

Physical, rheological and sensorial properties, and bloom formation of dark chocolate made with cocoa butter substitute (CBS)

ABSTRACT

This study examined the physical properties of enzymatically produced palm oil-based cocoa butter substitute (CBS) in dark chocolate. Melting profile, particle size distribution (PSD), rheological, textural behaviors, bloom formation and polymorphism were analysed using differential scanning calorimetry (DSC), master-sizer/polarized light microscopy (PLM), rheometer, stereomicroscope and x-ray diffraction (XRD), respectively. Dark chocolates were produced with cocoa butter (CB, without CBS), 5 g CBS (formulation-1) and 20 g CBS/100 g blend (formulation-2). Both chocolates with addition of CBS showed maximum melting temperature similar to CB-chocolate. However, the peak area and melting enthalpy for formulation-2 were significantly ($P < 0.05$) different from CB-chocolate. Significant differences ($P < 0.05$) in PSD, flow behavior, hardness and sensory characteristics were observed for formulation-2 whilst no significant difference ($P \geq 0.05$) was observed for formulation-1. Stereomicroscope images of all the chocolate samples did not show bloom at 24 °C for up to 8 weeks. Conversely, at 29 ± 1 °C, bloom formation was only observed for CB-chocolate and formulation-1 after two weeks of storage. Noticeable changes in XRD peaks were observed for bloomed chocolate. Overall, chocolate with formulation-1 was similar to CB-chocolate in terms of physical and sensory properties. However, chocolate with formulation-2 exhibited significantly lower sensory profiles particularly taste acceptance and hardness compared to CB-chocolate.

Keyword: Dark chocolate; Fat bloom; Polarised light microscopy; Melting; Polymorphism