Antimicrobial properties of furcellaran-chitosan coatings with bioactive peptides and its effect on the microbial counts of cold stored smoked ham

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Introduction: Various furcellaran coatings has been investigated for possible extensions of stored food products shelf-life, however the exhibited antimicrobial effect was not satisfactory (Jamróz et al., 2021; Kulawik et al., 2019b). Chitosan shows potent antioxidant and antimicrobial properties (Kulawik et. al, 2019a), however its use in coatings is often impaired by low mechanical stability and moisture sensitivity of chitosan films. Bioactive peptides are associated with different biological activities, including antioxidant and antimicrobial (Görgüç et al., 2020). Despite its promising potential there is a limited number of studies investigating their use as preservatives incorporated into the edible coatings matrix. The aim of this work was to assess the antimicrobial potency of edible coatings incorporated with 7 different antimicrobial peptides by investigating their effect on cold stored model meat products. This is a work in progress.

Materials and methods: The edible coatings were prepared by mixing solutions of chitosan with furcellaran (v/v ratio of 0.9:0.1). Afterwards the solutions of different bioactive peptides (LL-37, RW4, Cys-LL37, mellitin, MBP-1, brevifactin, LfcinBn) were added until reaching the final concentration of each bioactive peptide in the film forming solution of 5 µg/mL. The peptides were chosen based on their high antimicrobial potency reported in the literature.

Sliced hermetically sealed smoked pork hams were obtained from a meat processing supplier. Exactly 7 days prior to the end of shelf-life (day 0) packages were opened and ham slices were divided into 9 groups: control (not treated), dipped in film forming solutions with one of 7 bioactive peptides or in solution without peptides (film control). Each group was packed into PET trays with cover and stored for 10 days at 4 °C. The samples were analyzed for their total viable counts (TVC). The analysis was performed using PCA agar with incubation at 30 °C for 72h. The experiment was repeated three times.

Results and Discussion: The microbial contamination of hams on day 0 was 4.31 ± 1.06 log cfu/g and increased after 10 days to 8.03 ± 0.30 log cfu/g. The TVC of the film control was 4.82 ± 0.30 log cfu/g while In bioactive peptides groups varied from 4.33 – 6.55 log cfu/g. The highest inhibition was observed in hams treated with edible coatings and RW4. The coatings with LL37 showed similar inhibition as film control group, meanwhile the rest of analyzed groups showed higher TVC then in hams treated with film control. It seems that addition of bioactive peptides into the edible coatings resulted in hindered antimicrobial efficiency of the treatment. This might be due to formation of complexes between the coating matrix and bioactive peptides, which blocked the active sites of the peptides and matrix alike. Despite this the treatment resulted in 1.48-3.70 log/cfu/g reduction in bacterial counts after 10-day storage. Moreover, the film control, RW4 and LL37 groups almost completely inhibited the progress of microbiological growth (up to 0.6 log cfu/g increase after 10 days of storage).

Conclusions: The treatment resulted in a successful inhibition of microbial spoilage. The use of analyzed peptides did not seem to improve the antimicrobial potency of the edible coating matrix. More research is need to establish the true potential of using bioactive peptides as part of edible coatings for food shelf-life extension

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