Proceedings of the 3rd World Congress on New Technologies (NewTech'17)
Rome, Italy – June 6 – 8, 2017
Paper No. ICBB 114
ISSN: 2369-8128
DOI: 10.11159/icbb17.114

Collagen Based Hydrogels with Antimicrobial Activity

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Extended Abstract

3D printing and molecular 3D printing have emerged all but recently as techniques for the development of new types of engineered scaffolds for biomedical applications. Those applications are however strictly tied with the biocompatibility, non-compatible materials leading to infection, rejection of the implanted device by the organism and need of surgical removal. Unfortunately, after many research fields have developed sufficiently, the biocompatibility has been proved to be tied not only to the chemical characteristics of the device, but also to the physical 3D surface of the material, some materials being more prone to bacterial infection than others. Thus, the use of a biocompatible substance alone does not guarantee the success of the implant, if the chemical structure is not correlated with the intrinsic physical surface of the organ or portion of organ that needs to be replaces or whose function needs regeneration. The physical 3D structure of the organ can now be mimicked through the use of modern 3D printers which allow the formation of materials with micro and nanometric printed patterns. The use of antibiotics that would prevent the formation of microbial films is also an asset, in many cases leading to an extension of the period between rejections. In this study we aim to produce 3D scaffolds using collagen and hydroxyapatite, and to test the release properties of these scaffolds for antibiotic agents. The scaffolds will be constructed using a 3D molecular printer provided by EnvisionTEC©. Direct printing of collagen scaffolds without a reinforcing agent has proven quite difficult, due to the difficult printability of collagen, many times a support structure being employed, however in this study we are aiming to develop a 3D collagen/hydroxyapatite structure without the use of support structures, and in order to achieve this goal we will finely tune a variety of instrumental parameters, including printing temperature (temperature of the printing head and of the printing support), printing speed and pressure of the printing head. The collagen/hydroxyapatite will be cooled in the fridge for 24 hours before printing in order to obtain a stable temperature throughout the material. The release behaviour of the scaffolds will be tested using HPLC-DAD (high pressure liquid chromatography – diode array detection). The scaffold loaded with antibiotic will be immersed in water, and samples will be drawn at appropriate time intervals. The samples concentration will be calculated using a calibration curve plotted using known concentrations.

***Keywords*:** 3D scaffolds, collagen, hydroxyapatite, antimicrobian activity

Acknowledgements

The present work was possible due to the EU-funding grant POSCCE-A2O2.2.1-2013-1, Project No. 638/12.03.2014, code *SMIS-CSNR 48652*. The financial contribution received from the national project 'Composite hydrogels based on inorganic nanoparticles and collagen with prolonged antimicrobial activity for the prevention of wound infections (SANIMED)'', (PN-III-P2-2.1-PTE-2016- 0177) is also highly acknowledged.

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