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A novel robust hemostatic bandage based on mineral particles/graphene oxide-polymeric biomaterials

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Blood loss is one of the most significant challenges nowadays during accidents, surgery, and military war. Excessive blood loss leads to shock, organ failure, and death and requires immediate medical attention. Usually, when immediate medical attention is not available, using hemostatic bandages can help control bleeding and buy time until more advanced medical treatment is available. These bandages are designed to stop bleeding rapidly by promoting blood clotting and can be applied directly to the wound. On the other hand, in military settings, where injuries may be more severe, and medical resources may be limited, soldiers are often trained to use hemostatic bandages to control bleeding. In this context, the present study describes the synthesis of economical polymer (polyvinyl alcohol/silk fibroin)-mineral-metal (hydroxyapatite)/carbon (graphene oxide) based hemostatic bandage to control blood loss. For this, we synthesized silk fibroin, polyvinyl alcohol, hydroxyapatite, and graphene oxide, separately. The polyvinyl alcohol is synthesized by polyvinyl acetate via the esterification process. The prepared graphene oxide and hydroxyapatite were mixed at the time of gelation of polyvinyl alcohol. Next, SF solution was integrated into the prepared polyvinyl alcohol-graphene oxide and hydroxyapatite solution and cast on Petri dishes to produce a polyvinyl alcohol-silk fibroin-mineral-metal-carbon based hemostatic bandage. The results suggested that the prepared has high absorption ability (1040 %), hemolysis (2.38 %), platelets aggregation (35 %), protein loading (30 mg/cm2), and 89 % blood clot within 15 s. Moreover, biomaterials considerably enhanced the number of fibroblast cells with high biocompatibility and controlled blood loss. The method of synthesizing biomaterials in the present study is novel, simplistic, and economically feasible.

Recent Publications

1. Neetu Talreja, Divya Chauhan, Mohammad Ashfaq, Photo-antibacterial activity of two-dimensional (2D) based hybrid materials: Effective treatment strategy for controlling bacterial infection. Antibiotics. 2023. (Accepted).

2. Mohammad Ashfaq, Neetu Talreja, Neha Singh, Divya Chauhan, 2D-Nanolayer (2D-NL)-Based Hybrid Materials: A Next-Generation Material for Dye-Sensitized Solar Cells. Electronics. 2023. 12(3). 570.

3. Neetu Talreja, Mohammad Ashfaq, Divya Chauhan, RV Mangalaraja, Cu-MXene: A potential biocide for the next-generation biomedical application. Material Chemistry Physics. 2023. 127029.

Biography

Mohammad Ashfaq works as Assistant Professor at Chandigarh University, Mohali, Punjab, India. Ha has completed a PhD in Biotechnology with the Indian Institute of Technology, Kanpur, India and Banasthali University, Banasthali, India. Before joining Chandigarh University, Mohali, Punjab, India. He worked as an Assistant Professor at BS Abdur Rahman Institute of Science and Technology, Chennai, India, as a Researcher at the University of La Serena, Chile, University of Concepcion, Chile, and Post-Doctoral-Researcher in Polymer Microneedle Lab, School of Materials Science and Engineering, Beijing University of Chemical Technology, Beijing, China.

Ashfaq focuses mainly on interdisciplinary research involving nanomaterials and biological sciences, such as synthesis, characterization, and applications of nanomaterials/carbon nanofibers and polymeric composite-based materials. His area of interest consists of nanotechnology, nano-bioscience, biomedical applications of polymeric composite/nanotechnology (newer antibiotics and novel wound dressing materials), nano-cytotoxicity, biosensors, controlled release drug delivery systems (polymeric microneedles), nanoparticle systems of metals and metal oxides and its interaction of plants and animal cells. During his research tenure, he has published more than 40 research articles, 29 book chapters and 5 patents (filed).

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