World Academy of Science, Engineering and Technology
International Journal of Bioengineering and Life Sciences
Vol:16, No:12, 2022

Multiple Plant-Based Cell Suspension as a Bio-Ink for 3D Bioprinting Applications in Food Technology

Authors : Yusuf Hesham Mohamed

Abstract : Introduction: Three-dimensional printing technology includes multiple procedures that fabricate three-dimensional objects through consecutively layering two-dimensional cross-sections on top of each other. 3D bioprinting is a promising field of 3D printing, which fabricates tissues and organs by accurately controlling the proper arrangement of diverse biological components. 3D bioprinting uses software and prints biological materials and their supporting components layer-by-layer on a substrate or in a tissue culture plate to produce complex live tissues and organs. 3D food printing is an emerging field of 3D bioprinting in which the 3D printed products are food products that are cheap, require less effort to produce, and have more desirable traits. The Aim of the Study is the development of an affordable 3D bioprinter by altering a locally made CNC instrument with an open-source platform to suit the 3D bio-printer purposes. Later, we went through applying the prototype in several applications regarding food technology and drug testing, including the organ-On-Chip. Materials and Methods: An off-the-shelf 3D printer was modified by designing and fabricating the syringe unit, which was designed on the basis of the Milli-fluidics system. Sodium alginate and gelatin hydrogels were prepared, followed by leaf cell suspension preparation from narrow sections of Fragaria's viable leaves. The desired 3D structure was modeled, and 3D printing preparations took place. Cell-free and cell-laden hydrogels were printed at room temperature under sterile conditions. Post printing curing process was performed. The printed structure was further studied. Results: Positive results have been achieved using the altered 3D bioprinter where a 3D hydrogel construct of two layers made of the combination of sodium alginate to gelatin (15%: 0.5%) has been printed. DLP 3D printer was used to design the syringe component with a transparent PLA-Pro resin for the creation of a microfluidics system having two channels altered to the double extruder. The hydrogel extruder's design was based on peristaltic pumps, which utilized a stepper motor. The design and fabrication were made using DIY-3D printed parts. Hard plastic PLA was the material utilized for printing. SEM was used to carry out the porous 3D construct imaging. Multiple physical and chemical tests were performed in order to ensure that the cell line was suitable for hosting. Fragaria plant was developed by suspending Fragaria's cells from its leaves using the 3D bioprinter. Conclusion: 3D bioprinting is considered to be an emerging scientific field that can facilitate and improve many scientific tests and studies. Thus, having a 3D bioprinter in labs is considered to be an essential requirement. 3D bioprinters are very expensive; however, the fabrication of a 3D printer into a 3D bioprinter can lower the cost of the bioprinter. The 3D bioprinter implemented made use of peristaltic pumps instead of syringe-based pumps in order to extend the ability to print multiple types of materials and cells.

Keywords : scaffold, eco on chip, 3D bioprinter, DLP printer
Conference Title : ICABSE 2022 : International Conference on Advances in Biologic Scaffold Engineering
Conference Location : Cairo, Egypt
Conference Dates : December 15-16, 2022