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Ibrahim T. Ozbolat, Monika Hospodiuk

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Current Advances and Future Perspectives in Extrusion-based Bioprinting

Ibrahim T. Ozbolat and Monika Hospodiuk

Engineering Science and Mechanics Department, The Pennsylvania State University, University Park, PA, 16802

The Huck Institutes of the Life Sciences, The Pennsylvania State University, University Park, PA, 16802

Abstract

Extrusion-based bioprinting (EBB) is a rapidly growing technology that has made substantial progress during the last decade. It has great versatility in printing various biologics, including cells, tissues, tissue constructs, organ modules and microfluidic devices, in applications from basic research and pharmaceutics to clinics. Despite the great benefits and flexibility in printing a wide range of bioinks, including tissue spheroids, tissue strands, cell pellets, decellularized matrix components, micro-carriers and cell-laden hydrogels, the technology currently faces several limitations and challenges. These include impediments to organ fabrication, the limited resolution of printed features, the need for advanced bioprinting solutions to transition the technology bench to bedside, the necessity of new bioink development for rapid, safe and sustainable delivery of cells in a biomimetically organized microenvironment, and regulatory concerns to transform the technology into a product. This paper, presenting a first-time comprehensive review of EBB, discusses the current advancements in EBB technology and highlights future directions to transform the technology to generate viable end products for tissue engineering and regenerative medicine.

Keywords: Extrusion-based bioprinting, biofabrication, tissue and organ printing, bioink