World Academy of Science, Engineering and Technology
International Journal of Medical and Health Sciences
Vol:16, No:11, 2022

Improving Alginate Bioink by Recombinant Spider-Silk Biopolymer

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Abstract : Alginate, a natural linear polysaccharide polymer extracted from brown seaweed, is extensively applied due to its biocompatibility, all- aqueous ease of handling, and relatively low costs. Alginate easily forms a hydrogel when crosslinked with a divalent ion, such as calcium. However, Alginate hydrogel holds low mechanical properties and is cell-inert. To overcome these drawbacks and to improve alginate as a bio-ink for bioprinting, we produced a new alginate matrix combined with spider silk, one of the most resilient, elastic, strong materials known to men. Recombinant spider silk biopolymer has a sponge-like structure and is known to be biocompatible and non-immunogenic. Our results indicated that combining synthetic spider-silk into bio-printed cell-seeded alginate hydrogels resulted in improved properties compared to alginate: improved mechanical properties of the matrix, achieving a tunable gel viscosity and high printability, alongside prolonged and higher cell viability in culture, probably due to the improved cell-matrix interactions. The new bio-ink was then used for bilayer bioprinting of epithelial and stromal endometrial cells. Such a co-culture model will be used for the formation of the complex endometrial tissue for studying the embryo implantation process.

Keywords : cell culture, tissue engineering, spider silk, alginate, bioprinting
Conference Title : ICBBTS 2022 : International Conference on Biomaterials, Bioprinting and Tissue Spheroids
Conference Location : Jerusalem, Israel
Conference Dates : November 29-30, 2022