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3D Printing and nanocomposite gels as a new challenge in tissue repair and regeneration

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Over the past years, polymer-based materials have attracted research interest in the field of tissue repair and regeneration. Porous bioactive scaffolds with controlled properties can be obtained by processing polymer-based materials, as “solids” or injectable formulations.

Design and applications of injectable systems and hydrogel-based composites able to promote the regeneration of soft tissues, trying to reduce surgical invasiveness and to enhance efficient biomolecular interactions with cells, is a crucial aspect for damaged tissue repair. Furthermore, in order to repair bone, cartilage, intervertebral disc, adipose tissue, neural, and cardiac tissue, hydrogel-based materials have been widely analyzed as cell delivery systems providing a controlled release of drugs, proteins, cells, gene and other immobilized biomolecules. The suitable combination of 3D scaffold with hydrogels can provide high performance and functional systems, also focusing the attention on the possibility to control drugs or bioactive agent release.

In this scenario, 3D polymeric and composite rapid prototyped scaffolds were properly designed and developed, by means of rapid prototyping technique. Furthermore, different formulation of collagen and collagen-low molecular weight hyaluronic acid (LMWHA) were selected and combined with 3D scaffolds. Micro-computed tomography and compression tests were performed in order to analyze the morphological features and mechanical performances of 3D structures, respectively. On the other hand, rheological and injectability tests were performed in order to obtain important information on the functional properties of the injectable systems in terms of viscoelasticity and flow behavior. Biological analyses have also highlighted interesting information on cell-material interaction.

Biography

Teresa Russo obtained a PhD in Materials and Structures Engineering (Biomaterials) at the University of Naples, Italy. She is as a researcher of the Institute of Polymers, Composites and Biomaterials (IPCB) – National Research Council of Italy and her work is mainly focused on the possibility to combine Additive Manufacturing technologies, electrofluidodynamic techniques and multifunctional injectable gels for the optimization of multifunctional devices for tissue repair and regeneration. She is currently author of national and international papers, different book chapter and communications in international and national conferences. She has also been serving as an editorial board member of reputed journals.

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