ANTIBACTERIAL ACTIVITY OF SILVER NANOPARTICLES OBTAINED BY ELECTROCHEMICAL SYNTHESIS IN POLY(AMIDE-HYDROXYURETHANE) MEDIA

MELNIG VIOREL, STEFAN MARIUS, HRITCU LUCIAN, MIHĂȘAN MARIUS, GOSTIN IRINA, PRICOP DANIELA

Alexandru Ioan Cuza University of Iași, Romania

INTRODUCTION. Due to the outbreak of the infectious diseases caused by pathogenic bacteria, inorganic nanoparticles (NPs) have emerged up as novel antimicrobial agents. Silver NPs are substantially more effective than silver ions, enhanced antibacterial properties of silver NPs being demonstrated both in vitro and in vivo. For these reasons, in this study we investigated the antimicrobial effects of low concentrations of Ag NPs against representative microorganisms of public health concern. Here, we report that different Ag NPs sizes and concentrations can be applied effectively in the control of microorganisms and the prevention of deleterious infections.

MATERIALS AND METHODS. The synthesis of Ag-PAmHU coated NPs was performed using an Amel 549 potentiostat/galvanostat. Silver concentration was determined by atomic absorption spectrometry (AAS). The statistic distribution of Ag-NPs sizes was performed using NIS Elements Basic Research imaging software. A disk diffusion method was used to assay the susceptibility of *Escherichia coli* and *Staphylococcus aureus* to different silver NPs sizes and concentrations. The size and morphology of Ag NPs on the bacteria were examined by scanning electron microscopy.

RESULTS AND DISCUSSIONS

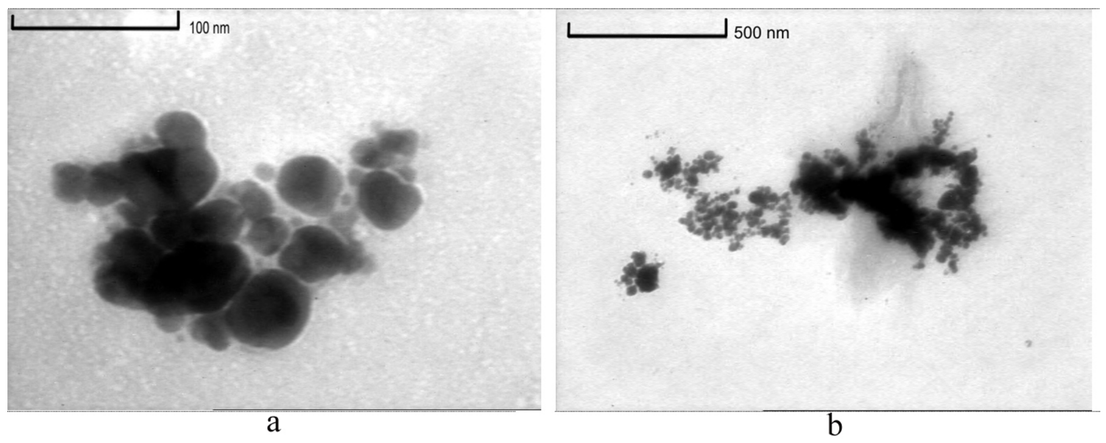

Fig. 1 TEM micrographs of Ag I (a) and Ag II (b) NPs

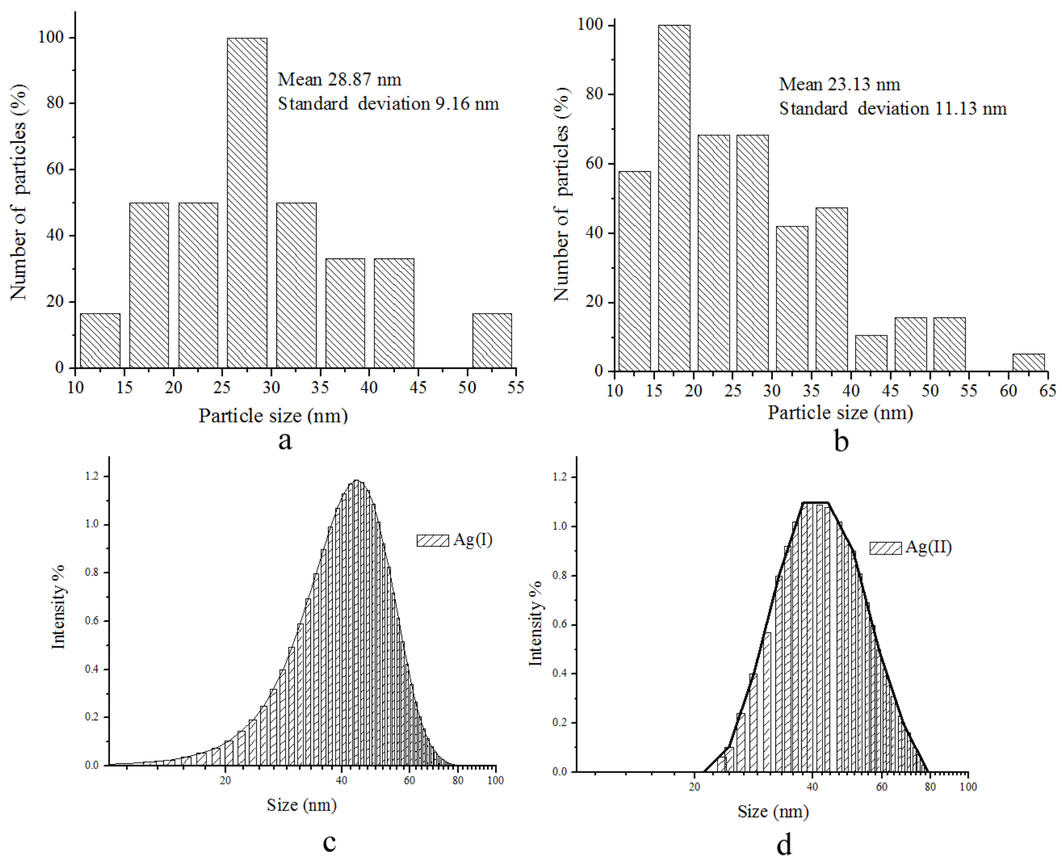

Fig. 2 Size distribution charts of silver NPs obtained from TEM analysis (a - Ag I, b - Ag II) and by laser granulometry (c - Ag I, d - Ag II)

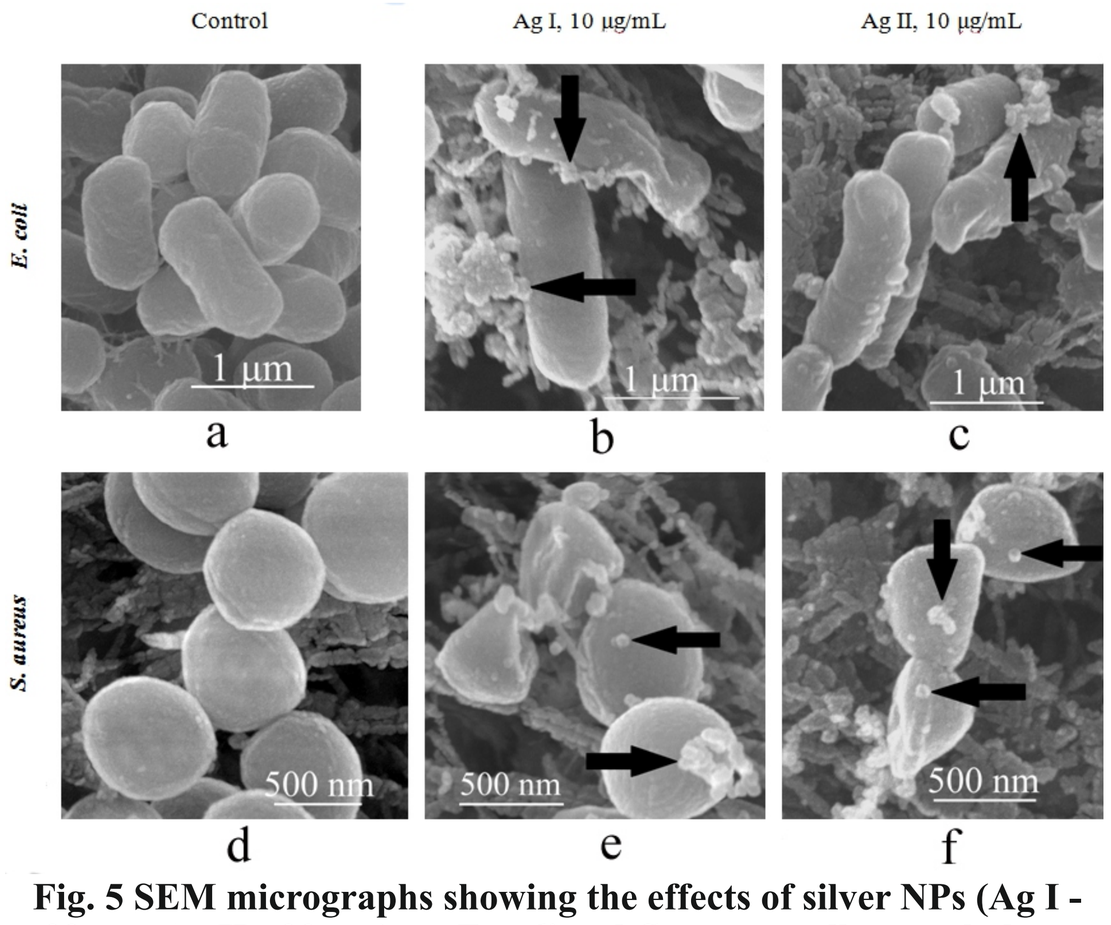

Fig. 5 SEM micrographs showing the effects of silver NPs (Ag I - 29 nm, Ag II - 23 nm) on *E. coli* and *S. aureus* cells morphology (arrows indicate the NPs attached on cell wall surface)

Acknowledgements. This study was supported by CNCSIS–UEFISCSU, 509 PNII–IDEI 1996/2008 research grant.

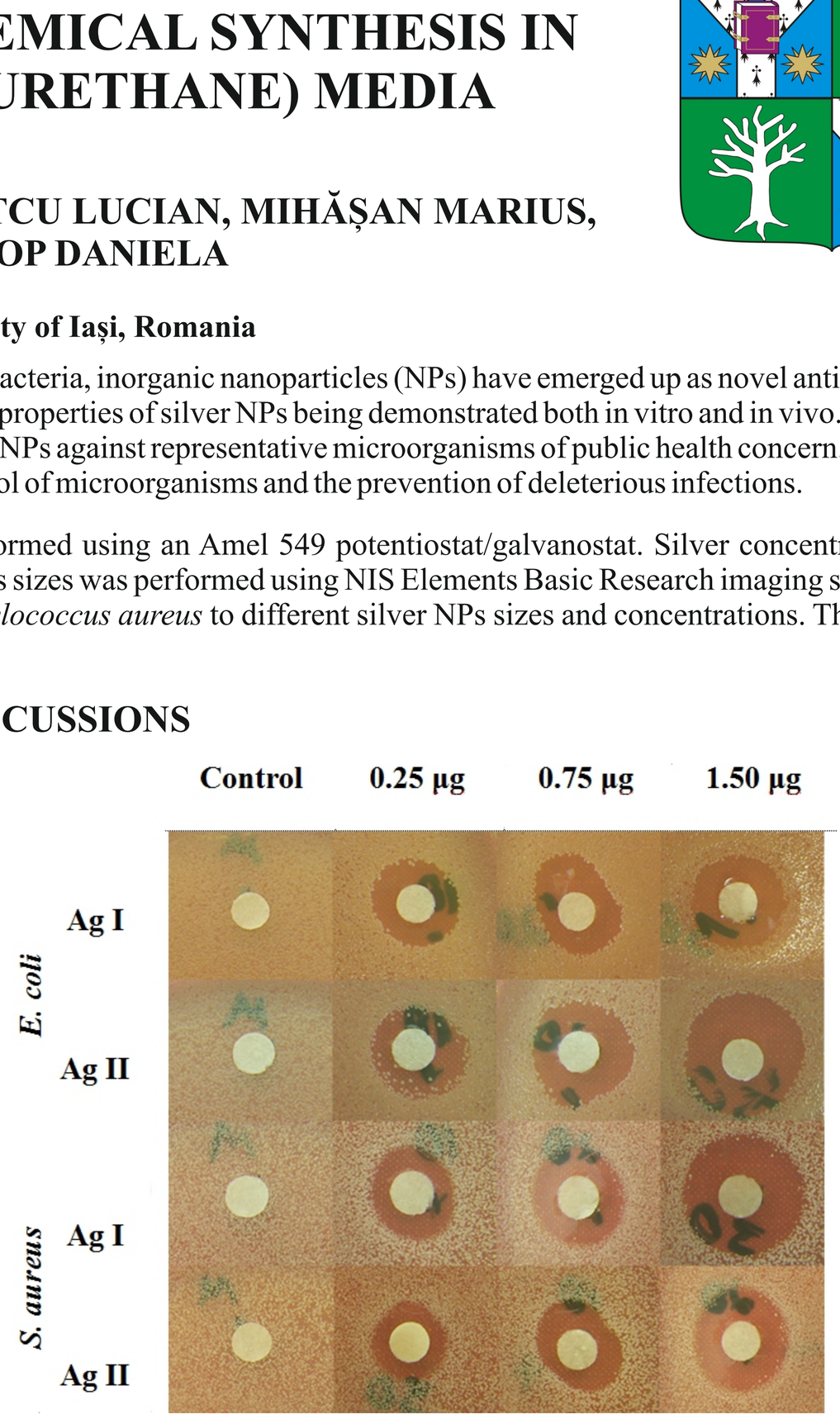

Fig. 3 Disk diffusion assay using Muller-Hinton agar supplemented with 29 nm (Ag I) respectively 23 nm (Ag II) at different concentrations (0.25 – 1.50 µg Ag /disk)

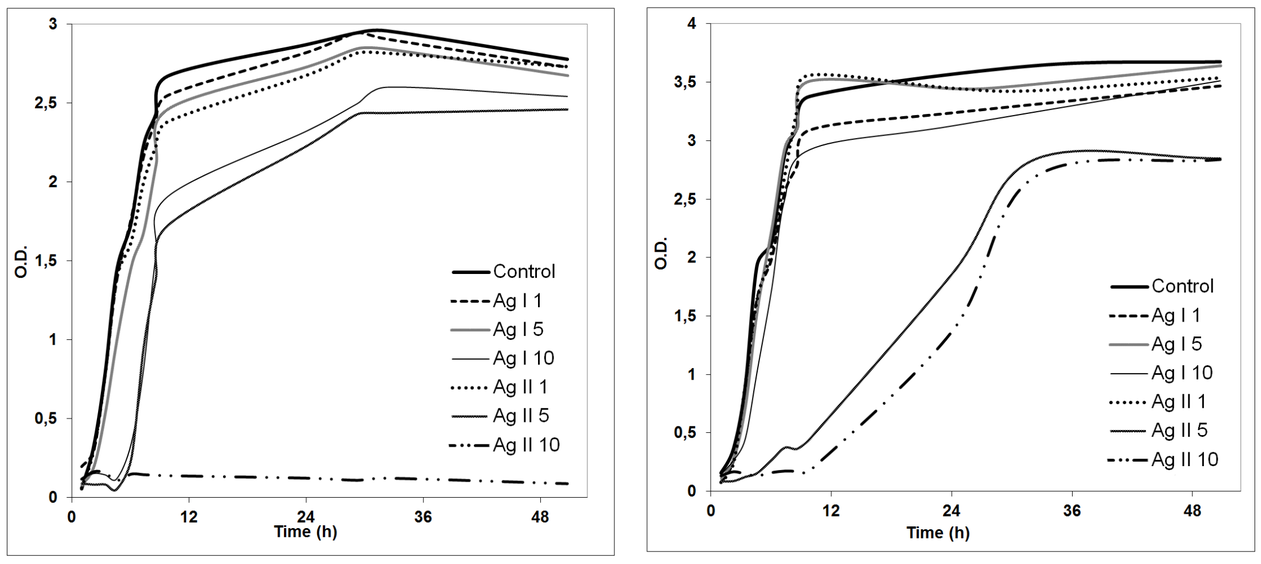

Fig. 4 Bacterial dynamic growth curve in LB media at different sizes and concentrations of silver NPs. (a) *E. coli*; (b) *S. aureus*

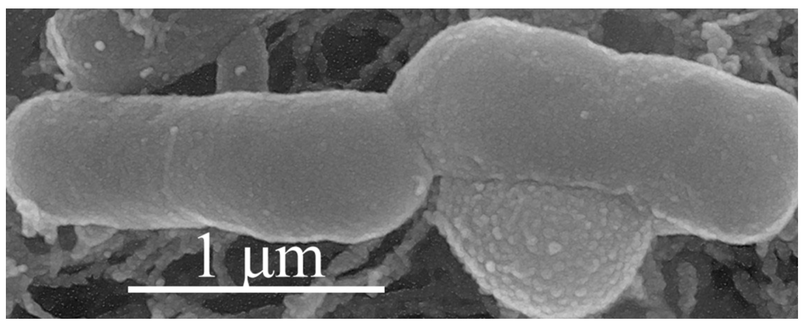

Fig. 6 SEM micrograph of *E. coli* cells and NPs aggregates

CONCLUSIONS

Silver NPs used in this study were synthesized in a simple and cost-effective manner and were found to have a stronger antibacterial effect at lower concentrations than those described in the earlier reports. The effect was dose dependent and was more pronounced against Gram negative bacteria than Gram positive ones. Moreover, the effect was size dependent, the smallest Ag NPs used having bactericidal effects resulting in killing *E. coli* cells.