PhD. Thesis Title

Nanoparticles for medical applications

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Abstract

Biomaterials are designed to interact with biological systems for medical purposes, either as part of a medical device or as part of a biological system. An ideal biomaterial should be bioactive, biocompatible, non-toxic, non-corrosive, bioinert, bioadaptable and sterilizable. From this perspective, polymeric nanoparticles are a very good choice for making biomaterial-based dressings that can be used in various dermatologic conditions.

Polymeric nanoparticles are obtained from both natural and synthetic polymers and have applications in particular in medicine, due to their versatility and their potential to target the delivery of active substances in drugs. It has been observed that these nanoparticles accumulate in hair follicles and penetrate the skin. They also confer stability to the active substance, reducing the risks of degradation products, which can have toxic effects after administration. In addition, these nanoparticles have a core-shell structure, with different active substances encapsulated in the core, and the shell can provide both stability and control on drug release.

The natural polymers used to make nanoparticles that have applications in dermatology are chitosan, alginate, collagen, cellulose, starch and gelatin because they are considered to be non-toxic and biodegradable. These biopolymers have the advantage that they can encapsulate a wide range of active substances, from small molecules to proteins and nucleic acids, and that they can be functionalized by chemical reactions, which improve their therapeutic properties. Among these polymeric biomaterials the most widely used are chitosan and alginate.

From this perspective, this PhD thesis aimed to synthesize state-of-the-art nanoparticles with improved performance in various medical applications, and its objectives were i) synthesis of ZnO nanoparticles by microwave-assisted hydrothermal method, ii) development of composites based on sodium alginate, salicylic acid and zinc oxide nanoparticles and iii) obtaining antimicrobial textiles for medical applications.

Keywords: hydrothermal maturation in a microwave field method, spin-coating, zinc oxide nanoparticles, sodium alginate, salicylic acid, cotton, antimicrobial activity