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Bacterial Repellence from Polyethylene Terephthalate Surface Modified by Acetylene Plasma Immersion Ion Implantation – Deposition

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There is an increasing interest in developing new methods to reduce bacterial adhesion onto polymeric materials used in biomedical implants. The antibacterial adsorption behavior on PET treated by PIII-D using acetylene at different working pressures is investigated. The surface structure of the treated PET is determined by RBS, laser Raman spectroscopy, and XPS. The results show the formation of thin hydrogenated amorphous carbon (a-C:H) films with different structures and chemical bonds on the PET surface. The ability of Staphylococcus aureus (SA) and Staphylococcus epidermidis (SE) to adhere to PET is quantitatively determined by plate counting and Gamma-ray counting of the 125I labeled bacteria in vitro. The adhesion efficiency of SA on the a-C:H film deposited is about 16% of that on the untreated PET surface, and the adhered bacterial concentration of SE on the carbon film deposited is about 1/6 of that of the PET surface. The reduction in bacterial adhesion can be explained by the free energy of adhesion which predicts whether microbial adhesion is energetically favorable or not. Our results show that bacterial adhesion is energetically unfavorable on the a-C:H films deposited at 0.5 and 1.0 Pa and this study suggests one possible method to repel bacteria from polymeric surfaces.