Surface-modified PET for cardiovascular applications: preliminary biocompatibility studies

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Abstract.

Half of the annual human deaths worldwide are due to cardiovascular diseases [1]. Currently, synthetic grafts play a vital role in medicine, as implant demands exceed natural available sources and thus alternative solutions are needed. Poly(ethylene terephthalate) or PET is extensively used as a synthetic graft material on account of its excellent bulk properties (high mechanical and thermal properties) and chemical inertness. A major drawback is its poor surface properties that directly influence biological performance. Herein, we present a nature-inspired surface modification strategy suitable for fine-tuning surface properties of PET grafts.

Materials & Methods. A two-step surface modification strategy was applied to PET (see Fig 1.). A dopamine-based coating procedure was used to facilitate the subsequent covalent immobilization of gelatin. In parallel, physisorbed surfaces were obtained by dip-coating.

A surface characterization was performed using SCA, AFM and XPS, coupled with radiolabelling. Also, preliminary haemocompatibility and *in vitro* assays were applied.

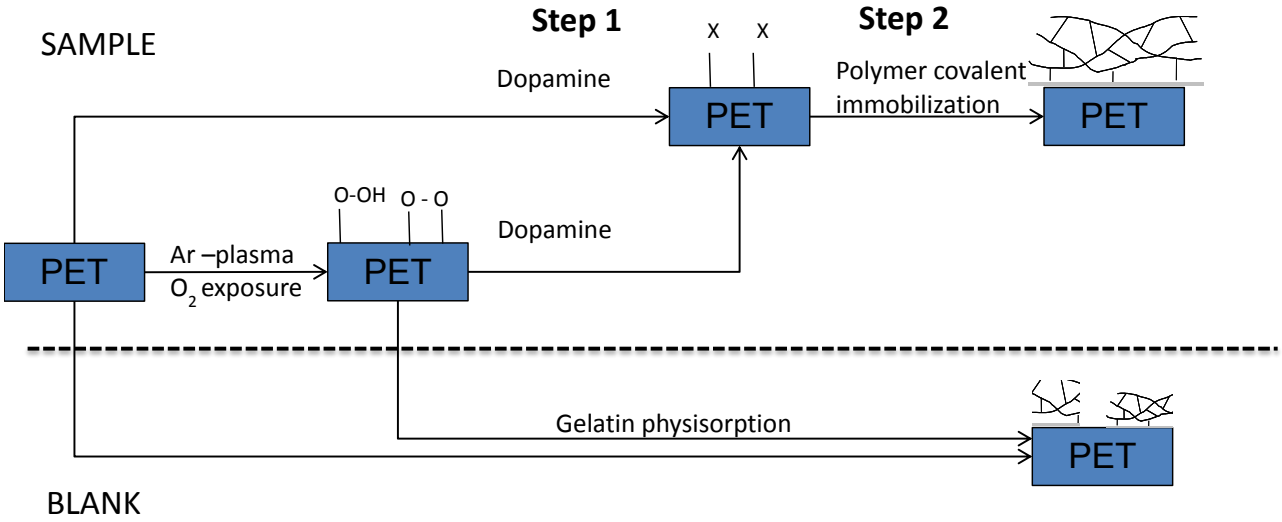

Fig. 1: Schematic representation of the general surface modification strategy.

Results & Discussion. Current surface modification strategies consist either of complex multi-step and time-consuming steps or the use of compounds (e.g. glutaraldehyde) that can raise toxicity issues [3]. Therefore, most synthetic grafts are generally modified by a physical means, neglecting coating stability issues. To circumvent these problems, we have developed an easy aqueous-based

method to surface-modify PET. A dopamine coating was applied to facilitate the covalent immobilization of gelatine type B as target biocompatible protein [2].

A comparative study between physically and chemically modified PET was pursued. Surface modification and I^{125} gelatine radiolabelling techniques showed clear differences. Covalent immobilization led to a more homogeneous and stable coating. Interestingly, minimal platelet activation was also observed, while HUVEC cell adhesion tests underlined the importance of a stable coating.

Conclusion. Stability and toxicity issues were avoided by using a 100 % organic solvent-free method to surface modify PET for cardiovascular applications. The importance of a covalent-based coating was shown to play an essential role in both the haemocompatibility and the *in vitro* cell behaviour.

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