

ABSTRACT

This dissertation thesis deals with the antimicrobial susceptibility testing of newly prepared compounds based on quaternary ammonium salts (KAS) and their reference standards commonly used in practice. The new compounds were prepared in cooperation with the Department of Toxicology and Military Pharmacy of the Faculty of Military Health Sciences of the University of Defence and the Biomedical Research Centre at the University Hospital Hradec Králové as a part of joint projects.

The antimicrobial activity was established on gram-positive (G+) and gram-negative (G-) bacteria from type culture collections and clinical isolates, in planktonic and biofilm form. At first, the basic antimicrobial activity evaluation was performed by using the microdilution broth method. Additionally, the modified methodology was used to explore the influence of culture broth and initial bacterial density on evaluating the antimicrobial activity. Secondly, by using the quantitative suspension test, that better simulates normal practice conditions, has been successfully implemented at the department for the detailed antimicrobial activity evaluation. Thirdly, the biofilm model based on the Calgary Biofilm Device was successfully introduced and optimized for antibiofilm activity testing. Detailed antibiofilm activity was also evaluated by advanced biofilm models and the potential of combination treatment of selected compounds with laser irradiation was investigated on the *E. faecalis* biofilm model.

Complex antibacterial effect of tested compounds was observed on both G+ and G- strains, including the highly infectious *F. tularensis* strain. The influence of several structural modifications of the KAS molecule on antibacterial activity was examined, such as related to the alkyl chain length, the addition of a second alkyl chain and the modifications of the polar part of the molecule. In addition to the effectiveness against the planktonic form of bacteria, the antibiofilm activity was also investigated in detail. The tested KAS exhibited generally good antibiofilm activity and, moreover, the combination of KAS and laser treatment led to complete biofilm eradication. This kind of combined treatment could be advantageous, especially in dentistry, where agents based on KAS could replace the highly irritating disinfecting agents which are used nowadays.

Obtained results were continuously published and the most promising compounds have been patented for possible future commercial use.

Key words: quaternary ammonium salts; disinfection; antimicrobial evaluation; biofilm models