Antimicrobial Biomaterials of Natural Origin and their Biomedical Applications

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Abstract

Natural Polymers have the potential to be used in a variety of biomedical applications due to their excellent biocompatibility, varied mechanical properties and sustainable resourcing. There are a distinct class of natural polymers that are produced by controlled bacterial fermentation including Polyhydroxyalkanoates (PHAs), Bacterial cellulose (BC), γ-Polyglutamate (γ-PGA) and Alginate. The added advantage of this class of natural polymers include the highly controlled production conditions resulting in repeatable properties.

PHAs are polymers of 3,4,5 and 6-hydroxyalkanoic acids produced by bacteria, mainly under nutrient limiting conditions. In this work we have modified PHAs with various natural antibacterial agents and active factors. In addition, a naturally antibacterial class of PHAs, thio-PHAs have also been produced. All of these polymers have been characterised with respect to their antibacterial activity against *Staphylococcus aureus* ATCC 6538 and *Escherichia coli* ATCC 8739 following ISO22916. These antibacterial polymers have been used for the development of tissue engineering scaffolds and medical devices.

BC is produced by several bacteria including *Gluconacetobacter xylinus* and has an inherent hydrogel-like structure. In this work the surface of cellulose has been functionalized to produce antibacterial BC. The cytotoxicity evaluation using HaCaT cells confirmed cytocompatibility for both modified and unmodified BC.

Biography

Professor Ipsita Roy is an expert in microbial biotechnology, natural biomaterials and their biomedical applications. She is currently a Professor at the Department of Materials Science and Engineering, Faculty of Engineering, University of Sheffield, UK. Professor Roy obtained her Ph.D. at the University of Cambridge and her postdoctoral work was at the University of Minnesota, USA. Subsequently, Professor Roy taught at Indian Institute of Technology, India, and University of Westminster, London, UK. Professor Roy has published over 100 papers in high 'Impact Factor' journals such as Biomaterials, Acta Biomaterialia and ACS Applied Materials Interfaces and has presented her work at numerous international conferences. Her group is currently focussed on the production of novel polyhydroxyalkanoates (PHAs), a group of FDA-approved natural polymers, their characterisation and application in hard/soft tissue engineering, wound healing and drug delivery. She is an editor of the Journal of Chemical Technology and Biotechnology (JCTB). Professor Roy has a total grant portfolio of 8.9 million pounds and has been the scientific coordinator of two large EU projects REBIOSTENT and HYMEDPOLY.