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Bactericidal efficiency of titanium plates treated with silver by low energy ion implantationCesar Aguzzoli¹, T.P. Soares¹, A. Lambrey², C.A. Figueroa¹, M. Giovanela¹¹University of Caxias do Sul, Caxias do Sul, Brazil ²École Européene d'Ingénieurs en Génie des Matériaux, Université de Lorraine, Nancy, France

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Titanium is being used at the moment for biomedical applications such as prosthesis, implants or other medical tools because of its mechanical properties (low density, high mechanical strength and fatigue resistance and good wear resistance) and because of its biocompatibility (biologically inert and corrosion resistant). However, dangerous and numerous problems of infections have been reported, which lead to implant removal. Those infections are due to bacterial biofilm formation on the implant surface, which once formed, cannot be removed by antibiotics action. To prevent biofilm formation, an intrinsic solution against bacteria settlement must be placed within the implant. Silver could be a good candidate, since it is already known and used as an antibacterial agent and is not toxic for human cells at very low concentrations. Its antibacterial properties are long lasting and attributed to the release of silver ions. To introduce silver in titanium plates the method chosen was low energy ion implantation (- 4 keV). Two sets of parameters were used, varying treatment time. These samples were characterized by RBS, GD-OES to quantify the content of silver (6×10^{15} atoms.cm⁻²) and determinate the profile of the elements in the samples. And then, samples were introduced in contact with industrial waste effluent for different period of time from 10 min to 4 h, and the initial and final bacteria concentrations were calculated with 3M[®] Petrifilm E. coli Count Plate. The results showed for all the samples a bacterial expansion in the first 10 to 60 min, possibly related to the ion release delay, before observing the antibacterial effect of silver. Samples treated for a longer time started their antibacterial action earlier than the ones treated for a shorter time, most probably because of their higher silver particles concentration. With the results, we can infer about the potentiality of this technique, which can be use in industrial treatments in large scale.

Keywords

Silver implanted

Antimicrobial action

Titanium surface modification