



Review Article

KOKUM BUTTER AS A POTENTIAL SUBSTITUTE FOR COCOA BUTTER IN CONFECTIONARY INDUSTRY

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Abstract: Cocoa butter is an important ingredient in the confectionery industries because of its unique physicochemical properties which is given by its peculiar fatty acid composition.

Keywords: Kokum Butter, Chocolate, Cocoa butter

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Introduction

Cocoa bean is the fatty seed found inside a cocoa pod, fruit of the *Theobroma cacao* plant. It is small evergreen tree belong to the family Malvaceae. This plant is native to the deep tropical regions of Central and South America. After harvesting the cocoa fruit, it is opened to expose the seed, then fermented for a few days to separate pulp and seed. Pulp is used in distilleries and seed is used to prepare cocoa powder or chocolate and cocoa butter. It is brittle at temperature below 25°C, soften in the hand and melts in the mouth having at a temperature of about 34°C. This specific physio-chemical properties makes it is an important ingredient in confectionery industry.

Cocoa butter is an ideal fat for use in chocolate but it is not suitable for use in warmer or tropical climates, as cocoa butter and chocolate soften under these conditions. About 30% of the world's cocoa crops are destroyed by pests and disease and is deteriorating due to climate change. With this the fat content of the cocoa bean is small in amounts as compared to the other fatty crops. Less amount of fat content and is cultivated in few countries having a tropical climate, makes it availability unstable and expensive [1]. Other than this to overcome some technological problems like fat bloom, etc [2-4]. Fat bloom is directly related to the fat in chocolate products, either cocoa butter or vegetable oils. Cocoa butter represents not less than 95% of chocolate fat. The addition of other vegetable fats above this level means the products are named compound coatings. A bloomed chocolate is characterized by the loss of the initial gloss of surface, giving rise to a more or less white aspect. Furthermore, the bloom can have different appearances, from a uniform dull gray to a marble aspect, as well as from small individual white points to large white spots on the chocolate [5]. So that during chocolate production it needs to find out replacer to use as cocoa butter alternatives.

Cocoa butter replacers (CBR) fats may be called cocoa butter extenders, or hydrogenated domestic butter, because they do not replace the full amount of cocoa butter. Their compatibility with Cocoa butter is lower than for Cocoa butter equivalence (CBE) but higher than for Cocoa butter substitutes (CBS). It has been reported that incorporation of certain vegetable fats or fractions rich in 2-oleodistearin (StOst) triacylglycerols into Cocoa butter or Cocoa butter/milk fat system can produce an increase in solid fat content (SFC), raise melting point and also give a slight decrease in tempering time [6,7].

In view of the fact that Cocoa Butter is the most expensive chocolate component whose price and availability often change. So, the efforts have made to search the possibility to replace the cocoa butter fully or in part, with kokum butter.

Physical Properties of Cocoa and Kokum Butter

The specific physical properties, cocoa butter (CB) is considered the most important chocolate component that determines its texture, melting behaviour, gloss, snap, etc. Cocoa butter is responsible for the functional attributes in chocolate products, such as hardness at room temperature and pleasant mouth feeling due to melting at body temperature. These unique properties of Cocoa Butter are due to the composition of its major triglyceride fractions. It contains three main fatty acids: palmitic (P), stearic (S) and oleic (O) acids that develop a stable β -polymorphic crystal structure in the course of chocolate processing [8].

Practically all oleic (unsaturated) acid is esterified at the sn-2 position of the glycerol molecule so that more than 75% of the total triacylglycerols (TAGs) are 1,3-dipalmitoyl-2-oleoylglycerol (POP), 1-palmitoyl-2-oleoyl-3-stearoylglycerol (POS) and 1,3-distearoyl-2-oleoylglycerol (SOS) [9].

Triacylglycerols display a complex polymorphic behavior, strongly influenced by momentum, heat and mass transfer during crystallization. Polymorphic crystallization is primarily determined by the rate of nucleation, being governed by thermodynamic and kinetic factors. Depending on the cooling rate and agitation level, triacylglycerols appear in various crystal lattices: α (hexagonal sub-cell), β' (orthorhombic sub-cell) and β (triclinic sub-cell). The three polymorphs are based on subcell structures which define cross-sectional packing modes of the zigzag aliphatic chain. Each polymorph has a unique melting point and crystal structural properties [10,11].

Application of kokum fat in chocolate

The kokum fat does not need fractionation for use in cocoa butter equivalent formulation, and after refining kokum kernel fat may be directly used in chocolate. Fractionation of the kokum fat gives a very high level of stearin fractions, which were useful for chocolate filling or chocolate coating [16]. Kokum fat, is used as an improver to increase the hardness of chocolate. Kokum fat is added in various proportions replacing cocoa butter in dark and milk chocolate formulations and its effects on rheology, hardness and triglyceride composition were studied.

Table-1 Physico-Chemical properties of Cocoa butter and Kokum butter [Source- Ref:12-15]

Sr No	Parameter	Kokum Butter	Cocoa Butter
A.	Physical Parameters		
1.	Total fat content (% of seed)	29.33	
2.	Colour	Pale white	
	Odour	Neutral	
3.	State at room temperature	Solid	Solid
4.	Melting point (°C)	40.3	27-40°C
B	Physico-chemical properties		
1	Iodine value (g I ₂ /100g)	32-40	32-35
2	Saponification value (mg KOH/g)	180 - 193	192-199
3	Acid value (mg NaOH/g)	< 10.0	1.04-1.68
4	Peroxide value (meq O ₂ /kg)	5.0	1.00-1.10
C	Fatty acid		
1	Palmitic acid	3.25	24.5-33.7
2	Stearic acid	49.33	33.7-40.2
3	Elaidic acid	3.00	
4	Oleic acid	34.42	26.3-35
5	Linoleic acid	5.25	1.7-3
6	Arachidic acid	1.20	1.00
7	Eicosenoic acid	2.25	
8	Other fatty acids	2.30	
9	Myristic acid (C14:0)	1.20	0-4.00
10	Lauric acid (C12:0)		0-1.00 (19.68 ± 0.004)
11	Palmitoleic acid(C16:1)		0-4.00 (28.16)
12	Caprylic acid		1.27
13	Undecanoic acid		1.69
D	Chemical properties		
1	Acid Value (mg NaOH/g of oil)	4.9	
2	Saponification number (mg KOH/g of oil)	200.2	
3	Iodine value	39.4	
4	Free fatty acids (%)	5.64	
5	Sterols	1.02	
6	Vit. E (mg/100g)	20.01	
7	Total Saturated FA (%)	52.78	
8	Mono Unsaturated FA (%)	39.67	
9	Poly Unsaturated FA (%)	5.25	
E	Triacylglycerol		
1	1(3) palmitoyl-3(1) stearoyl-2 oleoylglycerol (POS)	6	42.8
2	1(3)-distearoyl-2- oleoylglycerol (SOS)	72	27.5-33.0
3	1,3-dipalmitoyl-2- oleoylglycerol (POP)	Trace	21.8

Conclusion

The compatibility of some important properties of the kokum butter like as triglycerides in terms of fatty acid constituents, slip or sharp melting points, solid fat contents, iodine value, acid value and saponification values resulting promising alternative to cocoa butter fats. These results revealed good potential of kokum fat as a cocoa butter improver.

The fat could be used up to 5-10 % by weight of the product without affecting the taste and other properties of chocolate, which will save the cost of the chocolate manufacturing and also help to generate income for Kokum growers.

Application of research: Study of physico-chemical properties of Cocoa butter and Kokum butter

Research Category: Post-Harvest Engineering

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Cultivar / Variety / Breed name: Kokum

Conflict of Interest: None declared

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