

Área: FIS

Plasma-based surface modifications of PDMS strongly enhance the adhesion of antibacterial chitosan-based coatings

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Highlights

Polydimethylsiloxane (PDMS) was treated via wet chemistry or plasma to enable the adhesion of a chitosan-based coating. Wet chemical treatment did not enable the adhesion of the coating. Plasma treatment showed a significant increase PDMS hydrophilicity and enabled the adhesion of the coating.

Resumo/Abstract

Biomaterial-associated infections (BAIs) are a significant concern in implantable medical devices. A promising strategy to avoid BAIs is to coat medical devices with antimicrobial formulations. It is important that the coating has strong adhesion, ensuring that it remains intact and does not peel or degrade over time, maintaining the device's integrity and functionality. The objective of this work was to activate the surface of polydimethylsiloxane (PDMS), to attach a chitosan-based formulation, which showed promising results when produced in the form of films [1]. These films already showed to sustain the release of moxifloxacin up to six months, and strong antibacterial activity against *S. aureus* and *E. coli* [1,2,3]. The methodology consisted in modifying the surface of PDMS via wet chemistry or low-pressure oxygen plasma to enhance the adhesion of the coating. The chemical treatment of PDMS consisted in the immersion in Piranha solution (H₂SO₄:H₂O 3:2 v/v) for 6 h, while the plasma treatment consisted in exposing PDMS to low pressure plasma of argon 5 sccm and oxygen 20 sccm at 100 W and 1 min. After treatment, samples were immersed in 2 mg/mL dopamine solution at pH 8.5 for 24 h, then coated with the chitosan-based formulation [1] and cast at 40°C for 18 h. The results showed that wet chemical treatment did not enable the adhesion of the coating onto PDMS. Plasma treatment, besides being a faster and cleaner process, showed a significant decrease in PDMS water contact angle, from 110° to 20–35°. Moreover, an excellent adhesion of the coating was obtained, with a tensile strength of ~0.6 MPa, measured by pull-off test. These results confirm the appropriateness of plasma-based surface modifications, and particularly their applicability to design chitosan-based coatings showing antibiotic release.

[1] Sczesny NF et al. *Antibiotics*. 2024; 13:1055.

[2] Chevallier P et al. *Nanomaterials*. 2023; 13(3):484.

[3] Veloso FdS et al. *Coatings*. 2024; 14(3):291.

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