71st ICoMST
GIRONA - CATALONIA - SPAIN
3rd-8th August - 2025

MAINTENANCE OF THE PINK COLOR IN COOKED HAM BY THE ADDITION OF STABLE COCHINEAL CARMINE DYE

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I. INTRODUCTION

The appearance of food, especially its color, strongly influences consumer acceptance. In cured meat products, nitrates and nitrites are widely used for their antimicrobial action and coloring effects, but their use is controversial due to the formation of carcinogenic compounds. Cochineal carmine is a common natural dye, but it is sensitive to light. Microbiological safety and color stability in meat products without curing salts are believed to be achievable only through the addition of an extra additive. Hydroxysalts exhibit low toxicity, low production costs, and are easily obtained and handled [1]. They have been employed as heterogeneous catalysts for the esterification of free fatty acids and the transesterification of vegetable oils [2], ultraviolet (UV) radiation absorbers [3], and as components in vitamin formulations, acting as food supplements by enhancing aroma, stability, and nutritional properties [4], among other applications.

In this study, inorganic matrices, specifically zinc-based lamellar hydroxysalts adsorbed with the natural dye cochineal carmine, for obtaining stable cochineal carmine dye (Stable-carmine), were synthesized and applied in the formulation of cooked ham. The objective was to enhance the color stability of the product during storage, in comparison with cooked ham manufactured using conventional methods (with nitrites/nitrates and/or carmine).

II. MATERIALS AND METHODS

In a typical experiment, 60 mL of ethanol and 20 mL of an aqueous solution containing 0.010 mol L^{-1} of carminic acid (Dinâmica®, 98%) was mixed with 20 mL of a solution containing 0.013 mol $Zn(NO_3)_2 \cdot 6H_2O$ (Dinâmica®, 96%). Then, NaOH solution (1 mol L^{-1}) was added dropwise at room temperature and the final pH was adjusted to 6.7. The suspension was magnetically stirred at room temperature for 1 day. Later, this suspension was centrifuged and washed with distilled water, the procedure being repeated four times. The stable cochineal carmine dye (Stable-carmine) was lyophilized for 48 hours and used in the preparation of cooked hams made in accordance with Brazilian legislation [5,6]. The hams were sliced, vacuum-packed in transparent polyethylene packaging, and stored under refrigeration (5 ± 1 °C) for 60 days, either in the dark or exposed to white fluorescent light (1100 LUX). Instrumental color measurements (CR 400, Konica Minolta, Osaka, Japan) were taken every 10 days for the samples: F1, cooked ham without curing salts and without Stable-carmine; F2, cooked ham without curing salts and with Stable-carmine (0.0025%); F3, cooked ham without curing salts and with cochineal carmine (0.0008%); and F4, cooked ham with curing salt (0.25%) and without dyes.

III. RESULTS AND DISCUSSION

The results are presented in Figure 1. When evaluating the *L** coordinate for vacuum-packed ham stored over 60 days at 5 ± 1 °C, it is noteworthy that the value of this coordinate was significantly higher ($p < 0.05$) for the standard ham at time zero and decreased significantly ($p < 0.05$) for the ham stored in the dark. For the ham with Stable-carmine stored in the dark, there was a significant variation ($p < 0.05$) in the L* values throughout the storage period, but at the end of 60 days, the L* value did not differ from that at time zero.

The a* coordinate value in the ham with added Stable-carmine was initially 4.56 ± 0.25 and ended with 6.53 ± 0.54 ($p < 0.05$), which should also be considered a highly positive characteristic. It is noteworthy that the same vacuum-packed ham, when stored in the dark, showed similar behavior. This indicates that the ham with added Stable-carmine associated with vacuum packaging can contribute to improving the red color of the ham, even when stored in the dark. For the ham prepared with curing salt and stored under light, there was a significant reduction ($p < 0.05$) in the a* value, which can be characterized as a loss of color quality, considering that cooked ham is commonly sold sliced in transparent packaging. The b* value at time zero for the standard ham and the ham with added curing salt did not differ ($p > 0.05$) from each other.

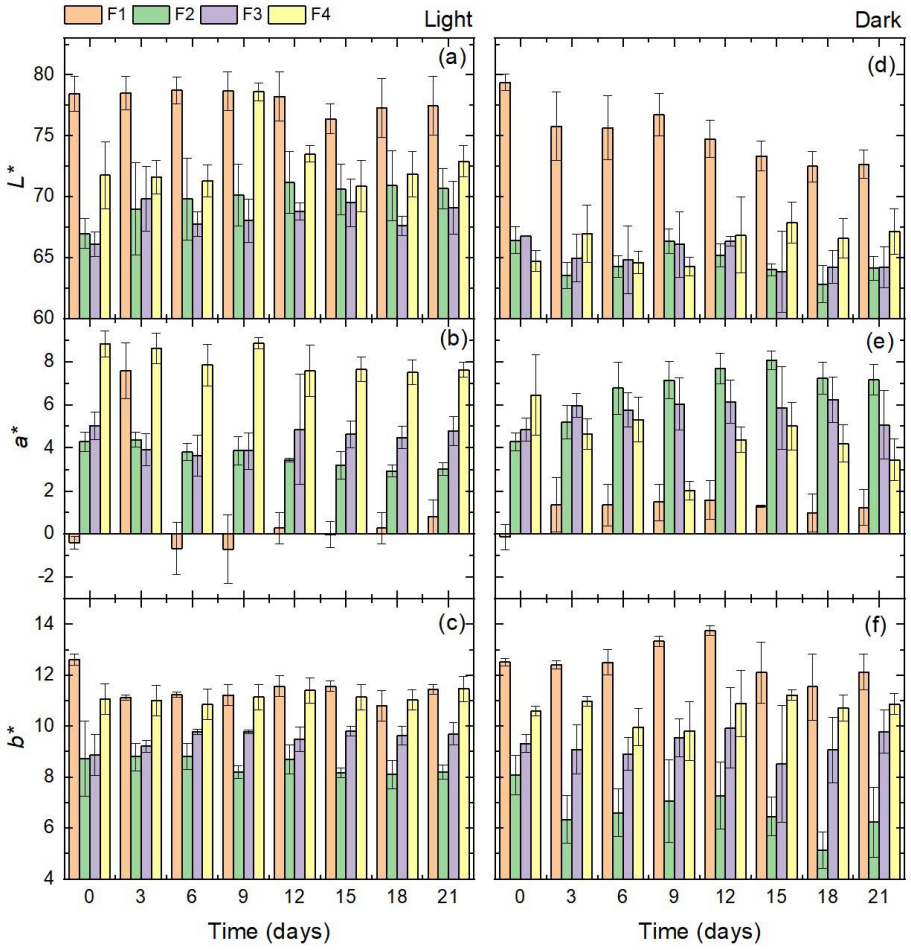


Figure 1. Behavior of the *L** (lightness; 100 = white, 0 = black), *a** (redness; +, red; −, green), and *b** (yellowness; +, yellow; −, blue) coordinates of the CIELAB system for vacuum-packed cooked ham stored under refrigeration. F1, cooked ham without curing salts and without Stable-carmine; F2, cooked ham without curing salts and with Stable-carmine (0.0025%); F3, cooked ham without curing salts and with cochineal carmine (0,0008%); and F4, cooked ham with curing salt (0.25%) and without dyes.

IV. CONCLUSION

This study demonstrated the feasibility of producing cooked ham without the use of curing salts, employing a stable dye derived from cochineal carmine, capable of preserving the typical color characteristics of cooked meat products.

ACKNOWLEDGEMENTS

Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) and Fundação Araucária.

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