

Integrating decellularized small intestine matrices and silk-based textiles for advanced hybrid medical devices development

Inês Vale¹, Inês V. Silva¹, Marta Rosadas¹, Ana L. Oliveira¹, Viviana P. Ribeiro¹

¹*CBQF-Centro de Biotecnologia e Química Fina–Laboratório Associado, Escola Superior de Biotecnologia, Universidade Católica Portuguesa, Porto, Portugal*

Medical textiles are frequently utilized in implants and other medical devices. But even though they are successful in providing structural support for the transplanted organs, they typically exhibit an inert nature that hinders the tissues' or organs' ability to repair or regenerate (1). Decellularized biological tissues, on the other hand, have a remarkable biological character because they include all the naturally occurring biochemical and biological components of the tissues apart from the cellular component that triggers immunological rejection. Decellularization of porcine small intestine submucosa has emerged as a promising approach for soft tissue engineering applications (2). This process involves the removal of cellular content and small intestine tissue layers while preserving the extracellular matrix (ECM) of submucosa layer, which provides structural support and bioactive molecules crucial for soft tissues regeneration. In our study, an innovative and fast-performing protocol will be developed for decellularizing porcine small intestine while maintaining both the submucosa and serosa layers. The main goal of this work is to develop advanced medical devices for burn wound applications by combining an advanced silk fibroin (SF) textile with the decellularized porcine small intestine (dPSI), providing both structural support and biological components for faster tissue regeneration. The interface between the SF textile and the dPSI will be created using a silk sericin (SS)-based hydrogel with biocompatible and glue-like properties.

References:

1. Wollina, U., et al., 2003. Functional textiles in prevention of chronic wounds, wound healing and tissue engineering. *Curr Probl Dermatol*, 31, pp.82-97.
2. Chai, Y., et al., 2020. Evaluation of decellularization protocols for production of porcine small intestine submucosa for use in abdominal wall reconstruction. *Hernia*, 24, pp.1221-1231.

Acknowledgments:

The authors thank Isabel Pinto at Seara, S.A., Vila Nova de Famalicão, Portugal, for supplying the biological tissue. National Funds from Fundação para a Ciência e a Tecnologia (FCT) UID/Multi/50016/2020, and Doctoral Research Grant 2021.05919.BD attributed to IVS. Authors acknowledge the Junior Researcher contract attributed to VR by the BE@T–Bioeconomy for Textiles and Apparel, investment TC-C12-i01—Sustainable Bioeconomy, funded through the Recovery and Resilience Program (PRR). MR would like to express gratitude to Cortadoria Nacional de Pêlo, SA. Authors also acknowledge to the funding provided by the project project IBEROS+ (0072_IBEROS_MAIS_1_E, Interreg-POCTEP 2021-2027).