Chitosan modifications: strategies and applications

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Natural occurring polymers are materials that have attracted considerable attention, as they are renewable and eco-friendly systems. Recently, with the aim to find substitutes for oil based conventional plastics, many efforts have been directed to improve the biopolymers applicability. Polysaccharides from vegetable or animal sources have been indicated to be promising alternative materials. Chitosan is the most studied polysaccharide due to its biocompatibility and biodegradability as well as its peculiar physico-chemical characteristics [1]. Chitosan, obtained from chitin deacetylation, has hydroxyl and amine groups responsible for properties such as antimicrobial and antioxidant activity, no toxicity and good chelating ability vs metal ions. Moreover, such functional groups are considered extremely important for chemical modification of the biopolymer aimed at improving the performance of the final material. In addition, low cost and easy processability make chitosan an extremely interesting material to satisfy the requirements of several application fields like tissue engineering, drug delivery, food packaging and waste removal [2]. Since chitosan suffers for low stability in aqueous media as well as poor mechanical properties, its chemical or physical modification is frequently used to improve its properties. At this regard, many strategies can be adopted to supply to abovementioned drawbacks. The most used procedures involve the formation of polyelectrolytic complexes, the use of chemical or physical crosslinking agents or the preparation of composite materials obtained by using nanometric filler [3]. The study of a proper procedure for chitosan modification is of pivotal importance since it should be modulated according to the specific application. Therefore, the present seminar will be focused on the optimization of different approaches used during my PhD experimental work in the chitosan modification to produce scaffolds and membranes for tissue engineering and environmental applications. Specifically, it will be analysed the influence of several parameters, such as polymer concentration, type, and amount of crosslinker/filler as well as preparation procedure, on fundamental properties like porosity, swelling ability, mechanical performance, and biocompatibility of the prepared materials.

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