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MODELLING THE FUTURE

UTAustin Portugal

Development of a microfluidic platform for the production of cell-loaded microcarriers

NANOTECHNOLOGIES
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ABSTRACT

- **Non-healing wounds** affect millions of people worldwide. Therapeutic costs range from €6,000 to €10,000 per patient and per year
- **Mesenchymal stromal cells** (MSC) and **growth factors** have shown to offer promising solutions for non-healing wounds therapeutics throughout the years
- **Alginate microcarriers** have gained attention since they provide protection and support for encapsulated cells, enhancing their viability and functionality
- **Microfluidics** offers several advantages for MSC and growth factors **encapsulation**, including biocompatibility, scalability and continuous microcarriers production
- ***The project focuses on the development of a microfluidic platform for co-encapsulation of MSC and growth factors within alginate microcarriers***

RESULTS AND DISCUSSION

- The platform already demonstrated successful alginate formulation and microcarriers production at **307 ± 24 microcarriers/min** by flowing two immiscible fluids through a T-junction microchannel
- But unsatisfactory microcarriers purification and scanning electron microscopy analysis support the need of integrating a downstream crosslinking step from the T-junction to recover spherical, stable and gelled alginate microcarriers (Fig. 1)
- Up to now, MSC and growth factors were successfully co-encapsulated by dripping gelation (Fig. 2)
- After 5 days-storage at 4 °C, cells were released and analyzed. Cell viability decreased over time, with **60% of released cells remaining alive for 120 h** while all free cells dying by 72 h. This demonstrates the protection of alginate microcarriers over time

METHODOLOGIES

- The acrylic T-junction microfluidic device was designed and fabricated by micromilling, characterized and optimized to integrate a downstream purification step
- Cell viability and recovery after storage for 120 h at 4 °C were assessed using flow cytometry and trypan blue exclusion test

Figure 1

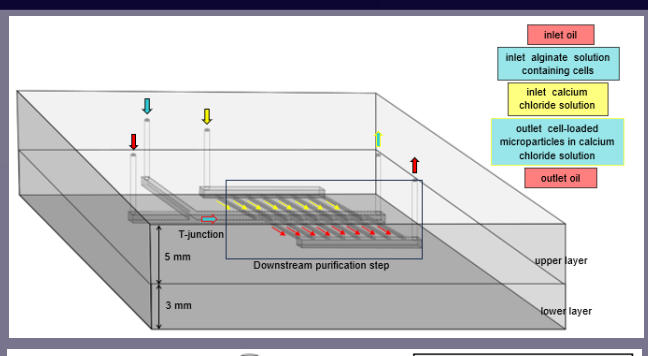
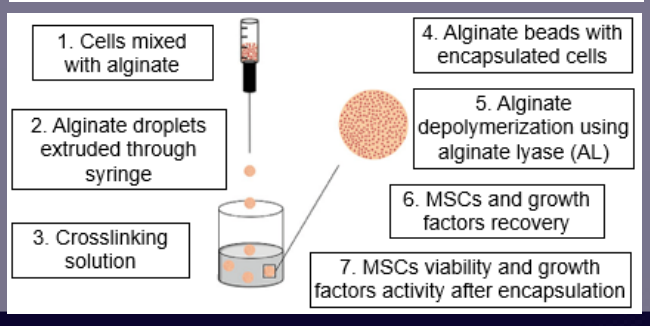


Figure 2



FUTURE PERSPECTIVES

- Optimization of the microfluidic device
- Co-encapsulation of MSC and growth factors using the microfluidic device
- Analysis of MSCs viability and growth factor activity
- Optimization of microcarriers formulation
- Incorporation of microcarriers into the hydrogel for wound healing applications

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Contact me

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