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Modification of chitosan by different plasmas

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Chitosan is biocompatible and biodegradable polymer prepared by partial N-deacetylation of chitin. The polymer is widely studied as a material for a number of medical applications such as wound dressing, separation membrane, matrices for immobilization of enzymes and cells, drug delivery and genetic engineering. Its surface properties play a key role in practical applications because the surface contacts with human body. Therefore, modification of the polymer surface with different techniques is used in order to alter surface properties. Chemical treatment is used to modify bulk properties, while plasma treatment is more favorable to control surface ones. Advantage of plasma treatment is a possibility to change physical and chemical properties of a very thin layer at a depth of tens nanometers, while bulk properties are intact. However, to our knowledge, a detailed study of positive influence of plasma treatment on surface properties of chitosan is a future prospect. Therefore, the aim of this work to study chemical composition and physical properties of chitosan surface treated with several kind of plasma discharge in vacuum. The surface was treated by flow of partially ionized N₂ and O₂ gas mixture prepared in glow discharge (1) in crossed electric and magnetic field, (2) in RF-diode system and (3) in RF-plasma reactor. Chitosan films with molecular mass of 120 and 500 kDa were used. The mass range characterized the best antimicrobial properties related to most of pathogenous microorganisms. XPS and AFM measurements were carried out to evaluate the degree of chemical and physical modification of the chitosan surfaces, while contact angle measurements were used for calculation of surface energy and its polar and dispersive components both on polymer/air and polymer/water interfaces.

Keywords

chitosan films
surface
plasma
XPS, AFM
topology