Development of an eco-friendly Thermal Induced Phase Separation (TIPS) process assisted by supercritical CO2 for the production of PLA scaffolds with tunable structural and mechanical properties

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Résumé en anglais	Many routes are nowadays utilized for the production of PLA scaffolds. In this study, a relative large scale of scaffolds was produced combining thermal induced phase separation and supercritical CO2 as a green alternative drying. The phase separation between polylactic acid and 1,4-dioxane was monitored by adjusting the process parameters such as the polymer concentration, the molecular weight, the solvent power and the cooling conditions. The morphologic changes occurring during the phase separation were analyzed by scanning electron microscopy. Structural and mechanical properties of scaffolds were correlated and it was possible to tune them depending on the process parameters. Moreover, an environmental analysis of the thermal induced phase separation (TIPS) process and the comparison between supercritical CO2 and the traditional freeze drying technologies were investigated. This work is the first known attempt to conduct the life cycle assessment (LCA) methodology on TIPS process and the polylactic acid scaffolds production. The results of the LCA have demonstrated that using supercritical-CO2 drying technology allows to reduce by at least 50 % the environmental impact of the whole process and to drastically diminish the production time.
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