Tempering and Crystallisation Effects on Mechanical Properties and Appearance in Dark Chocolate Systems during Industrial Manufacture

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ABSTRACT:

Introduction and objective: Tempering is a directed pre-crystallization that consists of shearing chocolate mass at controlled temperatures to promote cocoa butter crystallization in the most thermodynamically stable polymorphic form, to obtain products with good snap, colour, contraction, gloss and shelf life characteristics. This study investigated lipid crystallization behaviour during tempering of dark chocolates from different temper regimes and their effects on textural properties and appearance of finished dark chocolate products.

Materials and methods: Dark chocolates varying in particle size distribution (PSD) ($D_{90}$ of 18, 25, 35 and 50 $\mu$m) were processed using standard industrial manufacturing processes and tempered using an Aasted Temperer. Tempering influences on products’ crystallisation were studied using TA.XT2 Texture analyzer, HunterLab MiniScan Colorimeter and Gloss meter to establish relationships with their mechanical properties and appearance.

Results and discussions: Particle size was inversely correlated with texture and colour, and the greatest effects were noted with hardness, stickiness and lightness at all temper regimes with significant interactions among factors. Over-tempering caused significant increases in product hardness and stickiness, reduced gloss and darkening of both surface and internal periphery of products. Under-tempering induced blooming in products with consequential quality defects on texture, and appearance. The blooming caused hardening, dullness and reduced gloss in the products.

Conclusion: Attainment of optimal temper regime during pre-crystallisation of dark chocolate is necessary for the achievement of premium quality products with acceptable texture, colour and gloss. Over-tempering and under-tempering result in quality defects affecting mechanical properties and appearance characteristics of products.