7th International Workshop on Plasma-Based Ion Implantation Program and Abstracts

San Antonio, Texas, USA
September 16-19, 2003
Bacterial Repellence from Polyethylene Terephthalate Surface Modified by C\textsubscript{2}H\textsubscript{2} Plasma Immersion Ion Implantation

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There is an increasing interest in developing new methods to reduce bacterial adhesion onto polymeric materials that are used biomedical implant. The antibacterial adsorption behavior on polyethylene terephthalate (PET) treated by plasma immersion ion implantation (PIII) using C\textsubscript{2}H\textsubscript{2} is investigated. The surface structure of the treated PET is determined by laser Raman spectroscopy, X-ray photoelectron spectroscopy (XPS) and attenuated total reflection Fourier transform infrared spectroscopy (ATR-FTIR). The results show that a thin hydrogenated amorphous carbon (a-C:H) layer has been formed on the PET surface. The surface free energy measured using the static contact angle technique reveals that amorphous carbon deposition transforms the initially hydrophobic surfaces into more hydrophilic ones. The capacities of Staphylococcus aureus (SA) and Staphylococcus epidermidis (SE) for adhesion to PET were quantitatively determined by the plate counting and Gamma-ray counting of 125I radio labeled bacteria in vitro. The results indicate that the adhesion of the two bacteria to PET were all suppressed by PIII. The adhesion efficiency of SA on the coated surface was about 1/10 that on the untreated PET surface, and that of SE is about 25% of that of the virgin surface. Scanning electron microscopy (SEM) indicates a significantly greater number of SE adhering to amorphous carbon surface compared to the original PET. The reduction in bacterial adhesion can be explained by the DLVO theory. Because of the reduced attractive force that includes the hydrophobic effect and hydrogen bonding between the bacteria and modified substrate, the total interaction decreases and bacterial adhesion is consequently mitigated. This study suggests one possible method to repel bacteria from polymeric surfaces.