Non-Thermal Plasma Technology for Infection and Biofilm Control in Hospitals

Published date: April 5, 2016

Technology description

The burden of healthcare associated infections (HCAIs) is estimated to cost the NHS £1 bn per annum, while the emergence of antibiotic resistant bacterial pathogens, including Pseudomonas aeruginosa, MRSA, VRE and Clostridium difficile, threatens the dwindling supply of effective antibiotics and microbicides available to fight these infections. This project aims to develop an emerging technology, atmospheric pressure, non-thermal plasma (APNTP) for clinical applications in controlling biofilms and infections in hospitals.

Plasma medicine is an emerging field of research which has been gaining an ever increasing interest by researchers from a wide range of disciplines in the last decade. Plasma medicine involves the utilisation of gas plasma, specifically near room temperature atmospheric pressure non-thermal plasma (APNTP), in a variety of medical applications including surface decontamination and sterilisation. APNTP has proven to be an effective antimicrobial approach against bacteria in both planktonic and highly resistant biofilm modes of growth. We have previously evaluated the in vitro activity of APNTP against a set of clinically significant bacterial strains in both planktonic and biofilm cultures, including Pseudomonas aeruginosa. Furthermore, the interactions between non-thermal plasma and various cellular components, i.e. DNA, lipids and proteins, have also been examined, giving us clear insights into the mechanism of action. These experiments indicate that the plasma jet produces a range of antimicrobial reactive species which target multiple cellular components, decreasing the risk of bacterial resistance development.

This project seeks to develop, in collaboration with clinical colleagues and government agencies, an optimised hand-held plasma source for contamination, infection and biofilm control in the hospital environment. Development of this device will lead to evaluation of the technology in the clinic, on hard surfaces such as taps and sinks. It is envisaged that ultimately this will lead to applications such as control of chronically infected, non-healing wounds such as bed sores, diabetic ulcers and cavity wounds. The biocidal agents generated in situ are not subject to current EU biocidal products directives. Thus, the project seeks to develop a prototype with enhanced portability, efficacy and preliminary clinical evaluation, to ensure the translational potential of this technology is extremely high.

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