Prevention of bacterial adhesion onto electrospun fibroporous poly(carbonate) urethane membrane by embedding Graphene oxide

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Abstract

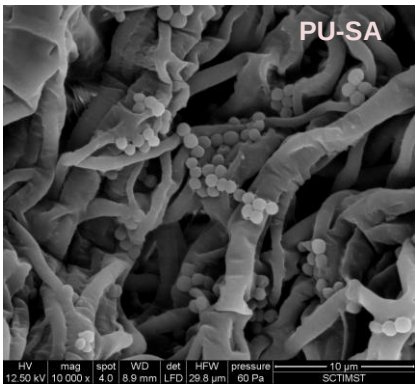
Functional restoration of human body is assisted by implantation of long term simple or sophisticated medical devices which closely involves use of biomaterials. Biomaterials, in such a scenario attract lots of bacteria which colonize and infect the surrounding healthy tissue leading to severe failure and rejection of the device. Bacterial infection starts with adherence of bacteria to biomaterial device surfaces either from pre-operative or post operative environment and formation of biofilm [1]. Solution to this problem lies in the development of coatings and materials which dissuade bacteria from attaching to these surfaces. Polyurethane based elastomeric membranes have found widely acclaimed usage as implants in biomedical applications but doesn't have any mechanism to ward off a bacterial invasion. To bring out such a defense mechanism we are adopting surface modification. GO (Graphene Oxide) was embedded onto the electrospun fibroporous polycarbonate urethane membrane by a simple method of electrospraying. The study represents our findings on antibacterial activity and efficiency of the method developed.

Various tools like SEM, contact angle, Raman spectra and mapping, and techniques like bacterial adhesion study have been done to support the data. Bacterial adhesion study on modified surface (GPU) and unmodified surface (PU) against *Staphylococcus aureus* (Gram positive, cocci) (SA) showed a reduction in 85% adhesion while a 64% reduction was seen against *Pseudomonas aeruginosa* (Gram negative, bacilli) (PA). SEM micrographs show the attachment of bacteria to the fibroporous membrane. On GPU, contact angle got reduced from 121.5°±1.5° to 92.5°± 4.2° making the surface slightly hydrophilic while Raman spectra and mapping showed the distribution of GO over the membrane surface.

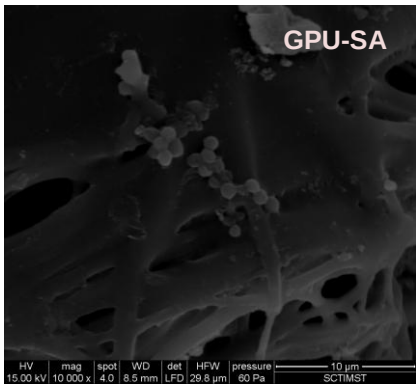
References

1. Busscher, Henk J., Henny C. van der Mei, Guruprakash Subbiahdoss, Paul C. Jutte, Jan JAM van den Dungen, Sebastian AJ Zaat, Marcus J. Schultz, and David W. Grainger. Science translational medicine, 153 (2012), 153rv10 (1-10).

Figures



SEM micrograph of SA attached to PU



SEM micrograph of SA attached to GPU