World Academy of Science, Engineering and Technology
International Journal of Materials and Textile Engineering
Vol:13, No:03, 2019

Keratin Fiber Fabrication from Biowaste for Biomedical Application

Authors : Ashmita Mukherjee, Yogesh Harishchandra Kabutare, Suritra Bandyopadhyay, Paulomi Ghosh

Abstract : Uncontrolled bleeding in the battlefield and the operation rooms can lead to serious injuries, trauma and even be lethal. Keratin was reported to be a haemostatic material which rapidly activates thrombin followed by activation of fibrinogen leading to the formation of insoluble fibrin. Also platelets, the main initiator of haemostasis are reported to adhere to keratin. However, the major limitation of pure keratin as a biomaterial is its poor physical property and corresponding low mechanical strength. To overcome this problem, keratin was cross-linked with alginate to increase its mechanical stability. In our study, Keratin extracted from feather waste showed yield of 80.5% and protein content of 8.05 ± 0.43 mg/mL (n=3). FTIR and CD spectroscopy confirmed the presence of the essential functional groups and preservation of the secondary structures of keratin. The keratin was then cross-linked with alginate to make a dope. The dope was used to draw fibers of desired diameters in a suitable coagulation bath using a customized wet spinning setup. The resultant morphology of keratin fibers was observed under a brightfield microscope. The FT-IR analysis implied that there was a presence of both keratin and alginate peaks in the fibers. The cross-linking was confirmed in the keratin alginate fibers by a shift of the amide A and amide B peaks towards the right and disappearance of the peak for N-H stretching (1534.68 cm-1). Blood was drawn in citrate vacutainers for whole blood clotting test and blood clotting kinetics, which showed that the keratin fibers could accelerate blood coagulation compared to that of alginate fibers and tissue culture plate. Additionally, cross-linked keratin-alginate fiber was found to have lower haemolytic potential compared to alginate fiber. Thus, keratin cross-linked fibers can have potential applications to combat unrestrained bleeding.

Keywords : biomaterial, biowaste, fiber, keratin
Conference Title : ICBNF 2019 : International Conference on Biomaterials and Natural Fibers
Conference Location : Singapore, Singapore
Conference Dates : March 28-29, 2019