DESCRIPTION FOR THE GENERAL PUBLIC

(state the objective of the project, describe the research to be carried out, and present reasons for choosing the research topic)

Researchers have been searching for an effective and safe method of removing microorganisms for many years, mainly because bacterial strains become resistant to commonly used antibiotics. Advances in nanotechnology make it possible to accurately design nanoscale surface properties for use in various areas of life, where human health is a priority (medicine, pharmacy, food industry). The aim of the project is to obtain novel polymeric layers covalently bound to a glass or silicon substrate. The resulting surfaces will be suitably modified to enhance their bactericidal activity. The effect of the applied method of preparation and modification the layers on their antimicrobial properties will be checked using selected strains of bacteria. Attachment of the polymer to solid support by covalent bonding should ensure the stability of such layer and retain its antimicrobial activity. This approach should prevent the detachment of the resulting layers from the substrate, e.g. under the influence of water.

The following tasks will be undertaken to realize the overall goal of the project:

- ✓ The preparation of star polymer layers and their characterization
- ✓ Layer modification by quaternization of the amine groups of the poly(*N,N'*-dimethylaminoethyl methacrylate)
- ✓ Modification of the star polymer layers by "*in situ*" formation of silver nanoparticles
- ✓ Investigation and evaluation of antibacterial properties of the star nanolayers

Surfaces of poly(*N,N'*-dimethylaminoethyl methacrylate) with the star topology will be obtained in this project. Star-shaped polymers with a defined number and length of arms will be synthesized by controlled atom transfer radical polymerization (ATRP) and then covalently attached to the functionalized glass and silicon substrates by "grafting to" methods. Obtained nanolayers will be characterized using modern measuring methods (quartz microbalance, ellipsometry, FTIR, AFM, TEM). In the next step polymer layers will be modified to increase their antimicrobial properties. In the last task of the project will be performed microbiological studies with the use of the obtained polymer surfaces will be carried out. This will assess the effect of the composition, structure and properties of the resulting layers on their biocidal activity.

The innovative solution of the proposed project involves the design of stable surfaces of star polymers and their modification to enhance antimicrobial activity. The studies planned in the project respond to the latest trend in global research on the antimicrobial materials and their potential use.