



EFFECT OF A KERATIN-CONTAINING PBSA FILM ON THE SHELF LIFE OF ATLANTIC SALMON (*SALMO SALAR*)

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Aim. The aim of this study was to evaluate the effect of film consisting of poly (butylene succinate-co-adipate) (PBSA) with keratin extracted from chicken feathers on the shelf-life of refrigerated Atlantic salmon (*Salmo salar*).

Methods. A total of three groups of salmon samples were compared: untreated salmon (ST, without film application), salmon in contact with PBSA film (CTR), and with a PBSA film containing 5% keratin (TRT) stored at 4 °C for 7 days. The samples were analyzed at days 0, 2, 5, and 7 for microbiological (total viable count at 30 °C and 7 °C, *Pseudomonas* spp., Enterobacteriaceae, *Brochothrix thermosphacta*, Enterococci, *E. coli*, and coagulase-positive staphylococci) and physicochemical (pH; water activity; thiobarbituric acid reactive substances, TBA test; total volatile basic nitrogen, TVB-N; trimethylamine, TMA; colour parameters, CIEL*a*b*) characteristics. Additionally, instrumental sensory analysis using an electronic nose (PEN3) was performed to correlate the response of selected sensors with chemical spoilage indicators (Pearson's correlation). Differences between samples and in the sampling time were evaluated by two-ways analysis of variance (ANOVA; $p < 0.05$ and $p < 0.01$). All analyses were performed in triplicate.

Results. Overall, the salmon TRT showed better quality preservation compared with ST and CTR samples throughout the entire experimental period. In line with current literature, CTR displayed a mild, inherent antimicrobial effect compared to ST, notably slowing down microbial growth by day 5 across key indicators (total aerobic counts, *Pseudomonas* spp., Enterococci, and maintaining *E. coli* below detection limits). The TRT maintained a protective trend, achiev-

ing a ~0.5 Log (CFU/g) reduction at day 5 against both total viable counts and *Pseudomonas* spp. compared to the ST. During storage, pH decreased in all groups, with TRT showing the lowest values, whereas water activity remained high and stable across all samples. Color analysis also showed that TRT preserved redness and chroma compared with ST and CTR. Moreover, TRT exhibited the lowest TBARS (0.028), TVB-N (21.31) and TMA (2.21) values, compared with both the ST and CTR samples at the end of the storage. This suggests a protective effect of keratin against lipid oxidation and the accumulation of volatile nitrogen compounds, whose functional groups of keratin may interact with oxidation products, volatile compounds, and the protein matrix of salmon. The electronic nose showed an increase in spoilage-related volatile compounds during storage, with sensors S2, S6, S7, S8 and S9 responses showing a significant positive correlation with TVB-N ($p < 0.05$). At the end of storage, TRT samples exhibited lower sensor responses than ST and CTR, further supporting the protective effect of the keratin-containing film.

Conclusions. The study showed that neat PBSA contributed to limiting microbial growth, whereas keratin incorporation enhanced the preservation of colour and reduced lipid oxidation and the accumulation of volatile nitrogen compounds. These complementary effects resulted in the keratin-containing PBSA film providing the best overall preservation of salmon quality during refrigerated storage, as also supported by the lower electronic-nose responses associated with spoilage. Further studies are required to confirm these findings and clarify the contribution of keratin to the overall preservative effect.