Enhanced viability and improved *in situ* antibacterial activity of the probiotic LAB microencapsulated layer -by -layer in alginate beads coated with nisin

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Abstract

Enhancing the viability and improving antibacterial activity of probiotic lactic acid bacteria (LAB) using microencapsulation methods are essential for their food applications. In the present study, a layer-by-layer technique was used to prepare alginate-nisin (Alg-N) as coating layer to encapsulate a probiotic LAB isolate. The isolate was identified as *Pediococcus acidilactici* according to the sequencing results of the PCR products. The LAB isolate showed proper auto-aggregation (60.22%), hydrophobicity towards xylene (52.75%), co-aggregation with *Staphylococcus aureus* (55.62%), and antibacterial activity against *Escherichia coli* and *S. aureus* (62.63 and 53.75% inhibition, respectively). The mean size of Alg and Alg-N microcapsules ~~were~~ was also equal to 762.63 and 501.77 µm, respectively based on the results of field emission scanning electron microscopy. In accordance with the zeta potential data, the Alg-N surrounding layer was confirmed. Furthermore, the Fourier transform infrared findings revealed the adsorption of nisin on the Alg beads. The ~~N~~nisin adsorption rate on the produced microcapsules was also equal to 60.28% with the highest release rate ~~at~~ on the seventh day of incubation. The ~~A~~antibacterial activity of the produced microcapsule on *S. aureus* (100% inhibition) was significantly (P<0.05) higher than that of the other foodborne bacteria studied. In addition, enhanced viability of the microencapsulated LAB in simulated gastrointestinal conditions and flavored milk, as well as its improved *in situ* inhibitory effect on *S. aureus* were verified. Accordingly, Alg-N microcapsule can be used as a proper protective/preservative coating for food applications of the selected probiotic LAB.

Keywords: layer-by-layer, alginate-nisin coating, enhanced survival, *in situ* antibacterial.