

Influence of the working parameters on the morphological properties and *in vitro* performance of supercritical CO₂ foamed bone scaffolds

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The high prevalence of bone diseases compromising the integrity of the osseous tissue and the increasing incidence of fortuitous severe fractures represent a global healthcare concern. [1]. The development of bone grafts from synthetic biopolymers, known as scaffolds, offers a promising outlook for the complete recovery of the bone functionality by promoting the self-healing capacity of the damaged tissue. Particularly, supercritical (sc-) CO₂-assisted foaming has been established as a versatile and efficient technology for the production of solvent-free scaffolds with remarkable *in vivo* outcomes [2].

Sc-foaming is a complex dynamic process with several processing parameters influencing the end structure of the scaffolds (porosity, pore size distribution and interconnectivity), but with a paucity of information to model this relation [3]. In this work, a combination of complementary characterization techniques, advanced X-ray microtomography (μ -CT) and mercury intrusion porosimetry (MIP) were performed to evaluate the effect of the sc-CO₂ foaming working parameters (temperature and soaking time) on the morphological properties of poly(ϵ -caprolactone) (PCL) scaffolds. From a step-forward point of view to its clinical use, *in silico* modelling of the cell infiltration capacity in the obtained PCL scaffolds was carried out and validated *in vitro* using mesenchymal stem cells (MSCs) to define the feasible operating window to obtain bone grafts with enhanced performance.

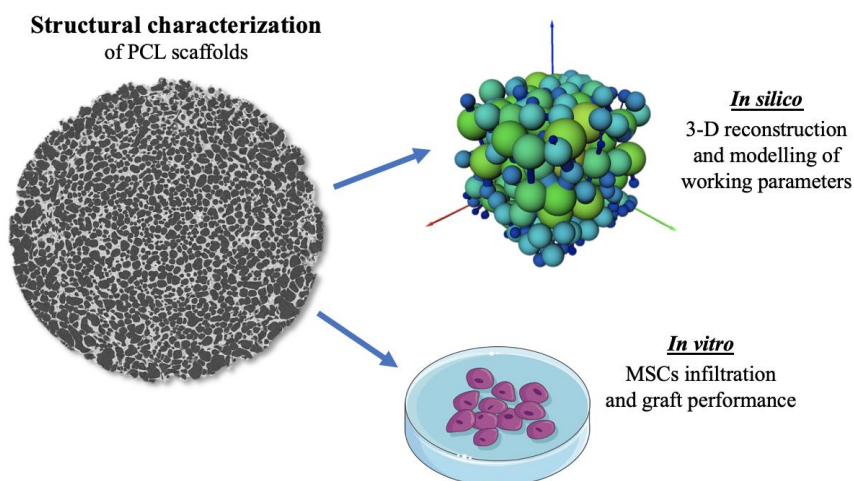


Figure 1. Workflow of the study of the sc-foamed PCL scaffolds. From the structural characterization to the *in vitro* assessment as synthetic bone grafts.

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References:

1. García-González *et al.* *Bioconjugate Chem.* **2015**, *26*, 1159–1171.
2. Santos-Rosales *et al.* *Polymers* **2020**, *12*, 533.
3. Santos-Rosales *et al.* *The Journal of Supercritical Fluids* **2020**, *166*, 105012.

