Grafting of bioactive polymer on silicone breast implants surface to improve biological response

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Poly(dimethyl siloxane) (PDMS) is one of the most widely used material in the biomedical field, but due to its hydrophobic character it is prone to bacterial adhesion and biofilm formation. For breast implants, the biocompatibility is challenged due to the development of a fibrous capsule which can get worse and degenerate into large cell lymphoma (BIA-ALCL) over time[1]. Thus, preventing a biofilm formation on the surface of breast implant seems preferable to any other existing treatment or to second surgical intervention[2].

The LBPS team has setted up a strategy to prevent bacterial contamination and capsular contracture formation by covalently immobilizing hydrophilic biopolymers on the surface of the implant. The technic involves a pre-irradiation (UV) step which generates radical sites allowing a "grafting from" polymerization step (*Figure 1*). The team has already worked on the grafting of an anionic biopolymer: the poly(styrene sodium sulfonate) on silicone surface in order to improve its biocompatibility[3]. However, it was no sufficient to prevent bacteria adhesion. That is why the work focuses now on the impact of grafting carboxylate groups carried by biopolymers such as poly-acrylic or poly-methacrylic acids (PAA, PMA) on the surface of PDMS. Their anti-adhesive properties could prevent the adsorption of proteins on the surface and thus, the adhesion of a broader spectrum of bacteria[4].

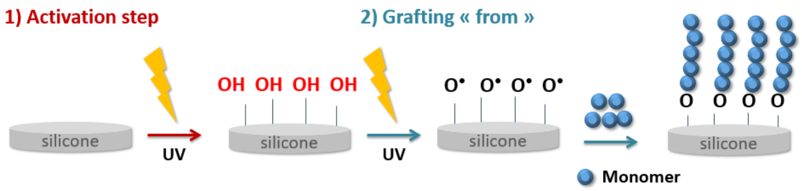

Figure 1: Reaction scheme of polymer grafting on silicone surface

Polyacrylic acid (PAA) as a non-toxic and biocompatible biopolymer seems to be a great candidate to bring antiadhesive property to repel bacteria or a bactericidal property to kill adhered bacteria. X-Ray Photolectron Spectroscopy (XPS) and 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.

References

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