Composite materials to prevent the microorganism adhesion on surfaces

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In recent years, many biomaterials have been developing and optimizing for tissue engineering application. Nevertheless, the inclusion of external constructs into human body may cause adverse reactions such as the onset of bacterial infections.[1] Microbial contamination is a problem regarding not only regenerative medicine but affects the entire medical field. It is estimated that many of the post-surgical complications are due to contamination of medical implants by pathogenic microorganisms (bacteria, viruses, and fungi). Bacterial contamination also affects several fields including food packaging, water purification systems, textile, aeronautic, aerospace and every aspect of public life. In addition, the widespread use of antibiotics to combat bacterial infections led to the development of antibiotic-resistant bacterial strains. [2] To avoid these events, it is necessary to develop new materials with antibacterial properties in order to obtain coatings for hospital surfaces, furniture, medical devices, and all other surfaces exposed to high risk of contamination. [3]

We are studying conjugated organic polymers (PANI, PPY and PEDOT) that have a molecular structure suitable for establishing electrostatic interactions with bacterial cell membranes such as to allow their easy elimination. To improve the processability of these systems the inclusion into a natural biopolymer as polysaccharide is also required. Indeed, polysaccharides are hydrophilic, biocompatible and many of these, like the chitosan, can reduce bacterial adhesion to surfaces. The obtained preliminary results show that the chemical and electronic properties of these polymers are promising for such application. Particularly, we have realized this composite as a possible biomaterial for tissue engineering. In fact, application of bactericidal scaffolds promotes regeneration of biological tissues avoiding the onset of bacterial infections. In this presentation the approaches adopted for the preparation of these systems are presented and discussed and possible new implementation are also described.

[1] M. Godoy-Gallardo *et al.*, "Antibacterial approaches in tissue engineering using metal ions and nanoparticles: From mechanisms to applications," *Bioactive Materials*, vol. 6, no. 12. KeAi Communications Co., pp. 4470–4490, Dec. 01, 2021, doi: 10.1016/j.bioactmat.2021.04.033.

[2] Y. Jiao, L. na Niu, S. Ma, J. Li, F. R. Tay, and J. hua Chen, "Quaternary ammonium-based biomedical materials: State-of-the-art, toxicological aspects and antimicrobial resistance," *Prog. Polym. Sci.*, vol. 71, pp. 53–90, Aug. 2017, doi: 10.1016/J.PROGPOLYMSCI.2017.03.001.

[3] K. Vasilev, J. Cook, and H. J. Griesser, "Antibacterial surfaces for biomedical devices," *http://dx.doi.org/10.1586/erd.09.36*, vol. 6, no. 5, pp. 553–567, Sep. 2014, doi: 10.1586/ERD.09.36.