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SYNTHESIS OF SMART NANOMATERIALS WITH POTENTIAL ANTIBIOFILM ACTIVITY FOR COATING MEDICAL DEVICES

F. Mancusi [1], E. Bianchi [1], F. Bugli [2], C. Montis[1], S. Cicchi [1], B. Richichi[1]

[1] *Department of Chimistry "Ugo Schiff", University of Florence, Via della lastruccia 3-13, 50019, Sesto Fiorentino, Italy*

[2] *Department of Basic Biotechnological Sciences, Intensive and Perioperative Clinics, Università Cattolica del Sacro Cuore, Largo A. Gemelli, 00168, Rome, Italy*

francesca.mancusi@unifi.it

Antibiotic resistance is a serious public health problem. The insurgence of such resistance is also related to the production, by several bacterial strains, of biofilms, complex polymeric architectural structures. Enveloped in this structure they become much more resistant to classical antimicrobial treatments making conventional drugs inadequate to eradicate infections. For this reason, biofilm infections on medical implants such as valves, stents, and catheters require the surgical removal and replacement of the devices, and recurrences of infection are very high. [1] Therefore, there is an urgent need for materials that prevent bacterial biofilm formation on medical devices. We aim to make a smart multilayer material for coating biliary catheters, which are often obstructed by biofilm-like infections, based on nanocellulose, a nanomaterial extracted from renewable biomass. The project foresees the production of different nanocellulose materials, characterized by antibacterial activity and opposite charges, that upon electrostatic interaction, can give rise to multilayered structures. Positive nanocellulose was obtained by reaction with (2,3-epoxypropyl) trimethyl ammonium chloride resulting in the opening of the epoxide and the introduction of ammonium salts onto the surface of the CNC. In contrast, negative sulphated nanocellulose, obtained by hydrolysis with sulfuric acid of the amorphous portions of cellulose, was functionalized in various ways: by introducing AgNPs, indole scaffold molecules, and gold complexes. A BODIPY-isocyanate fluorescent probe, linked to the different material allowed us to observe by confocal microscopy the formation and the morphology of the obtained material after deposition on the polymeric support. Thus, a triple layer consisting of a base of EVATANE® 40-55 plastic polymer, positive nanocellulose and negative nanocellulose was obtained by subsequent depositions. The third negative nanocellulose layer was varied by introducing the different types functionalized CNC (-) described above. A three-dimensional model of multilayer catheter was also obtained. Biological evaluations and flow studies will demonstrate the efficacy of the obtained system.

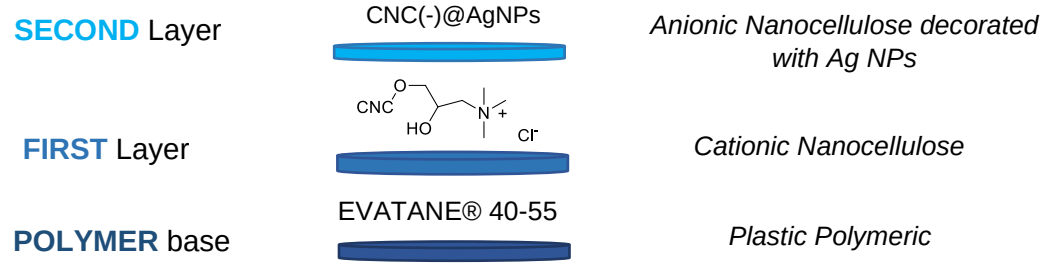

Figure 1. Image of the triple-state nanocellulose-based coating of catheters.

References

[1] Journal of Microbiology: X.H. Li, J.H. Lee, *J.Microbiol.*, **2017**, *55*, 753–766.

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