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Durable contact active antimicrobial materials formed by a one-step covalent modification of polyvinyl alcohol, cellulose and glass surfaces

Elena Poverenov [1], Moshe Shemesh, Antonino Gulino, Domenico A Cristaldi, Varda Zakin, Tatiana Yefremov, Rina Granit

Affiliations

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Abstract

In this work we have applied a direct covalent linkage of quaternary ammonium salts (QAS) to prepare a series of contact active antimicrobial surfaces based on widely utilized materials. Formation of antimicrobial polyvinyl alcohol (PVA-QAS), cellulose (cellulose-QAS) and glass (glass-QAS) surfaces was achieved by one step synthesis with no auxiliary linkers. The X-ray photoelectron spectroscopy (XPS) revealed tridentate binding mode of the antimicrobial agent. The antimicrobial activity of the prepared materials was tested on Bacillus cereus, Alicyclobacillus acidoterrestris, Escherichia coli and Pseudomonas aeruginosa. Active site density of the modified materials was examined and found to correlate with their antimicrobial activity. Stability studies at different pH values and temperatures confirmed that the linkage of the bioactive moiety to the surface is robust and resistant to a range of pH and temperatures. Prolonged long-term effectiveness of the contact active materials was demonstrated by their repeated usage, without loss of the antimicrobial efficacy.

Keywords: Antimicrobial materials; Contact active surfaces; Covalent linkage; Quaternary ammonium salt; X-ray photoelectron spectroscopy.

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