MECHANISM OF FAT MIGRATION OF LAURIC HARD BUTTER (PKS) AND NON LAURIC FAT (PMF) BASED FILLING CENTRE IN DARK CHOCHOLATE

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Introduction

Malaysia is the leading country in palm oil and palm kernel oil production. These fats are fractionated into liquid oleins and hard stearins (palm mid fraction and palm kernel stearin), the latter was used as the base filling center in chocolate. In warm seasons (Malaysian range temperature 25-30°C), these fats tend to migrate from the base center into the coating, due to the presence of short fatty acids or triglyceride and/or unsaturated fatty acids and low m.p. This migration causes the chocolate stickiness and softness, which consequently, leads to changes in the cocoa butter crystals and bloom formation. This phenomenon will affect Malaysian chocolate in the international market. Therefore, the objectives of our study were: To study the mechanism of PKS and PMF migration into the chocolate surface; to determine the effect of desiccated coconut on the rate of migration of PKS and PMF migration; to study the effect of different storage temperatures on the rate of fat migration and the polymorphic changes in cocoa butter due to fat migration. The main goal of this study was to find a way to improve the shelf life of local Malaysian chocolates.

Materials and Methods

The fat migration was stimulated in real product by using layers of cream filling and dark chocolates approximately 100g each in a plastic box of 200g size. Two types of filling were prepared, F1 (30% palm kernel stearin, 70% icing sugar), and F2 (30% palm kernel stearin, 15% desiccated coconut and 55% icing sugar). For the coating section dark chocolate was used. Samples were stored at 30°C for 8weeks to study the mechanism of PMF and PKS migration. For the effect of temperature on fat migration, the samples were stored at 35°C and 18°C for the same period. Each week interval, chocolate was be separated and dissected into 3, 6, 9, 12 and 15mm to study the physiochemical properties of the dark chocolate using Texture analyser for hardness, Humidity chamber for bloom, DSC for melting point, NMR for SFC and X-ray for polymorphic changes and the chemical tests soxhlet apparatus for total fat content, GC for FAME and HPLC for TGs.

Results and Discussion

Hardness decreased with the increasing storage time and increase with the increase in distance. Chocolate filled with F_2 was substantially softer than those filled with F1. This could be due to the presence of coconut oil in F_2. An increase in the amount of liquid phase resulted in softer chocolate (Dimick and Manning, 1987). In F_2, very low SFC (5 and 10%) was observed at 3mm and 6mm distance at 30°C after 5 weeks storage period respectively. This could be due to the incompatibility between lauric fats and CB (Herzing, 1989). DSC melting profiles show two distinct peaks in both cases, this complex melting behavior occurred in the region of dilution effect (SFC%). Dark chocolate filled with F_1 (harder) bloom 4 cycles faster than those filled with F_2 (softer). F_1 samples showed onset of bloom (32 cycles) and complete bloom (38 cycles) at 3, 6 and 9mm distance while F_2 onset of bloom (36 cycles) and complete bloom (41 cycles) in all distances. This may be attributed to the compatibility between coconut oil and PKS and chemical incompatibility between lauric fats and cocoa butter, this result was supported by Laustsen (1991) who suggested that, bloom in lauric based compounds is caused by migration of trilaurin to the surface of chocolate rather than, as commonly believed, due to migration of cocoa butter. The percentage of fat in the filling and the chocolate layer attained equilibrium values after 6 weeks storage period in the chocolate filled with F_1, whereas in F_2 the net fat migration occurred after 4 weeks time. Since the lipid in F_2 is more liquid than F_1 and both are usually more liquid than cocoa butter at room temperature, they tend to migrate more easily into the chocolate structure. The use of desiccated coconut in F_2 increases the rate of movement by 100% in F_2 than F_1.The extent of triglycerides movement from a biscuit base into its chocolate coatings depend on storage time, temperature, SFC and the fat content of the base (Talibot 1990).

Conclusions

The migration of lauric fat from the filling into the dark chocolate changed the physical and chemical properties of cocoa butter. Both fillings show improved bloom resistance (5-7 weeks), using desiccated coconut improve the bloom resistance by 6 cycles. Thus palm kernel stearin and desiccated coconut showed bloom resistance at 30°C, this combination would be the best filling if the chocolate stored below 25°C.

References

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