Georgia Tech Research Corporation
Technologies Available for LICENSING
OFFICE OF TECHNOLOGY LICENSING
https://licensing.research.gatech.edu | techlicensing@gtrc.gatech.edu

Microfluidic Droplet for Drug Delivery and Therapeutic Applications

A hydrogel microspheres using biocompatible synthetic material that can encapsulate viable cells and bioactive molecules using a novel microfluidic droplet system

Inventors at Georgia Tech have demonstrated that hydrogel microspheres using biocompatible synthetic material can encapsulate viable cells and bioactive molecules using a novel microfluidic droplet system. Cells, biomolecules, and drugs are suspended in liquid polymer solution and then extruded in droplet-form via microfluidics into a continuous phase solution containing an oil-crosslinker mixture. This unique method creates well-defined structures that allow for quick reactions and in situ delivery to the patient. The microspheres are comprised of biocompatible polyethylene glycol-based (PEG) polymer, and the diameter size of the beads (ranging from 10-1000 micrometers) can be fine-tuned by adjusting the nozzle dimensions and flow rates of the microfluidic droplet system. The hydrogel microspheres and their degradation by-products are non-toxic and do not elicit an inflammatory response.

Summary Bullets

- Viable, cellular micro-environments requiring precise control are achieved using hydrogel microspheres with diameter sizes ranging from 10-1000 micrometers
- A protective, semi-permeable capsule encases the cells and biomolecules
- Release rates of encapsulated biomolecules or drugs are controlled by adjusting the polymer parameters used to fabricate hydrogel microspheres

Solution Advantages

- Viable, cellular micro-environments requiring precise control are achieved using hydrogel microspheres with diameter sizes ranging from 10-1000 micrometers
- A protective, semi-permeable capsule encases the cells and biomolecules
- Release rates of encapsulated biomolecules or drugs are controlled by adjusting the polymer parameters used to fabricate hydrogel microspheres

Potential Commercial Applications

- Injectable hydrogels integrating pancreatic islets and VEGF for islet vascularization
- Micro-coatings for immuno-isolation

- Cell-based drug delivery systems for treatment

Background and More Information

Micro-encapsulation of cells in semi-permeable polymer networks is a promising approach for avoiding immunosuppressive therapy in allogeneic, xenogeneic and genetically modified cell transplantation. Current technology uses an electrostatic droplet generator and alginate-based polymers. Major drawbacks to this system are that cellular micro-spheres are limited to larger diameter sizes (>200 micrometers) and alginate-based polymers provide minimal control over the cellular micro-environment. By utilizing advanced synthetic polymers, bioactive molecules can be chemically conjugated, and the cellular micro-environment can be fine-tuned based on therapeutic application.

Inventors

- Dr. Andrés García
  Executive Director - Georgia Tech, Parker H. Petit Institute for Bioengineering and Bioscience
- Devon Headen
  Graduate Research Assistant - Georgia Tech School of Mechanical Engineering
- Edward Phelps
  Graduate Research Assistant - Georgia Tech School of Mechanical Engineering
- Dr. Guillaume Aubry
- Dr. Hang Lu
  Assistant Professor - Georgia Tech School of Chemical and Biomolecular Engineering

IP Status

Patent has issued : US9381217B2

Publications

Protease-degradable microgels for protein delivery for vascularization, Biomaterials - January 2017

Images

Visit the Technology here:
Microfluidic Droplet for Drug Delivery and Therapeutic Applications