a cool night. On a few occasions, the temperature dropped to 20.5°C in the early morning following a cool rainy night. The oil samples were examined regularly for any signs of crystallisation for a period of 30 days. Foods cooked in the controls and the samples containing a 50/50 mixture were also examined organoleptically for a difference in taste by the Food Research Institute taste panel.

RESULTS

TABLE I

SOLIDIFICATION OF THE MIXTURE WITH DECREASING TEMPERATURE

SAMPLE	25°C	24°C	23°C	22°C	21°C	20°C	16°C
100% Coconut	Liquid	Crystals appear	Solidification	Solid	solid	Solid	Solid
90% Coconut 10% Groundnut	Liquid	Slight signs of crystals	Crystals	Solid	Solid	Solid	Solid
80/20 Mixture	Liquid	Liquid	Liquid	Cloudiness	Solid	Solid	Solid
70/30 Mixture	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Solid
60/40 Mixture	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Crystals
50/50 Mixture	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Crystals
100% Groundnut	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid	Liquid

TABLE II

ORGANOLEPTIC ASSESSMENT OF OIL BY PANEL OF SIX

SAMPLE	EGGS FRIED IN SAMPLE						CHIPS FRIED IN SAMPLE					
	(1)	(2)	(3)	(4)	(5)	(6)	(1)	(2)	(3)	(4)	(5)	(6)
100% Coconut	No difference	No difference	No difference	No difference	No difference	No difference	No difference	No difference	No difference	No difference	No difference	No difference
100% Groundnut												
50/50 Mixture												

DISCUSSION: The results shown in Table I indicate that at a very low temperature of 20° Centigrade, a 50/50 mixture of the oil will maintain a good market appeal since it would not exhibit crystallisation. Since the experimental conditions were similar to those obtained in the big shops and supermarkets, a 50/50 mixture would overcome the temporary problem of oil in air conditioned supermarkets. The results in Table II show that the blend would not make any tase difference to the housewife for cooking or frying purposes; this would be expected since the samples under consideration are refined and de-odourised.

Table III shows the composition of Coognut and Peanut oils and also of the theoretical c omposition of a 50/50 mixture.

TABLE III

FATTY ACID COMPOSITION OF PURE OILS AND THEIR BLEND

ACIDS	PERCENT IN COCONUT	PERCENT IN PEANUT	PERCENT IN 50/50 MIXTURE(THEORETICAL)
Caprylic	8	-	4
Capric	7	-	3.5
Lauric	48	-	24
Myristic	18	0.1	9
Palmitic	8.5	11	10
Stearic	2.3	3	2.62
Oleic	6	46	26.2
Linoleic	2	31	16.5
Linolenic	-	1.5	0.75
Other higher acids	-	6.1	3.05
TOTAL	99.8	98.7	99.62

From Table 3, the theoretical fatty asic composition shows it to be a more nutritional oil from the point of view of its content of essential fatty acids (linoleic, linolenic) than pure Coconut oil.

CONCLUSION

The problems of crystallisation of oil at low t emperatures can be overcome by winterisation. In Ghana, however, the arguments against winterisation are:

(1) The bulk of coconut oil is sold on the open market at ambient temperatures where they assume the liquid state.

(2) The oil industry is not yet advanced to further process and utilise the solid bye-product of winterisation.

Though throughout the history of edible oil processing, liquid oils have been considered as pure when sold without any admixture with other oils, under these circumstances, one solution of the

problem would be to blend coconut oil with an oil which is equally consumed in Ghana, with a view to improving on both the nutritional and marketing quality. The results of a recent survey also showed that the population who buy from shops, prefare and utilise more groundnut oil which is the most expensive amongst the local oils in Ghana. The results have indicated that this can be achieved successfully with a 50/50 mixture of refined and de-odourised groundnut oil and coconut oil. From the cost point of view, such a blend should be cheaper than pure groundnut oil.

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