SELECTION OF POLY(ε-CAPROLACTONE) SCAFFOLDS DESIGN FOR TRIPLE NEGATIVE BREAST CANCER 3D CULTURE

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Abstract

Cells are traditionally cultured *in vitro* in two dimensions (2D), but it presents some limitations, as lost of their *in vivo* morphology and reduction of cell-cell and cell-extracellular matrix (ECM) interactions. Hence, three-dimensional (3D) cell culture models, such as scaffolds, are being developed to overcome the aforementioned restrictions and to mimic the physiological tissue environment. Cancer Stem Cells (CSCs) are a subpopulation of a tumor or cancer cell line, which are responsible for metastasis and tumor recurrence. They have the capacity to initiate tumor growth and maintain long term self-renewal, as well as they exhibit resistance to conventional therapies. Their study in 2D culture is limited due to the induction of differentiation during CSCs propagation. Interestingly, 3D culture systems can avoid it, besides they can produce an enrichment of CSCs population.

In the present study, scaffolds were manufactured by Fused Filament Fabrication (FFF) technique with the BCN3D Sigma 3D printer. Five fabrication parameters were selected to obtain 27 scaffolds designs, which have different pore size and filament diameter. The tested parameters were layer height, infill density, infill pattern, infill direction and material flow. Poly(ε-caprolactone)(PCL) was the material used to manufacture scaffolds. PCL is commonly used for tissue engineering applications due to its good mechanical characteristics, as its low melting temperature and low biodegradability, good biocompatibility, FDA approval and low cost. MDA-MB-231 triple negative breast cancer (TNBC) cells were cultured on FFF scaffolds to analyze cell efficiency. Therefore, fabrication parameters of scaffolds with highest cell proliferation rates were chosen to accommodate 3D cancer cell culture and further analyze the CSCs enrichment. The enrichment of this malignant subpopulation would facilitate future experiments to find and develop new therapeutic strategies against CSCs.

Keywords—PCL, scaffolds, three-dimensional cell culture, 3D Printing

Professional Biography

Emma Polonio Alcalá studied the Bachelor's degree in Biotechnology and completed the Master's degree in Molecular Biology and Biomedicine at the age of 22 years, both from University of Girona. Her degree's project was *A new synthetic inhibitor of the fatty acid synthase (FASN) with cytotoxic effects* and her master's project was entitled *Effects of the new antitumoral drug ABTL0812 in preclinical models of triple negative breast cancer*. Both projects, qualified with an excellent mark, were performed in the New Therapeutic Targets Laboratory (TargetsLab) research group in the Department of Medical Sciences from University of Girona. Some of her results were published in a congress proceeding (Giro-Perafita *et al.*, 2017). Nowadays, her research is also linked with TargetsLab and it is focused on the design and fabrication of biocompatible scaffolds for three-dimensional breast cancer cell culture, in collaboration with the Product, Process and Production Engineering Research Group from University of Girona.



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