P828 Surface functionalization strategies to inhibit biofilm formation on silicone materials for implantable devices

Francesca Ruini[1], Chiara Ceresa[3], Gianna Allegrone[3], Devid Maniglio[2], Federico Piccoli[4], Maurizio Rinaldi[3], Giandomenico Nollo[2,5], Iole Caola[4], Francesco Tessarolo[2,5], Letizia Fracchia[3], Gianluca Ciardelli[1], Valeria Chiono[1]

[1]Politecnico di Torino, Department of Mechanical and Aerospace Engineering, Torino, Piemonte, Italy, [2]University of Trento, Department of Industrial Engineering, Trento, Trentino-Alto Adige, Italy, [3]Università del Piemonte Orientale "A. Avogadro", Department of Pharmaceutical Sciences, Novara, Piemonte, Italy, [4]Azienda Provinciale per i Servizi Sanitari di Trento, Department of Medicine Laboratory, Trento, Trentino-Alto Adige, Italy, [5]Bruno Kessler Foundation, Healthcare Research and Innovation Program (IRCS-FBK-PAT), Trento, Trentino-Alto Adige, Italy

Introduction

Silicone is frequently encountered in many biomedical applications (e.g. syringes and catheters) due to its moulding properties, chemical inertness and high oxygen permeability. However, the high level of hydrophobicity of silicone has been shown to allow bacterial colonization with subsequent biofilm formation on the surfaces of the medical devices increasing the risk of infection and limiting the devices life time. In this work, silicone surface functionalization techniques with a biological antifouling agent, AC7 biosurfactant (AC7BS), were employed in order to prevent biofilm formation.

Materials and Methods

AC7BS was extracted from cultures of Bacillus subtilis AC7. To ensure AC7BS sufficient coating, sterilized silicone disks were plasma-activated using argon as plasma gas (5 min, 15 sccm, 100W). Then, AC7BS functionalization on silicone was performed by two distinct approaches: i) AC7BS physical absorption (dipping in 2 mg/ml AC7BS solution) (Fig. 1A); ii) AC7BS covalent grafting using an aminosilane (APTES) to introduce amino groups to silicone prior to immobilization of AC7BS via carbodiimide chemistry (EDC/NHS)(Fig.1B). Morphological and physicochemical characterisation was performed on both AC7BS modified surfaces.

Results

The developed surface functionalization strategies were found to significantly increase hydrophilicity of silicone. AC7BS after physical absorption or covalent grafting procedure was confirmed by XPS and ATR-FTIR analysis. Silanisation on silicone activated surfaces was quantified by a colorimetric method and the subsequent AC7BS covalent grafting was evaluated by liquid chromatography–mass spectrometry (HPLC-MS) and corresponded to 22% of the total AC7BS amount.

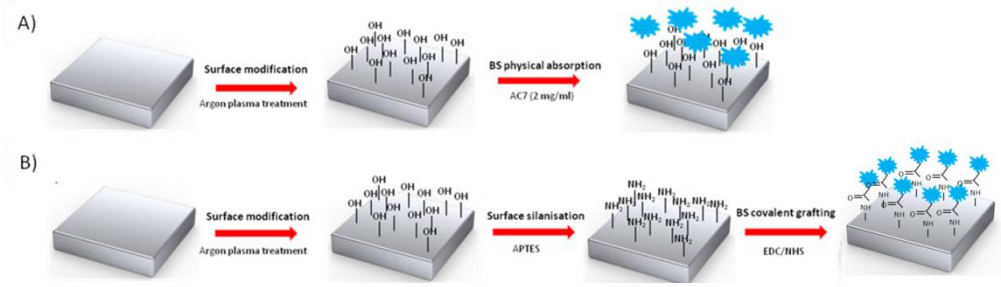

Fig.1 Schematic representation of AC7BS silicone functionalisation strategies: A) AC7BS absorption and B) AC7BS covalent grafting on activated silicone surfaces.

Conclusion

These results suggest the potential use of both functionalization approaches on silicone as anti-adhesive and antimicrobial coatings for silicone medical devices. Future works will be aimed to confirm the inhibition of fungal and bacterial biofilm growth on silicone.