PLASMA PROCESSING OF POLYPYRROLE-HEPARIN THIN FILMS ON TITANIUM SUBSTRATES FOR BIOMEDICAL APPLICATIONS

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Many structural materials have been placed in the live body in attempt to aid the body in repairing processes of diseases. The predominantly used materials in the treatment of various diseases have been and still are metals and polymers. The materials that can function intimately with the living cells tissue, with minimal adverse reaction, must be manufactured as multiple metallic or nonmetallic phases.

Titanium and its alloys are considered to be the most attractive metallic materials for biomedical applications because of their excellent mechanical properties, corrosion resistance and biocompatibility [1]. In recent years, many methods have been applied to improve the biocompatibility and biofunctionality of titanium-based implants.

Conducting polymers such as polypyrrole (PPy) offer a new class of material for trial use in biological applications. PPy has been chosen as coating polymer to protect the metal implant against corrosion and could be surface modified with biologically active molecules able to stimulate positive interactions with bone tissue [2, 3]. Surface modification of these materials with biological moieties is desired to enhance the biomaterial-tissue interface and to promote desired tissue responses. Heparin (HE) is a potent anticoagulant that can be immobilized on biomaterial surfaces to increase their hemocompatibility.

Many ingenious and useful techniques have been evolved for modifying the surface structure, while keeping the bulk structure unchanged. The plasma polymerization is the process mostly used for the deposition of thin polymer and polymer-based composite films with a variable amount of functionalities available for reaction with biomolecules [1, 4, 5].

In this context, the strategy followed was based on a plasma deposition of PPy and PPy-HE films onto Ti substrate. Heparin was immobilized on/in the PPy films using plasma processing. Heparin was chosen because it is a component of the extracellular matrix of blood vessels and has anticoagulant properties.

The chemical composition and the morphology of the polymeric films PPy and Ppy-HE films deposited onto Ti substrate were investigated using Fourier transform infrared (FT-IR), Raman spectroscopy and atomic force microscopy (AFM). Results showed that HE was incorporated into the PPy matrix and is presented on particle surface.

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