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PST021 - COCO-FIT: FUNCTIONAL FAT FROM BAMBANGAN KERNET FAT STEARIN AS COCOA BUTTER IMPROVER FOR TROPICAL APPLICATIONS

Norazlina Mohammad Ridhwan^{1*}, Nurul Azzaimah Fitri Khairil Anuar¹, Hasmadi Mamat¹, Siti Nur Hazwani Oslan¹, Dynatalie Delicious², and Norliza Julmohammad¹

¹ Food Security Research Laboratory, Faculty of Food Science and Nutrition, Universiti Malaysia Sabah, 88400 Kota Kinabalu, Sabah, Malaysia

² Community Nutrition and Health, Faculty of Food Science and Nutrition, Universiti Malaysia Sabah, 88400 Kota Kinabalu, Sabah, Malaysia

*Corresponding author: azlina_ridhwan@ums.edu.my

ABSTRACT

This project produced a cocoa butter improver (CBI) by fractionating pure bambangan seed fat and blending it with cocoa butter to assess its impact on cocoa butter properties. Various attributes, including physicochemical properties, fatty acid composition, solid fat content, and compatibility of the produced stearin with cocoa butter, were evaluated through analytical analysis, gas chromatography, and pulsed nuclear magnetic resonance. Twelve physical blends were prepared from the pure bambangan seed fat and the stearin with cocoa butter, with the proportion of cocoa butter increased by 20 %. Among these blends, COCO-FIT (bambangan stearin) improved the thermal properties of cocoa butter at a blending ratio of 20% COCO-FIT and 80% cocoa butter. No significant changes were observed in the physicochemical properties of cocoa butter, indicating that the fat is compatible with cocoa butter. The solid fat content shifted towards higher temperatures, with COCO-FIT improving the gradual decrease in solid fat content of cocoa butter towards 30 °C to 35 °C. These blends melted at body temperature, reached 0 % SFC at 40 °C, and showed ideal compatibility without eutectic effects. Therefore, COCO-FIT presents as a novel cocoa butter improver to improve the hardness and melting properties of chocolate in tropical climates.

Keywords – cocoa butter improver, bambangan kernel fat, tropical chocolate, physicochemical properties

INTRODUCTION

Cocoa butter (CB) is one of the most valuable and expensive fats in the food industry and serves as an essential ingredient in chocolate production due to its desirable melting profile, glossy appearance, and stable β -polymorphic form. It is mainly composed of stearic (36.5%), oleic (33.5%), and palmitic acids (25.8%), with triacylglycerols such as POS (40.2%), SOS (25.7%), and POP (17.6%), which together make up its unique texture and mouthfeel (Bahari & Akoh, 2018; Sonwai, Kaphuekngam & Flood, 2014). However, as CB faces supply constraints, high costs, and softening issues in tropical climates, acoconut butter, illipe butter, and sal fat. However, these natural CBIs are expensive and

limited, so the development of sustainable alternatives is essential. Bambang seeds (*Mangifera pajang*), an underutilised by-product with a fat content of ~9.9%, have a fatty acid profile very similar to that of CB (Norazlina et al., 2020; Jahurul et al., 2019, 2018). By fractionation, bambangan seed fat BKF yields high-melting stearic fractions rich in SOS (55.83–64.70%) and stearic acid (44.72–48.50%), making them promising CB improver candidates. Blending the stearins with CB offers a cost-effective approach to improve physicochemical and thermal properties, especially for chocolate products destined for tropical markets. This study investigates the physicochemical, thermal, and compatibility properties of BKF and its stearin fractions blended with CB, focusing on the fatty acid composition, solid fat content, and optimal blending ratios that best reflect CB properties while improving melting stability under tropical conditions.

OBJECTIVE

The main objective of this innovation is the development of COCO-FIT, a cocoa butter improver produced from the fractionation of pure bambangan seed fat. In particular, the study aims to investigate the physicochemical, thermal, and compatibility properties, including fatty acid composition and solid fat content of bambangan seed fat and its stearin fractions blended with cocoa butter, and to identify blending ratios that best mimic the properties of cocoa butter while improving melt stability for tropical environments.

DESCRIPTION OF THE PROJECT

COCO-FIT is a functional fat produced from bambangan seed fat through a two-stage fractionation process. Derived from the underutilised seeds of *Mangifera pajang*, this sustainable ingredient valorises agricultural by-products while offering a high-SOS composition and desirable thermal properties. In this study, COCO-FIT (bambangan stearin) were physically blended with commercial cocoa butter (CB) and the results showed that the main fatty acids in COCO-FIT blends were palmitic (22.42–25.72%), stearic (37.23–37.63%), and oleic (31.83–33.79%), with blends containing 80% closely matching CB's FA profile. These blends exhibited iodine value 36.17–36.58 g I₂/100 g and slip melting point 28.83–29.17 °C slightly higher than C, providing enhanced heat resistance. Solid fat content curves indicated higher solids above 30 °C, complete melting at ~37 °C, and 0% SFC at 40 °C, making them ideal for tropical storage. Compatibility testing revealed no eutectic softening effects, and the best-performing blends delivered CB-like sensory and physical properties with improved thermal stability. COCO-FIT can be incorporated into cocoa butter at up to 20% without negatively affecting physicochemical characteristics, offering a cost-effective, sustainable cocoa butter improver for tropical chocolate applications.



Figure 1: COCO-FIT produced from the fractionation of bambangan seed fat

Table 1: Physicochemical properties of COCO-FIT

	COCO-FIT	Cocoa butter
Physicochemical properties		
Iodine value (g I ₂ /100 g)	36.17 - 36.58	33.08
Slip melting point (°C)	28.83 – 29.17	25.00
Fatty acid composition (%)		
Palmitic (C ₁₆)	21.73 ± 0.01	24.79 ± 0.04
Stearic (C ₁₈)	38.92 ± 0.13	36.33 ± 0.57
Oleic (C _{18:1})	31.12 ± 0.11	33.00± 0.01
Solid fat content (%)		
25 °C	75.16	73.58
30 °C	48	35
35 °C	2	0
40 °C	0	0

NOVELTY

This research is the first to detail the physicochemical compatibility of the bambangan stearin with CB. It demonstrates that using 20% high-SOS stearin in CB yields cocoa butter-like fats with improved heat resistance, making them suitable for tropical chocolate manufacturing. This valorizes the bambangan seed, an agricultural by-product, into a high-value, sustainable functional fat for the confectionery industry.

CONCLUSION

The two-stage fractionation of bambangan seed fat has successfully produced functional fat (COCO-FIT) that can be mixed with cocoa butter. Blending 20 % COCO-FIT (bambangan stearin fractions) with 80 % CB did not lead to significant changes in the physicochemical properties, fatty acid composition, and solid fat content profile of CB, but improved its thermal stability. COCO-FIT can serve as a CB improver in tropical chocolate production, support waste utilisation, and reduce dependence on imported CB.

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