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Optimization of Canned Talang Queenfish Color Sterilized by Rotary Retort: Storage Stability, Artificial Intelligence—Adaptive Neuro Fuzzy Inference Systems Modeling TBA Based on Color Attributes

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ABSTRACT

This study aimed to improve the color quality of sterilized Talang Queenfish. It also optimized sterilization conditions using Response Surface Methodology (RSM) with a central composite design. The effect of storage on color attributes was evaluated. Sterilization temperatures tested were 110°C, 115°C, and 121°C, with durations of 10, 20, and 30 min. Two methods were compared: rotary sterilizer (RS) and conventional autoclave (CA). Color parameters measured included L^*, a^*, b^*, ΔE, hue angle (h), chroma (C), whiteness index (WI), yellowness index (YI), and browning index (BI). The Adaptive Neuro-Fuzzy Inference System (ANFIS) was used to model thiobarbituric acid-reactive substances (TBA). Optimal conditions were 116°C for 15.54 min. Under these conditions, the RS method improved L^*, a^*, ΔE, C, h, and WI compared to CA. These values reached 38.77, 31.25, 64.47, 0.16, 45.32, and 39.29, respectively. In contrast, YI and BI decreased by 27.94% and 32.82%. The RS method significantly enhanced color attributes immediately and during storage. ANFIS with a gaussmf membership function accurately predicted TBA. The sixth reduced model achieved the lowest prediction error. These results indicate that color parameters can be used as quality indicators in fish processing.

1 | Introduction

The visual appearance of food, particularly its surface color, serves as a critical indicator of product quality and significantly influences consumer acceptance prior to any sensory evaluation. Among various quality parameters, color is frequently used by consumers as a primary criterion for accepting or rejecting a food product, especially in the absence of other sensory cues (Abdulla et al. 2004; Hatcher et al. 2004; Du and Sun 2004; Pedreschi et al. 2000). Color is widely recognized as one of the most important sensory attributes in both fresh and processed foods. It not only enhances the initial visual appeal but also strongly shapes consumer preferences and perceptions. From a physical standpoint, color perception arises from the interaction of light—defined by its intensity and wavelength—with a material, which is then detected by the human eye (Costa et al. 2011; Sahin and Sumnu 2006). Many researchers have underscored the critical role of color in influencing consumer perceptions of food quality. As a primary visual cue, color is strongly associated with key sensory attributes such