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Chitosan hydrogel based nanocomposite system with self-healing ability: Films and patches

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Introduction & Aim: Bio-polymeric hydrogel system prepared from chitosan cross-linked with glycerol possesses the self-healing ability, which enables this fantastic hydrogel material to form smooth films or coating. By successful utilization of this self-healing ability possessed by this hydrogel material we have fabricated different types of nanocomposite hybrid biomaterials.

Methods: In the first approach chitosan nanocomposite hydrogel was fabricated by using Carbon dots (CDs) synthesized from commercially available Assam CTC tea. Then a composite nanomaterial was also synthesized by coating the surface of graphene oxide by the iron oxide nanoparticle and this composite nanomaterial was used to fabricate chitosan-iron oxide coated graphene oxide nanocomposite hydrogel films. This chitosan based hydrogel system was also used to fabricate a kind of super absorbent patch using cotton wool. We also modified the patch by incorporating graphene oxide (GO) into this hydrogel system. The films and the patches were fabricated by gel casting technique and by the compression molding technique, respectively.

Results & Conclusion: The films obtained from chitosan-CDs nanocomposite hydrogel system showed UV-blocking ability along with the improved mechanical and thermal property. Chitosan-iron oxide coated graphene oxide nanocomposite hydrogel films are robust along with another interesting property, the antimicrobial activity. Cotton based patches after loading GO showed antimicrobial activity as well as efficient wound healing ability when tested in animal model and thus can serve as a bandage material. The main advantage of such patches is that any type of chemicals, drugs, nano or micro particles can be loaded in it as per requirement. Since chitosan is a bio-polymer having the inherent property of biodegradability and biocompatibility, so such type of films and patches fabricated from chitosan based hydrogel system may find high potential application in the bio-medical as well as food packaging industry. The patches may have application in the textile industry as well.

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