Polymeric biomaterials based on k-carrageenan for biomedical engineering applications

PhD. Student Cristina-Elena Constantin (Stavarache)

PhD. Advisor Prof. Horia IOVU

Abstract

The thesis entitled “Polymeric biomaterials based on k-carrageenan for applications in biomedical engineering” presents the development of k-carrageenan based materials by approaching two research directions, 1) for the development of systems for the encapsulation and controlled release of active substances with therapeutic activity and 2) for the manufacture of scaffolds by 3D printing of polysaccharides inks for biomedical applications.

During this doctoral thesis, polysaccharide-based interpenetrating network beads obtain by ionotropic gelation of k-carrageenan and sodium alginate were designed for the encapsulation of ketoprofen, to ensure an improved drug release. The characterization of beads was assessed to determine encapsulation efficiency and drug release profile. Moreover, the development of core-shell systems was studied for the release of the drug, 5-aminosalicylic acid (5ASA) in the colon, by coating hydrogel particles based on chitosan crosslinked with sodium tripolyphosphate, with a layer of kCG using the electrostatic interaction between the two biopolymers in order for these systems to release the drug in the intestinal environment.

Also, this research reports the development of a polysaccharide formulation based on k-carrageenan and sodium alginate in order to produce a novel scaffold for engineering applications and the characterization of the obtained 3D specimens. Furthermore, using the extrusion-based 3D printing technique, 3D printed scaffolds were obtain by extruding the developed ternary mixture composed of alginate, k-carrageenan and carboxymethyl cellulose. These structures based on the ternary ink were characterized. The incorporation and release of vitamin B1 into and from the novel printed ternary structures was evaluated.