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Title : Effects of Persian acorn starch coating functionalized with CNC stabilized *Zataria multiflora* essential oil Pickering emulsion on the shelf-life of rainbow trout fillet

Summary:
This study aimed to evaluate the effect of Iranian acorn starch coating activated with Pickering emulsion of *Zataria multiflora* essential oil on the microbial, chemical, and sensory properties of rainbow trout fillets stored under refrigerated conditions. The chemical composition analysis of *Zataria multiflora* essential oil using gas chromatography–mass spectrometry (GC-MS) revealed that thymol (43.93%), p-cymene (13.27%), and carvacrol (9.67%) were the major components. The antioxidant activity of the essential oil, evaluated using DPPH and ABTS methods, showed significant and concentration-dependent antioxidant potential. The Pickering emulsion of the essential oil was prepared using cellulose nanocrystals, and its particle size and zeta potential were determined as 274.8 nm and −75.5 mV, respectively. Moreover, the antibacterial activity of the Pickering emulsion was stronger than that of the free essential oil, with *Staphylococcus aureus* showing the highest sensitivity. Rainbow trout fillets were prepared in four treatments: uncoated control, starch coating, starch coating with free essential oil, and starch coating with Pickering emulsion of essential oil. Overall, the acorn starch coating containing the Pickering emulsion of *Zataria multiflora* essential oil significantly ($P \leq 0.05$) reduced lipid oxidation (TBARS) and total volatile basic nitrogen (TVB-N) compared to the control treatment On day 9, TBARS was decreased to 1.04 mg/kg and TVB-N reduced to 11.9. Microbial analysis during 9 days of refrigerated storage showed that the starch coatings containing the Pickering emulsion led to a reduction of aerobic mesophilic bacteria by 2.52 log cycles, psychrotrophic bacteria by 2.69 log cycles, *Enterobacteriaceae* by 1.84 log cycles, and lactic acid bacteria by 1.6 log cycles compared to the control. In sensory evaluation, the acorn starch coating with the Pickering emulsion of *Zataria multiflora* essential oil received higher scores in terms of color, odor, texture, overall acceptability, and the color indices of L^* (lightness), a^* (redness), and b^* (yellowness) compared to other treatments. This study demonstrated that acorn starch coating activated with the Pickering emulsion of *Zataria multiflora* essential oil not only reduced the chemical changes and preserves the sensory quality of rainbow trout fillets but also effectively inhibited the growth of spoilage microorganisms. Therefore, it can be considered an effective and innovative strategy for the preservation of rainbow trout fillets.

Keywords: Acorn starch, Pickering emulsion, Essential oil, *Zataria multiflora***, Packaging, Rainbow trout, Cellulose**.