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Nanoencapsulation and immobilization of cinnamaldehyde for developing antimicrobial food packaging material

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ABSTRACT

Use of antimicrobial coatings on food packaging is one of the important technologies of active packaging for improving food safety. There is growing demand for natural antimicrobials because of fear of adverse health effects of synthetic preservatives. The objectives of this study were to compare antibacterial properties of free and nanoencapsulated cinnamaldehyde in solution; polylactic acid (PLA) surfaces cast with cinnamaldehyde; and glass and PLA surfaces coated with cinnamaldehyde nano-liposomes. Cinnamaldehyde was nano-encapsulated by lipid bilayers of polydiacetylene – N-hydroxysuccinimide (PDA-NHS) nano liposomes and immobilized on glass slides and PLA films. Glass surfaces immobilized with nano-encapsulated cinnamaldehyde showed significant antibacterial activity against *Escherichia coli* W1485 and *Bacillus cereus* ATCC 14579, with reductions of 2.56 $\log_{10}$ CFU/ml and 1.59 $\log_{10}$ CFU/ml respectively in 48 hours. PLA films cast with cinnamaldehyde also showed significant antibacterial activities against *E. coli* W1485 (2.01 $\log_{10}$ CFU/ml reduction) and *B. cereus* (4.81 $\log_{10}$ CFU/ml reduction). However, when the liposomal encapsulated cinnamaldehyde was immobilized on PLA films, it did not show any antibacterial activity. Glass surfaces coated with nano-encapsulated cinnamaldehyde may be used as an active packaging material in preserving liquid foods; however, further study is required to improve antimicrobial activities of PLA surfaces.

Keywords: Antimicrobial coating; cinnamaldehyde; Polylactic acid film; nano-liposome encapsulation; food packaging.