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Biobased materials for engineered lung tissue

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Chronic respiratory diseases (CRDs) represent a significant global health challenge, affecting an estimated 545 million people globally, around 7.4% of the world's population [1]. Chronic obstructive pulmonary disease (COPD), in particular, is a major contributor to this burden, representing the fourth leading cause of death worldwide [2]. Extracorporeal membrane oxygenation (ECMO) has been used as a life-support tool for critically ill patients who can no longer survive with optimal medical therapy. However, there is ongoing controversy over whether patients on ECMO should receive lung transplantation [3].

Lung transplantation remains the only curative treatment for end-stage pulmonary disease. While the use of decellularized lung scaffolds has shown promise in regenerative medicine, progress is constrained by limited donor availability and inconsistencies in scaffold quality [4,5]

In this work, we investigate how biobased polymers can effectively be used in lung tissue engineering. The native lung extracellular matrix (ECM) is a macromolecular structure with unique properties, that provides mechanical support, stability and elastic recoil for different pulmonary cells. The ECM plays a key role in lung development, remodelling, repair, and the maintenance of tissue homeostasis [6]. Studying viscoelastic biomaterials that could potentially replicate the lung ECM might lead to the development of models and, ultimately, real-life solutions for pulmonary diseases.

In this study, we assess the morphological, mechanical, and flow properties of biopolymers, as cellulose based ones, with potential to be used for lung tissue regeneration. Rheological measurements, microscopy techniques, and spectroscopy methods have been used to characterise the polymers under study. Results show that the mechanical properties of the polymers under study can be adjusted by changing concentration, molecular weight and adding physical crosslinkers. Due to lungs complex structure, engineering lung tissue is challenging and needs to be further explored.

References:

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