Quantitative study on the 3D printing of scaffolds based on alginate in the field of biomedical engineering and their physicochemical characterization

R. Sfondyla[1], A. Argyros[2,3], N. Michailidis[2,3,*], A. Aggeli[1,3,*]

[1]Department of Chemical Engineering, Aristotle University of Thessaloniki, Thessaloniki, Greece

[2]Department of Mechanical Engineering, Aristotle University of Thessaloniki, Thessaloniki, Greece

[3]Centre for Interdisciplinary Research and Innovation (KEDEK), Thermi, Greece

(nmichail@auth.gr , aggeli@auth.gr)*

ABSTRACT

The 3D printing of scaffolds is one of the methods used in medicine to replace tissues that may be damaged or in case that there is a lack of transplants, due to their ability to mimic the extracellular matrix of the tissues found in the human body and to be replaced in order to be a means of growth, proliferation and differentiation of progenitor cells that will contribute to tissue regeneration.[1] One of the materials used as structural features for 3D printing is alginate because it is a biocompatible and biodegradable material.[2] On the contrast, it is characterized by poor rheological and mechanical properties with the risk of incorrect and delayed integration of the material into the body resulting in possible contamination of the surrounding tissues.[3] However, its rheological properties can be easily modified through the process of ion crosslinking which can greatly affect its cytocompatibility. The aim is to present a systematic quantitative study to determine the appropriate compositions of alginate and metal ions in order to properly carry out the ion crosslinking procedure in order to form stable 3D printed structures and their subsequent physicochemical characterization with a wide range of complementary techniques.[4] This particular study paves the way for other similar studies focusing on the novel application of 3D printed biopolymers for the creation of biomedical devices.

KEYWORDS: 3D printing, alginate, ion crosslinking, quantitative study, medical devices

REFERENCES

[1] Behere I, Ingavle G. (2022). *J Biomed Mater Res A*. 110(2), 443-461.

[2] Axpe E, Oyen ML. (2016). *Int J Mol Sci*. 17(12).

[3] Gonzalez-Fernandez T, Tenorio AJ, Campbell KT, Silva EA, Leach JK. (2021), *Tissue Eng Part A*. 27(17-18), 1168-1181.

[4] Łabowska MB, Cierluk K, Jankowska AM, Kulbacka J, Detyna J, Michalak I. (2021). *Materials*. 14(4).