Title Natural antimicrobial chitosan-lysozyme composite packaging films and coatings for enhancing food safety and quality

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Abstract

Introduction: Antimicrobial enhanced packaging films and coatings have great potential for insuring safety of food surfaces through controlled release of antimicrobial substances from the carrier film structure to food surface. Chitosan has been well known for its excellent film-forming property, broad antimicrobial activity, and excellent compatibility with other substance. Inherent antimicrobial properties of chitosan and its high film forming and entrapping ability is the primary driving force in the development of new applications for this underutilized biopolymer. In this study, chitosan was used as a film forming polymeric matrix to incorporate hen egg white lysozyme for developing semi-permeable chitosan-lysozyme (CL) composite films and coatings and to evaluate their antimicrobial activities in food systems. **Materials and Methods:** CL solutions were prepared by incorporating 60% of lysozyme (dry weight of chitosan) into 3% chitosan solution. The solution was made into films or applied as coatings on Mozzarella cheese and hard boiled eggs. Cheese was inoculated with *L. monocytogenes*, *E. coli*, or *Pseudomonas fluorescens* at 104 CFU/g, or with mold and yeast at 102 CFU/g, and vacuum-packaged or coated with CL films. Hard-boiled eggs were coated with CL solution and challenged with *L. monocytogenes* or *Salmmonella enteritidis* at 104 CFU/g. Both cheese and eggs were stored at 10°C for monitoring the growth of bacteria and fungi. In addition, the same CL xolutions were stored at 10, 21 or 37°C up to 6 months for an accelerated shelf-life testing to evaluate physicochemical, antimicrobial and film forming properties. **Results and Discussion:** CL films enhanced the inhibitory activity of chitosan against both Gram-positive and Gram-negative microorganisms, thus broadening their applications in ensuring food quality and safety. Applying CL films and coatings effectively controlled post-processing microbial contaminants on Mozzarella cheese, and enhanced microbial safety and extended shelf-life of hard-boiled eggs by inhibiting the growth of bacteria and fungi. With storage at 10-20°C, pre-made CL solutions are stable and may be distributed as a commercial product for coating and/or film applications in different foods for at least 6 months.