Nitric Oxide-generating Coating on Biomedical Titanium Implants

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Titanium (Ti) and its alloys are widely used in biomedical implants due to their excellent mechanical properties, biocompatibility, and corrosion resistance. However, bacterial infections remain a critical challenge, often leading to implant failure[1]. Nitric oxide (NO)-generating surface coatings have emerged as a promising approach to tackle this issue[2]. Platforms can be loaded with NO donors and released via specific triggers; however, the applicability of this approach is limited by the inability to sustain NO production once the donors are depleted. Previously, we have established that polymeric amines can catalytically generate NO from S-nitrosothiols (RSNOs)[3]. In this study, the polymeric amine poly(allylamine hydrochloride) (PAH) was used as a catalytic NO-generating coating for titanium surfaces. PAH was immobilized on titanium surfaces using a self-assembled monolayer as a linker. The coated titanium surfaces were characterized using Fourier transform infrared spectroscopy, x-ray photoelectron spectroscopy, atomic force microscopy, contact angle measurement, and scanning electron microscopy. The PAH-coated titanium produced up to 22.42 ± 2.14 µM NO after 24 hours of incubation with GSNO and could be reused for at least 5 cycles with no reduction in NO generation. Additionally, the biocompatibility of the coated surfaces was assessed, demonstrating a cell viability of more than 90%. The results of this study support the potential of PAH-coated titanium surfaces as a viable approach for preventing infection whilst enhancing the performance and longevity of biomedical implants through a safe NO-generating strategy.

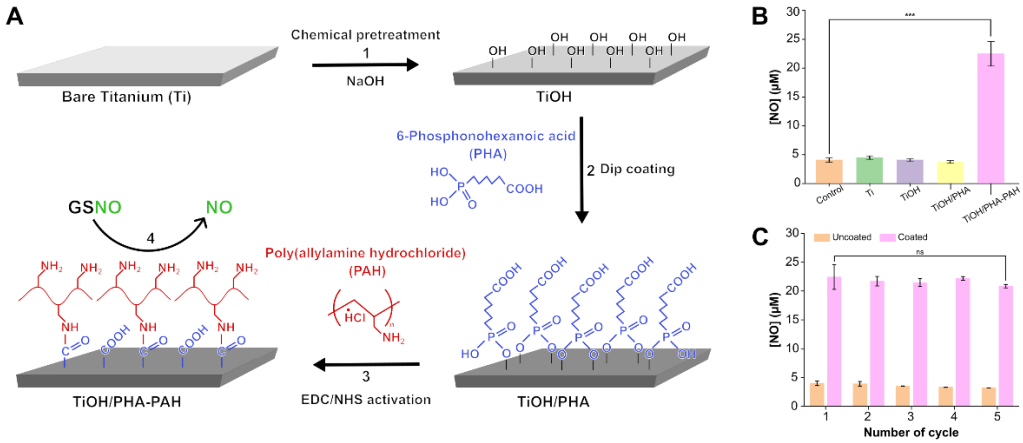

Figure 1: A. Surface coating schematic, B. Cumulative NO generation after 24 hours from PAH-coated titanium, C. Recyclability test of PAH-coated titanium

References:
[1] Arciola, C. R.; et al. *Nature Reviews Microbiology* **2018**, *16*, 397-409.
[2] Schairer, D. O.; et al. *Virulence* **2012**, *3*, 271-279.
[3] Luo, Z.; et al. *Small* **2023**, *19,* 2200502.