Abstract #110793

(Invited) Atmospheric Pressure Plasma and Depositions of Antibacterial Coatings

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Abstract Text:

Healthcare-associated infections (HCAI) are complications of healthcare that result in elevated patient morbidity and mortality. HCAI present a huge financial burden for patients, hospitals and insurers due to extended hospitalisation and associated care. According to the estimations, in the US alone, HCAI affects approximately 2 million patients annually, of whom approximately 90.000 patients die, with an estimated annual cost estimated to range from 28 billion to 45 billion US$. [1] European Union is facing the similar situation, the European Centre for Disease Prevention and control (ECDC) advice that approximately 4.1 million acute care patients acquire a HCAI annually, with 37.000 deaths directly attributed to HCAI. With increasing prevalence of HCAI across European countries and threatening development of antimicrobial resistance to widely used antibiotics, there is a recognised need for novel approach in battle against this healthcare burden [2]. One of the approaches involves a development and fabrication of materials with antimicrobial properties. Usually, these are coatings with integrated antibacterial agent that is responsible for the elimination of microorganisms that come into contact with active surface. There is a variety of different antibacterial compounds integrated in such coatings, such as different antibiotics, chemical compounds, peptides. Recently, metal nanoparticles (NPs) have been increasingly used in designing coatings with antibacterial properties due to their large surface-to-volume ration, physiochemical properties and biological multi-target mechanism of actions. Besides all beneficial properties of NPs their emergence of cytotoxicity is limiting their practical applications in human body. [3-4] To overcome this drawback it is important to design a new class of antibacterial coatings with firmly embedded NPs that allows controlled release of antimicrobial agent into the microenvironment. Atmospheric pressure plasma technology has shown a big promise as an alternative and cost-efficient method for deposition of coatings with antibacterial properties.

This contribution explores the potential of plasma-assisted approach for fabrication of antibacterial coatings, containing different metal NPs on medical textiles. Plasma-assisted deposition of coatings was carried out with so-called ˝sandwich technique˝, where nanoparticles were embedded between two layers in order to tailor the desirable ion release and to prolong antibacterial effect of fabrics. Antibacterial effects of different nano-coatings were tested against G+ and G- bacterial species, *Staphylococcus aureus* and *Escherichia coli*, respectively. Besides antibacterial properties, potential cytotoxic effects were also studied. The study demonstrates that atmospheric pressure plasma can be an efficient technique for deposition of antibacterial coatings containing metal NPs. Medical textiles with plasma-assisted nano-coatings showed effective antibacterial properties. The choice of proper metal antimicrobial agent and optimal concentration of NPs should be considered in regards to potential cytotoxic effects when these materials would be used in medical environments.

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[4] Rai M, Yadav A, Gade A. *Biotechnol Adv.*, **27**(1), 76-83 (2009).

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