A particle-agglomeration method for the preparation of 3D chitin-based hybrid matrices

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Hybrid materials have an immense potential for applications in a variety of advanced technologies, both as structural materials, as well as functional materials in biomedical applications. The sustainable development of hybrid materials is moving towards the use of green chemistry and clean technologies, namely by the use of natural polymers, sol-gel processes, ionic liquids (ILs) and supercritical fluids.
In this work chitin-based hybrid 3D structures were prepared by particle agglomeration associating the use of an IL and a sol-gel process. Bioactive particles were produced dissolving chitin in an IL and precipitating the solution in a bath containing tetraethylorthosilicate/water/ethanol/hydrochloric acid. Particle agglomeration was promoted by critical point drying as particles were loaded and pressed in a mould together with a gellan gum solution which enhanced the agglomeration and provided mechanical strength to the system. At the same time it is possible to impregnate the particles with an active compound. Ibuprofen was chosen as a model drug and impregnation was successfully achieved. Chitin-based materials were characterized in terms of their morphological and mechanical properties, sustained release ability, bioactivity and biocompatibility. The findings suggest that this strategy is feasible and advantageous to process hybrid chitin 3D matrices with both functional and structural characteristics that make then suitable for regenerative medicine applications.