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Polymeric nanoparticle engineering: From temperature-responsive polymer mesoglobules to gene delivery systems

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A novel approach for the preparation of nano- and microcapsules in aqueous solutions by using thermo responsive polymer (TRP) templates (mesoglobules) is described. The method comprised three steps: Formation of mesoglobules, coating the templates by seeded radical copolymerization, followed by core dissolution and core removal upon cooling. When mesoglobule entraps bio-macromolecules during the process of their formation, it makes it possible to load a controlled amount of bioactive compounds without covalent attachment. Special attention is paid to the mesoglobule dissolution upon cooling, as well as their loading efficiency. Details on the outer shell formation and the possibilities for targeting ligands incorporation and control of the shell porosity are discussed. Finally, the seeded radical copolymerization was used for covering DNA complexes with cationic copolymers bearing TRP blocks. This review is an attempt to convince researchers of the promising perspectives for using mesoglobules as potential reservoirs, carriers, and transferring agents for biologically active substances.

Protein delivery system based on alginate microspheres produced using aerosolization technique

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Micro encapsulation of proteins in alginate microspheres was successfully produced using aerosolization technique. Insulin, ovalbumin and bovine serum albumin were used as model proteins with different molecular weight. The highest encapsulation efficiency and loadings was achieved by insulin-loaded alginate microspheres. An increase of protein molecular weight decreased encapsulation efficiency (from 50 to 32%) and protein loadings (from 51 to 3.3%). The lowest loading was BSA-loaded microspheres. Similar trend was found in case of microspheres size. Particle size reduced from 33 µm to 22.5 µm from microspheres encapsulated insulin to BSA. Dried morphology of microspheres revealed smoother spherical microspheres of BSA, ovalbumin and insulin respectively. Interestingly, *in vitro* release showed that alginate microspheres prevented release of insulin when incubated in HCl for 2h, followed by slower release of BSA (5%) and ovalbumin (40%). Complete release of 100% insulin, BSA and ovalbumin occurred after 8h, 14h and 15h incubation in PBS pH 7.4. The aerosolization technique demonstrated the potential of alginate microspheres for oral delivery of protein therapeutics.

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