Biological response and surface behaviour of two bioactive polymers grafted on PDMS surfaces

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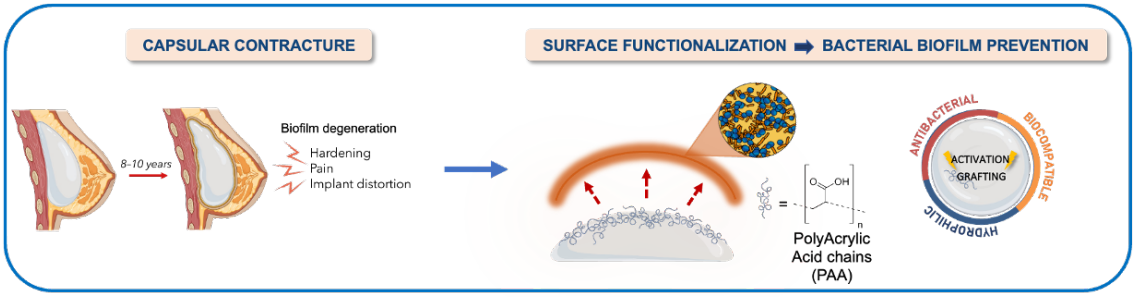
Résumé :

Poly(dimethyl siloxane) (PDMS) is one of the most widely used material in the biomedical field. However, for breast implants, the biocompatibility is challenged due to side effects caused by foreign body reaction (FBR), like capsular contracture, causing pathological fibrosis and skin deformations which can get worse and degenerate over time [1]. Indeed, despite its numerous advantages, the hydrophobic character of PDMS promote the adhesion of bacteria belonging to breast implant issues. Recently, breast implant-associated anaplastic large cell lymphoma (BIA-ALCL) has been detected in women 8-10 years post-surgery, threatened even more the long-term biocompatibility of these implants [1,2]. Thus, preventing a biofilm formation on the surface of breast implant seems necessary. The laboratory has set up strategies to prevent bacterial contamination by covalently immobilizing hydrophilic bioactive polymers on the implant's surface [3-5]. The technic involves an ultraviolet (UV) pre-irradiation step which generates radical sites allowing a « grafting from » polymerization step. The current work focuses on the impact of grafting carboxylate groups carried by bioactive polymers such as poly(acrylic acid) (PAA) on the PDMS surface [4,5]. Polyacrylic acid (PAA) as non-toxic, biocompatible, and hydrophilic bioactive polymer seems to be a great candidate to bring new properties to the surface [4,5]. X-Ray Photolectron Spectroscopy (XPS) and Fourier-Transformed Infrared spectroscopy (FTIR) analysis have demonstrated the covalent grafting of this polymer. Water contact angle measurements have highlighted the change in hydrophilicity on the surface, and a colorimetric assay allowed us to assess the grafting rate of PAA. Tensile strength assays were performed to ensure that the functionalization process does not significantly alter the material's mechanical properties. Moreover, first biological and microbiological tests have been done to investigate the role and the impact of the bioactive polymers grafting on biological mechanism occurring after implantation.



Surface functionalization onto silicon breast implant to prevent bacterial biofilm

Références :

[1] : M. Lam, V. Migonney, C. Falentin-Daudre, *Acta Biomateriala*, **2021,** *121*, 68-88.
[2] : V. Moris, M. Lam, L. Amoureux, A. Magallon, A. Guilloteau, T. Maldiney, N. Zwetyenga, C. Falentin-Daudré, C. Neuwirth, *BMC Microbiology*, **2022**, *22,* 192.
[3] : M. Lam, R. Vayron, R. Delille, V. Migonney, C. Falentin-Daudré, *Materials Today Communication*, **2022,** *31*, 102218.
[4] : A. Wozniak, V. Humblot, R. Vayron, R. Delille, C. Falentin-Daudré, *Coatings* **2023**, *13*(11), 1888.
[5] : A. Wozniak, C. Falentin-Daudré, *Colloids and Surfaces A Physicochemical and Engineering Aspects*, **2024**, *703(2)*, 135346.