

Streszczenie i słowa kluczowe w języku angielskim

The negative impact of excessive fat and sugar intake on human health highlights the importance of developing healthier alternatives to existing food products, a topic of growing technological and societal relevance. However, this endeavor involves significant technological challenges and carries the risk of altering key quality attributes that determine consumer acceptance. The aim of this study was to develop alternative formulations of wafers with cream with reduced sugar and fat content. Additionally, the formulations were modified by eliminating palm oil and incorporating a commercial citrus fruit extract (Flavomix) to enhance product stability. The wafers were produced under industrial conditions and stored for 13 months in two types of packaging: polypropylene film (PP) and metallized polypropylene film (PP-met). The study included wafer sheets (standard and extract-enriched) and wafers with creams with different formulations: standard (WS), sugar-reduced (WC), modified fat phase based on shea fat and high-oleic rapeseed oil (WT), and extract-enriched (WTE). The following parameters were evaluated: oxidative and microbiological stability, color, texture, water activity, sensory properties, melting profile, and solid fat index. The addition of the citrus extract to wafer sheets effectively slowed down lipid oxidation, demonstrating significant protective effects for up to 10 months of storage. Similarly, the creams with the modified fat phase (WT and WTE) exhibited higher oxidative stability compared to the WS samples. In the WTE sample, this effect was further enhanced by the addition of the extract, which was characterized by high antioxidant activity and a high content of phenolic compounds. In contrast, the sugar-reduced cream (WC) showed oxidative changes comparable to those observed in WS sample, but differed in color characteristics, exhibiting a noticeable lightening, whereas the WTE cream darkened gradually during storage. The study also revealed that WC wafers maintained higher water activity throughout the storage period than other variants, confirming the role of sugar in water-binding capacity. In terms of texture, WT and WTE wafers were less hard than WS and WC samples. All wafer variants demonstrated high microbiological stability over the entire storage period. Unexpectedly, PP film provided better oxidative stability of the fat phase compared to PP-met, although the latter was more effective in protecting the wafers against water activity changes.

In summary, the reformulation of the cream filling, involving palm oil elimination and extract incorporation, improved the overall quality of the wafers. The use of a standardized commercial extract is particularly relevant for the food industry, both from a practical and technological standpoint. Importantly, the study was conducted under real industrial conditions,

which more accurately reflect actual storage processes compared to simulated environments. Despite the demonstrated efficacy of the extract, its use should always be preceded by optimization studies to determine the optimal dosage, as excessive concentrations and/or pro-oxidative conditions may lead to adverse effects.

Keywords: sugar-fat-based fillings, reformulation, wafers, bakery products, storage changes

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