Controlled release of antibiotics by cyclodextrin-based nano-devices and biofilm inhibition

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A drug delivery system (DDS) is a device that allows the introduction and controlled release of a biologically and pharmacologically active molecule, in order to exploit the advantages of optimizing drug in specific body districts. Therefore, DDSs can reduce local or systemic side effects. Cyclodextrins play a relevant role in DDS design, due to their remarkable binding abilities and lacking in cytotoxicity towards human cells.

In this study different cyclodextrin-calixarene nanosponges (CDCANSs,[1] Figure 1) were loaded with antibiotics and assayed against different model bacterial strains and biofilm formation. Their ability to release antibiotic molecules under different pH conditions was assessed by suitable kinetic experiments. Minimum Inhibitory Concentration (MIC_{90}, i.e. inhibiting the 90% of bacterial growth) of CDCANSs/tetracycline complex outlined the ability of the material to incorporate the antibiotic without lack of efficiency. Moreover, the CDCA NSs/tetracycline complex inhibited biofilm formation, whereas the nanosponge alone caused an increasing of biofilm production, acting as a scaffold.

The results of this research study indicates CDCANSs as promising drug delivery systems for fighting bacterial infections, particularly whenever biofilm-producing bacteria are involved.

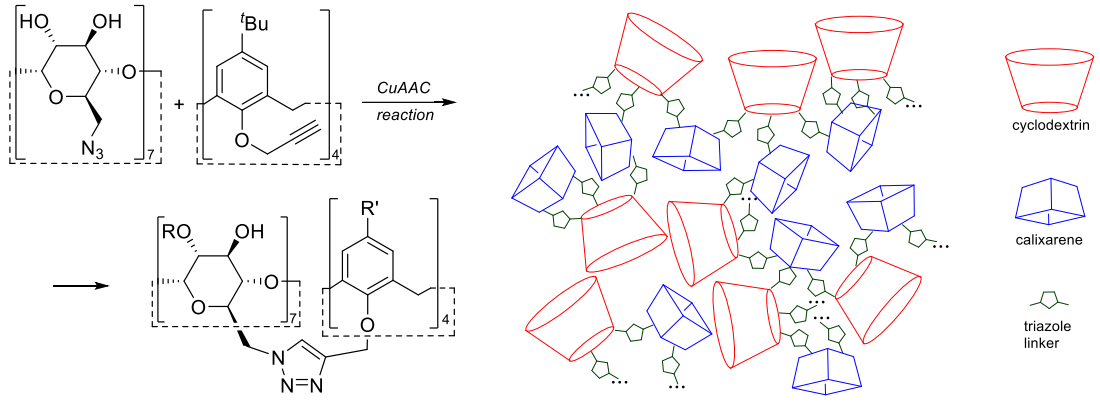

Figure 1

References

1. a) P. Lo Meo, G. Lazzara, L. Liotta, S. Riela, R. Noto *Polym. Chem.* **2014**, *5*, 4499-4510. b) V. Cinà, M. Russo, G. Lazzara, D. Chillura Martino, P. Lo Meo. *Carbohyd. Polym.* **2017**, *157*, 1393-1403.