Quaternary ammonium salts in healthcare - antimicrobial activity of newly synthesized cationic surfactants

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With the increasing antibiotic resistance among clinically significant strains such as *Staphylococcus epidermidis*, *Pseudomonas aeruginosa*, and *Candida albicans*, the search for alternative substances has become crucial. Quaternary ammonium salts (QAS) as cationic surfactants exhibit biological activity, providing antibacterial properties. The presented results come from studies of QAS groups with varying chemical structures (two gemini QAS and one multifunctional) in terms of activity. Initially, the ability to inhibit growth was examined by determining the minimal inhibitory and bactericidal/fungicidal concentrations. The next stage involved assessing the ability of QAS to coat abiotic surfaces (stainless steel, silicone, polystyrene), consequently inhibiting pathogen cell adhesion. Promising results indicate significant application potential, preliminarily confirmed by safety studies – hemolysis tests of sheep erythrocytes. The gemini compound $2xC_{10}AAG_3$ exhibited inhibitory and bactericidal effect at a concentration of 5 μM, while $2xC_{14}AAG_3$ inhibited growth at 20 μM and showed bactericidal activity at 40 μM against *S. epidermidis*, though they showed no anti-adhesive effect. The multifunctional $2xC_{12}AA$ did not exhibit inhibitory effects but demonstrated high anti-adhesive efficacy, completely preventing *C. albicans* adhesion to the tested surfaces and significantly (up to 80%) reducing the adhesion of other strains [Previously published in: Izbińska et al. (2024) Colloids Surf. B: Biointerfaces 239, 113932]. The high anti-adhesive efficacy and low hemolytic activity (up to 8% at the highest tested concentration) indicate both safety and effectiveness, which may contribute to patient protection, for example, by coating medical equipment (such as catheters) to prevent nosocomial infections, where gemini compounds could effectively function as surface and skin disinfectants. Research supported by NCS OPUS16 Grant No. 2018/31/B/NZ9/03878 (principal investigator - EO).