Nanoantibiotics: design of multifunctional MSN nanosystems containing both antibiotic and copper ions to combat bone infection.

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Finding novel strategies to combat bone infections is a major challenge for the biomedical scientific community [1]. Currently, mesoporous silica nanoparticles (MSNs) have been proposed as promising drug nanocarriers for the destruction of biofilms [2]. It has been demonstrated that polycationic macromolecules such as dendrimers grafted on MSNs surface notably increases the effectiveness of the loaded antibiotic [3,4]. Here, the design of novel multifunctional MSN-based nanosystems with high efficacy against bacterial biofilms is described. The nanosystem is composed of MSNs loaded with antibiotics, e.g. levofloxacin or rifampicin, and externally functionalized with a polypropylenimine dendrimer of third generation (G3) and copper ions. The nanosystems were characterized by XRD, TEM, EDS, TGA, DLS, ELS, FTIR and elemental analysis. The antibiotic loading and release were evaluated through UV-Vis and fluorescence spectroscopies. The polycationic dendrimer allows the binding of copper ions on the functionalized MSNs surface through their complexation by the tertiary amine groups as well as the MSNs internalization in the bacteria cells. The function of Cu^{2+} ions is to inhibit the development of bacterial resistance [5,6]. The antimicrobial activity was verified by testing the direct effect of the MSN nanosystems onto *S. aureus* biofilms. The obtained results showed a synergistic effect between the antibiotic and copper ions which is probably increased due to bacteria internalization. (Figure 1)[2].

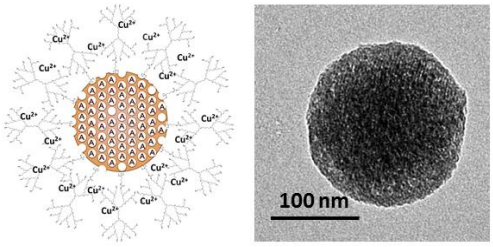

Figure 1. MSN-Antibiotic-G3-Cu2+ scheme and TEM image of the nanosystem.

References

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