COLOUR DEVELOPMENT AND RESIDUAL NITRITE IN RESTRUCTURED HAM FORMULATED WITH VARYING CONCENTRATIONS OF SODIUM NITRITE OR NATPRE T-10

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I. INTRODUCTION

Much work has been done in recent years to replace nitrite with natural ingredients that can deliver on nitrite's multifunctional properties [1]. Of these, colour is critical, as it is a key driver of consumer acceptability [2] and a distinguishing feature of cured meat products. In the present study, we assessed the effect on colour of sodium nitrite at various concentrations (0–200 ppm) and compared it to that of a natural fruit and spice extract, NATPRE T-10 (Prosur, Murcia, Spain). The ingredients were incorporated in a restructured ham product, and colour development and residual nitrite concentration were evaluated during 90 and 60 d of refrigerated storage, respectively.

II. MATERIALS AND METHODS

Restructured ham was manufactured with ground (8 mm) ham inside muscles (*M. adductor*, *M. semimembranosus*) and formulated with 0, 1, 5, 40, 100, 150, or 200 ppm sodium nitrite, or 1% NATPRE T-10. After vacuum-tumbling at 6 rpm for 2 h, samples were stuffed in 40-mm plastic casings and cooked at 82 °C (100% RH) to an internal temperature of 71.1 °C. After chilling at 2 °C for 15–16 h, casings were stripped and sample logs sliced to a thickness of 2 mm, vacuum-packaged (6 slices per package, positioned side-to-side), and stored at 1.5–3 °C, in complete darkness. Samples were scanned with a HunterLab MiniScan EZ colourimeter (CIE *L*a*b**, illuminant D65, 10° observer) on days 0, 5, 10, 15, 30, 45, 60, 75 and 90 post-packaging. Residual nitrite analysis was performed on selected samples (5, 40, 100, 150 ppm nitrite, and 1% NATPRE T-10) on days 10, 30 and 60, and was done according to the colourimetric method described in AOAC Official Method 973.31 [3]. The study was replicated three times. Statistical analysis was conducted as a mixed model using JMP Pro 16 (SAS Institute, Cary, NC), with significance established at $P < 0.05$.

III. RESULTS AND DISCUSSION

Colour *a** of 0 and 1 ppm nitrite samples was initially lower than in all other treatments, which did not differ from each other at d 0, and remained mostly unchanged for all treatments throughout the entire storage period (Fig. 1). *b** was always highest in 0 and 1 ppm nitrite and remained mostly unchanged throughout the storage period. *L** tended to be higher in 0 and 1 ppm NO_2^-, and also remained mostly stable in all samples throughout storage. Extent of discolouration as measured by *a**/*b** directionally agreed closely with *a** results. Chroma was higher in 0 and 1 ppm nitrite and remained mostly unchanged for all treatments. There was no detectable residual nitrite in the 0 and 1 ppm nitrite and NATPRE T-10 treatments, throughout the 60-day storage period during which it was analysed (Fig. 2). Initial residual nitrite concentrations increased from 5 to 150 ppm ingoing nitrite, and decreased throughout storage. At 5 ppm ingoing nitrite, residual nitrite was not detectable on day 0.

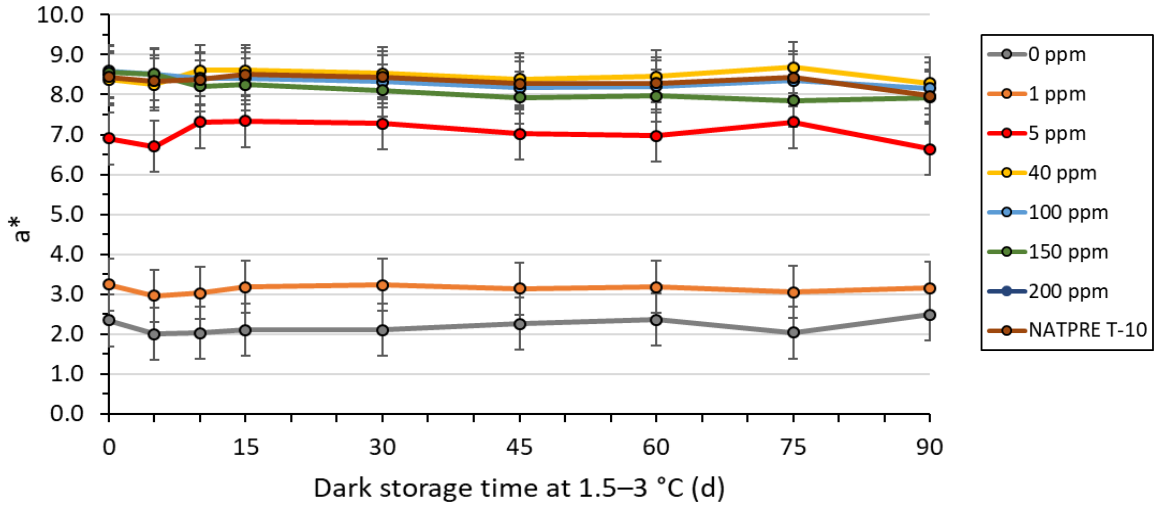

Figure 1. Colour a* values of ham samples during storage at 1.5–3 °C. Error bars represent 95% confidence intervals.

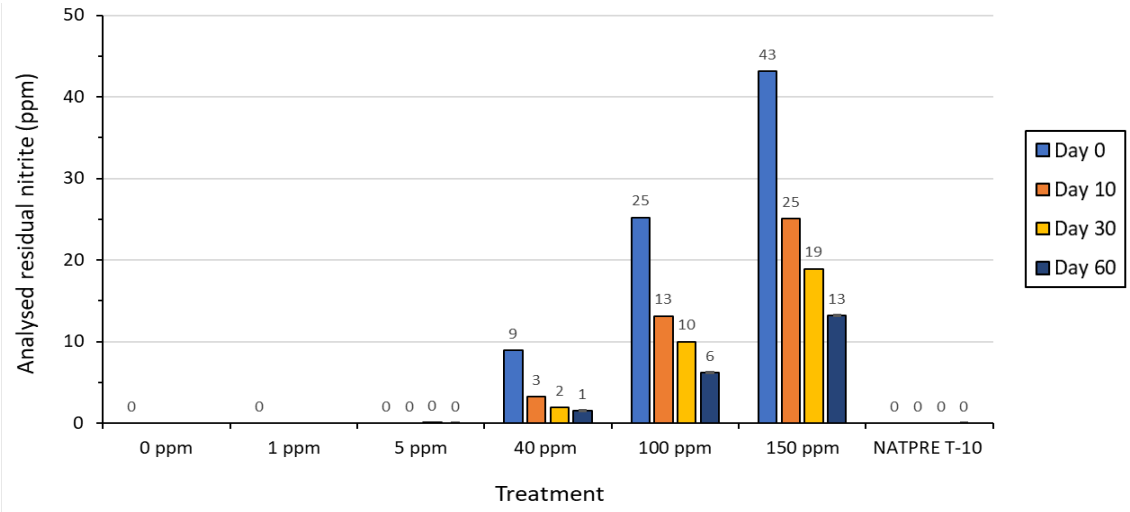

Figure 2. Residual nitrite concentration of ham samples stored at 1.5–3 °C for up to 60 d. 0 and 1 ppm samples were analyzed on day 0 only. *ppm* refers to ingoing nitrite concentration.

IV. CONCLUSION

A minimum of 40 ppm nitrite was required to form typical pink ham colour. A similar colour was achieved with addition of NATPRE T-10 at 1%. Sodium nitrite at 1 ppm or less was not sufficient to form a colour of comparable intensity, and 5 ppm resulted in a colour of intermediate intensity. Residual nitrite concentration was proportional to ingoing nitrite level and declined during storage. NATPRE T-10 was sufficient to develop a pink colour of comparable intensity and resulted in no detectable residual nitrite.

ACKNOWLEDGEMENTS

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