

Preparation and Characterization of Different Multilayer Alginate Microcapsules

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Abstract

Introduction: Microencapsulation technology is a valuable technique for protection and delivery of materials which cannot be administered alone due to their low solubility, volatility and etc. A biopolymer alginate has been used most commonly as microcapsule forming material. In order to increase the mechanical stability and safety of alginate microcapsules, multilayered microcapsules are prepared. Alginate-poly L-lysine alginate, is the oldest multilayered microcapsule. Introducing another polycationic polymer which has similar properties to poly L-lysine (PLL) and also is much more cost effective, so it might be a valuable suggestion. The aim of this study was to compare linear (LPEI) and branched (BPEI) form of polyethylene imine, with the oldest and rather expensive one, PLL, and also, we have compared sodium cellulose sulfate (NCS) as an anionic layer with sodium alginate in outer layer of multilayered microcapsules to investigate the effect of different covering layers in microcapsule's cytotoxicity.

Methods and Results: In this study by using electrostatic bead generator different types of microcapsules, APA, ALA and ABA were produced. Shape, size, surface morphology, mechanical stability and cytotoxicity of microcapsules were evaluated using optical microscope, SEM, explosion test and MTT assay respectively. According to shape and size evaluation, multilayered microcapsules with different cationic layer concentrations (0.01, 0.03 and 0.06 W/V %) were spherical, with a diameter range of 500- 900 μm . SEM images showed uniform and smooth surfaces. Explosion test revealed that applying cationic solutions with 0.03% and 0.01% concentration resulted in higher mechanical stability for ALA and APA in comparison to ABA ($P < 0.05$), while mechanical strength induced by cationic solutions with 0.06% concentration were not statistically different in all three groups of microcapsules ($P > 0.05$). MTT assay on HepG2 cell line was performed using microcapsules ALA, ALN, APA and APN and showed no statistically significant difference in cell viability for the all types.

Conclusions: According to our results, LPEI as a covering layer for alginate microcapsules showed the same properties as PLL. Therefore it could be introduced as a cost effective alternative to PLL in fabrication of multilayered microcapsules.

Key words: Microencapsulation; Polyethylene imine; Poly L-lysine; Alginic acid