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SENSORY EVALUATION OF CHICKEN MEAT COATED WITH ALGINATE ENRICHED WITH PLANT EXTRACTS AND NISIN

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I. INTRODUCTION

Meat and meat products are particularly vulnerable to degradation due to exposure to physical, chemical, and biological agents. These factors can lead to undesirable sensory changes, such as discoloration and off-flavors, making the product unappealing. In this context, the choice of packaging materials and technologies plays a crucial role in mitigating spoilage while preserving the sensory attributes of meat. In this context, edible films and coatings combined with active compounds can be an alternative approach. The addition of functional agents enables the creation of active packaging, improving the product's characteristics and consequently increasing its shelf-life.
This study explores the impact of bio-based packaging materials on chicken meat sensory properties. Laurel leaf extract, olive leaf extract, and nisin were used as active agents.

II. MATERIALS AND METHODS

Laurel and olive leaves extracts were obtained by ultrasonic-assisted extraction technique in an ultrasound bath using 70:30 (v/v) ethanol:water. The coating solutions were prepared in distilled water by mixing 1% (w/v) of sodium alginate (SA) and 0.5% (w/v) of glycerol under agitation overnight at room temperature. Lyophilized extracts of laurel and olive leaves were dissolved in distilled water, stirred for 1 h, filtered under vacuum and added to the film-forming solutions in the following concentrations: LLE: Laurel at 2% (w/v); MIX: LLE at 1% (w/v) + OLE at 1% (w/v); and NIS: Nisin at 1% (w/v) (dissolved in 0.01 N HCl). All solutions were stirred for 1 h.
Chicken breast pieces (24 h *post mortem*) weighing ca. 50-70 g were coated by spraying at room temperature, until the entire surface was covered. Then, a solution of $CaCl_2$ at 1.5% (w/v) was sprayed to achieve enhanced crosslinking. Coated and uncoated samples (PLA: control) were packed in polylactic acid (PLA) biopolymer trays + PLA films. Uncoated samples (CNT, control) were also packed in conventional polypropylene trays and polythene films. The samples were stored at 4 ºC and analyzed over 13 days. The study was conducted in triplicate and on three different occasions. Analyses were performed in duplicate.
The sensory analysis was conducted with 6 semi-trained sensory panel with a background in meat quality. A structured intensity scale ranging from 0 to 9 was used, where 0 corresponded to the absence of the attribute and 9 represented its maximum intensity. The panel evaluated visual and odor attributes related to meat and overall freshness acceptability (OFA) attributes: color, odor, and freshness. The sensory evaluation was performed at 0, 1, 3, 6, 9, and 13 days.

III. RESULTS AND DISCUSSION

The changes in the sensory attributes of chicken breasts during refrigerated storage are shown in Figure 1. At the beginning of storage, fresh samples had high scores (> 8) for typical and OFA attributes. At day 6, the scores ranged between 5 and 6 for OFA attributes. From day 9 onwards, the scores were consistently below 5. Different properties were observed in the samples after treatments (day 1 and subsequent days) due to the incorporation of the coatings. On day 1, the sensory panel observed a significant ($P > 0.001$) appearance of a yellow-green color in samples coated with LLE and MIX. LLE and MIX samples showed an increase of 3.8 and 3.5 points, respectively. In contrast, the CNT, PLA, and NIS samples, maintained scores below 0.5, similar to day 0. The panel also observed an increase in herbaceous odor intensity on day 1. LLE and MIX samples scored 2.6 and 2.0, while CNT, PLA, and NIS scores remained below 1. The differences observed for yellow-green and herbaceous were consistent over time. However, it appears that the differences had no significant impact on the OFA parameter scores, as no significant differences were observed between treatments over time. The scores for sensory attributes related to unpleasant odors due to oxidation and microbial development, such as ammoniacal, rancid, and putrid, were consistently higher for control samples.

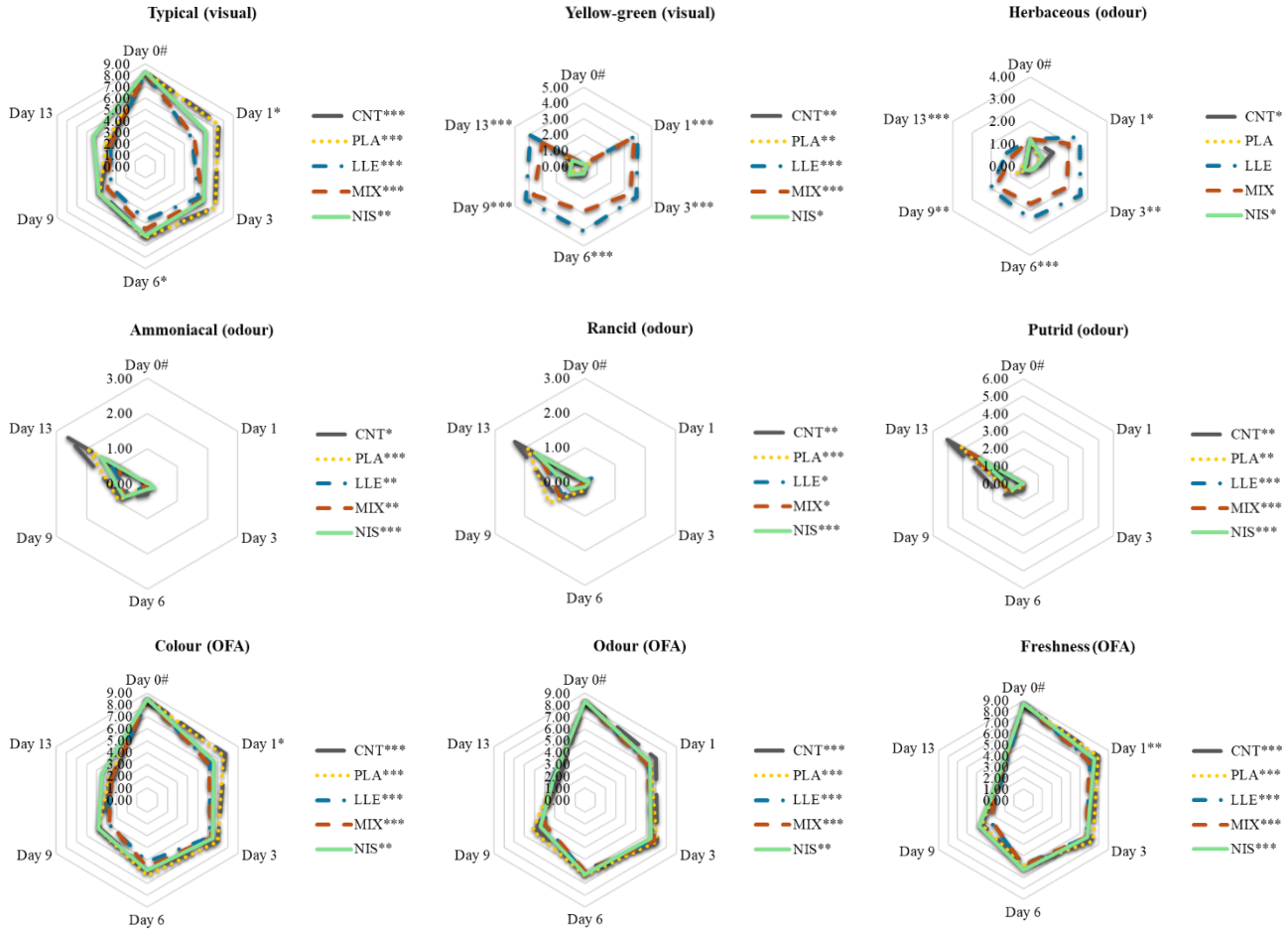


Figure 1 - Radar plot of the sensory properties (visual, odor, and OFA - overall freshness acceptability) during storage, and images (day 1 and 13) of chicken breast pieces stored at 4 °C.

Before treatment, Significant differences between storage times for each treatment are marked in the figure legend, *P < 0.05, **P < 0.01, ***P < 0.001. Significant differences between treatments for each storage time are marked on the x-axis, *P < 0.05, **P < 0.01, ***P < 0.001.

The addition of the extracts has a greater impact after 24 hours of treatment, as the panel was able to detect the presence of the compounds. From day 3 to 13, no significant statistical differences (P > 0.05) were observed for the OFA scores between coated and uncoated samples, with the largest differences being less than 1. This suggests that despite superior scores being identified for yellow-green and herbaceous attributes, the panel gave a generally positive rating for color, odor, and freshness. The increase in yellow color intensity over time, combined with the appearance of unpleasant odors in the control samples, may help to explain the obtained scores.

IV. CONCLUSION

In the global context, the sensory panel provided positive ratings. Coated samples maintained better color stability and odor quality compared to the control samples. Coated samples developed fewer unpleasant odors (rancid, ammoniacal, and putrid) than untreated samples. However, color properties for samples with laurel and olive require further optimization to minimize their impact and increase consumer acceptance.

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