Synergistic effect with antibiotics and inhibition of bacterial biofilm formation from polyaminocyclodextrin-silver nanoparticles

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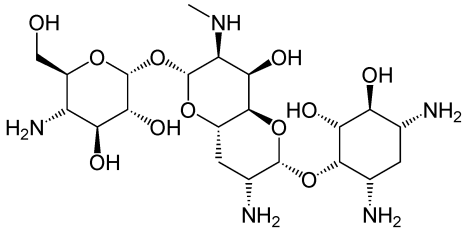
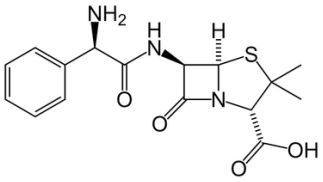
Due to the increasing occurrence of antibiotic resistant bacterial strains that cause serious public health problems, new or improved antimicrobial compounds are needed. In this view, silver nanoparticles (AgNPs) are increasingly used as an alternative to antibiotics.

In this study polyaminocyclodextrin-silver nanoparticles (PACD-AgNPs), obtained by a facile photochemical protocol[1], were assayed against Gram-positive and Gram-negative bacterial strains for their antimicrobial activity in combination with apramycin (APRA) and ampicillin (AMP) antibiotics, and their ability in inhibiting biofilm formation. Minimum Inhibitory Concentration (MIC_{90}, i.e. inhibiting the 90% of bacterial growth) of apramycin (APRA) and ampicillin (AMP) antibiotics (Figure 1) coupled with PACD-AgNPs revealed a synergistic effect, assessed by mathematical model analysis of the relevant isobolograms. Interestingly, significant results in terms of bacterial growth inhibition were obtained by assaying sub-lethal amounts of PACD-AgNPs coupled with APRA or AMP against the corresponding antibiotic-resistant *Escherichia coli* strains. Furthermore, very low AgNP concentrations inhibited bacterial biofilm formation.

This study provides insights on the attractive possibility of using cyclodextrin-metal nanoparticles in combination with conventional antibiotics to obtain improved antimicrobial composites which can be subjected to future investigations to assess molecular mechanisms of action.



APRA



AMP

(Figure 1)

References

1. a) M. Russo, A. Meli, A. Sutera, G. Gallo, D. Chillura Martino, P. Lo Meo, R. Noto *RSC Adv.* **2016**, *6*, 40090-40099. b) M. Russo, D. Chillura Martino, E. Caponetti, P. Lo Meo *ChemistrySelect* **2018**, *3*, 3048-3055.