Capillary-Channeled Polymer Fibers for Isolating Exosomes (2018-006)

Efficient biological nano-entity isolation methodology for research, medical diagnostics, and biopharmaceutical delivery.

Market Overview

This capillary-channeled polymer (C-CP) fiber technology is a cost efficient and highly selective method to isolate exosomes facilitating widespread use of these cellular fragments for biomarker research, medical diagnostics, and targeted delivery of therapeutics. Exosomes are lipid membrane-derived vesicles secreted by most types of cells, which hold promise for diagnosing disease, as they retain the biomarkers of their parent cell. By analyzing exosomes, the presence of diseased cells may be detected prior to clinical onset of chronic diseases. Currently available methods of exosome isolation, like differential centrifugation in which particles are separated from a solution based on their specific size, shape, and density, often compromise the structure of the vesicle and are also time-consuming and costly on a clinical scale. Clemson University researchers have developed a novel, high-yield, low-cost method for isolation and collection of these nano-entities that can be customized to isolate various types of exosomes.

Technical Summary

The use of polyethylene terephthalate (PET) capillary-channeled polymer (C-CP) fibers in a hydrophobic interaction chromatography (HIC) protocol has shown promise in efficiently and effectively isolating exosomes in laboratory settings, with scalable potential. The technology demonstrates the ability to collect nano-entities on a much faster time scale with comparable yields and size distributions compared to traditional methods of exosome isolation, including differential centrifugation and the ExoEasy Maxi kit (QIAGEN). The versatility of PET C-CP fibers allows surface modifications for exosome type-specific isolation, which would prove useful in medical diagnostics. The fibers provide opportunity for scalable separations, allowing for implementation in small, spin-down columns as well as on a preparative scale for bulk exosome isolation from bioreactors. Exosome isolation on such a large scale would enable their potential use as natural, biocompatible drug delivery vehicles.

Application

Diagnostics; Targeted Drug Delivery

Development Stage

Clinical proof of concept (cervical cancer)

Advantages

- Efficient low cost method to collect exosomes compared to existing techniques
- Fibers can isolate both specific and generic exosomes, allowing for highly selective collection
- Method does not compromise the physical structure of targeted exosomes, enabling their use for medical diagnostics and therapeutic drug delivery

App Type	Country	Serial No.	Patent No.	CURF Ref. No.	Inventors
Provisional	United States	62/626,398	NA	2018-006	Dr. R. Kenneth Marcus Dr. Terri F. Bruce

About the Inventors

Dr. R. Kenneth Marcus

Professor of Chemistry at Clemson University

Dr. R. Kenneth Marcus earned his B.S. degrees in chemistry and physics from Longwood College and an analytical chemistry Ph.D. in 1986 from the University of Virginia. He serves on the editorial advisory board for three international journals and was the recipient of the 2001 S.C. Governor's Award for Excellence in Science Research. In 2010, Dr. Marcus was named a Fellow of the Royal Society of Chemistry (FRSC), in 2012 a Fellow of the American Association for the Advancement of Science (FAAAS), and in 2016 a Fellow of the Society for Applied Spectroscopy, and a 2018 Fellow of the National Academy of Inventors (FNAI). His research interests revolve around the development and application of new plasma techniques for the atomic spectroscopic analysis of diverse materials, as well as novel platforms for bioseparations, including proteins and exosomes.

Dr. Terri F. Bruce

Director of the Clemson Light Imaging Facility

Dr. Terri Bruce serves as the director of Clemson University's Light Imaging Facility. She holds B.S. degrees in Chemical Engineering and Applied Biology from the Georgia Institute of Technology and received her Ph.D in Biological Sciences in 2009 from Clemson University, where she specialized in Cell Biology. She has over 12 years of industrial experience, including process design engineering and product development. In addition, Dr. Bruce has over 9 years of teaching experience at the collegiate level and was a former recipient of the Clemson University Outstanding Teaching Assistant of the Year Award.

Related Publications:

- Exosome isolation and purification via hydrophobic interaction chromatography using a polyester, capillary-channeled polymer fiber phase
- Overload Effects in Reversed Phase Protein Separations using Capillary-Channeled Polymer Fiber Columns

For more information about this technology, please contact:

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