Heparin Immobilization onto Plasma Modified Polyethylene Terephthalate to Improve Blood Compatibility

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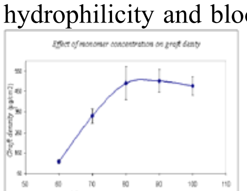
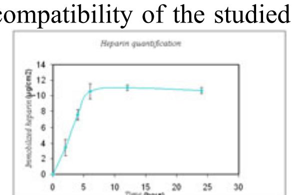
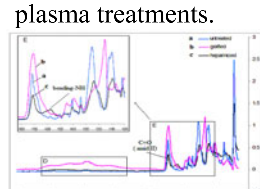
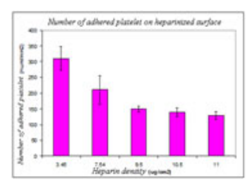
Polymeric materials have been attracted many R&D attentions to be used in biomedical applications such as blood-contacting devices. Attempts were made to evaluate the changes in heamocompatibility properties of poly ethylene terephthalate surface by grafting acrylic acid(AAc) and immobilizing heparin on PET surface through two step plasma treatments for the first time. PET surface was modified by using a new method namely "two-step plasma treatments" (TSPT). In the first step, the films were pre-treated with low temperature glow discharge oxygen plasma and immersed into the aqueous monomer solution of AAc. The second step was carried out by plasma polymerizing of pre-adsorbed reactive monomer on the surfaces of dried pre-treated films. Finally, heparin immobilization was performed in the presence of 1-ethyl-3-(dimethylaminopropyl) carbodiimide. All films were characterized by attenuated total reflection Furrier transformer infrared (ATR-FTIR) spectroscopy and scanning electron microscopy (SEM). Roughness of the hydrogel and heparinized layers in wet state were measured by atomic force microscopy (AFM). The surface hydrophilicity and blood compatibility of the studied films were evaluated on the basis of water contact angle and platelet adhesion measurements (LDH Test).

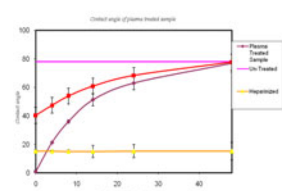
The AFM results showed that the heparin formed a uniform layer onto the PET with comparatively high level of anti-thrombin-binding capacity. The results of measuring water contact angle show that surfaces became very hydrophilic after the subsequent immobilization of heparin via the carbodi-imide chemistry. In vitro studies by LDH method showed that platelet adhesion onto modified surfaces with heparin was drastically reduced in comparison with un-modified PET. The modified PET surface demonstrated significant improvement on anticoagulation activities of human blood in comparison with un-treated PET. Based upon *LDH* data the amount of platelet adhering on the heparin-immobilized films decreased significantly in comparison with AAc-grafted-PET and un-treated PET. These results prove that the hydrophilicity and hemocompatibility of PET films could be effectively improved by immobilizing the heparin biomacromolecule on the surface using two step plasma treatments.

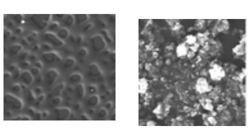




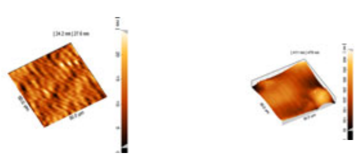








SEM of PET-g- AAc (Left), PET-g-AAc- Immobilized –Heparin(Right)



AFM of PET-g- AAc (Left), PET-g-AAc- Immobilized –Heparin(Right)

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