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Biocompatible, plant-based bilayer coatings for medical devices

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Recent trends in biomedical research indicate that naturally derived polymers are increasingly explored as vehicles for drug delivery. Being biocompatible and biodegradable, these biomaterials could be employed in cardiovascular applications, to obtain drug-eluting devices. In the last years, plant-based proteins, such as zein, and polysaccharides, such as alginate, have emerged as suitable materials for medical applications, being easily available at low cost and readily processable [1]. The purpose of these natural-based coatings is not only to improve the biocompatibility of metallic devices but also to modify their surface properties in an attempt to avoid the stimulation of chronic inflammation or delayed re-endothelialization, which are often observed when using synthetic but not naturally-derived polymers as coating materials [2]. In this study, we develop novel biodegradable zein-based bilayer coatings with the aim of providing sustainable and active alternatives to synthetic coatings and bare metal cardiovascular devices. Rutin, a plant-based flavonoid compound, was incorporated in the zein layer and experiments were conducted to assess its release from single and bilayer coated substrates (sustained release up to 96% observed after 21 days) and the resulting antioxidant activities. In addition, extensive physico-chemical characterization and *in vitro* biocompatibility (with human umbilical vein endothelial cells and primary human fibroblasts) of the fabricated surfaces were carried out in detail (Fig. 1). Our findings confirm that the proposed plant-based bilayers fulfill the key requirements for successful drug-eluting cardiovascular devices. The exclusive use of green solvents and natural polymers of which the coating is composed can indeed ensure biocompatibility, promotion of cell proliferation and sustained release.

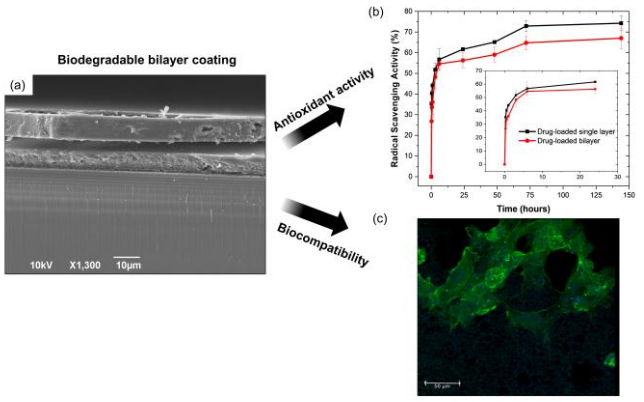

***Figure 1**: (a) cross-sectional SEM image of the fabricated bilayer; (b) radical scavenging activity against free radicals of aqueous extracts from single layer (black lines) and bilayer (red lines) coatings, with inset between 0 and 24 hours; (c) CLSM of endothelial cells grown on our fabricated coating for 48 hours.*

References

[1] *G. Suarato et al. Front Bioeng Biotechnol. (2018) 6:137*
[2] *T. Palmerini et al. J Am Coll Cardiol. (2014) 63(4):299-307.*

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