Exploring Graphene for Biomedical Applications: a strong ally for hydrogels and a sharp enemy for bacteria

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Abstract

Thrombosis and infection are the major problems associated with blood contact devices. Making use of graphene based materials (GBMs) outstanding mechanical strength and high area/thickness ratio, and by playing with GBM thickness, lateral size and oxidation degree, it is possible to design novel biomaterials with antibacterial, bio/hemocompatible and mechanically suitable properties. We have explored different conjugations of GBMs, polymers/matrices and production techniques according to the desired application [1]. GBM-containing biomaterials were designed towards two main biomedical applications: i) as antimicrobial composites and coatings for dialysis catheters [2-5]; and ii) mechanically reinforced hydrogels for vascular grafts [6]. Results highlight the importance of GBM exposure on the surface of the biomaterials in order to exert antimicrobial properties, with oxidized GBMs presenting better performance. The oxidation degree also seems to be a detrimental factor in the mechanical reinforcement of hydrogels. Poly(2-hydroxyethyl methacrylate) (pHEMA)/ graphene oxide composites stand out as biomaterial with antibacterial and anti-thrombogenic properties, revealing huge potential for load-bearing applications, including blood contact devices.

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