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Improved High-Density Functionality of Polymer Surfaces (2015-044)

Enhances Chemical Versatility and Binding Capacity of Polymer Surfaces for use in Protein Separations and Downstream Processing

Market Overview

This easy modification creates polymer surfaces with high-density functionality by using polyethylene terephthalate (PET) capillary-channeled polymer (C-CP fibers) as the support material. The low-cost modification provides the capability for fast protein separations for proteomics applications and downstream processing due to the improved binding capacity. Protein therapeutics is experiencing phenomenal growth and is poised to reach a market value of $1,463 million by 2020. While this market has seen much improvement and growth in the last decade, the development of high efficiency, low-cost stationary phases for protein separation continues to be an area of interest and opportunity. There are many forms of support phases employed in downstream processing, but the more conventional materials are lacking in inherent production throughput. Clemson University researchers have developed a modification by implementing a serial, polymer cross-linking procedure and polymerization to create PET C-CP fiber surfaces with higher functionality and binding capacity while maintaining efficient hydrodynamics.

Technical Summary

This modification has potential for highthroughput analytical protein separations and downstream processing. The PET C-CP fibers are treated in a relatively straightforward manner with polyethylenimine (PEI) to generate polyaminelayers on the fiber surfaces. 1,4-Butanedioldiglycidyl ether (BUDGE) was then used to cross-link the PEI on the fiber surfaces and further increase the PEI. Multiple enhancements of chemical versatility and higher binding capacity do not affect the already highly efficient hydrodynamic transport properties of C-CP fibers. The polymer PEI-BUDGE layer also does not inhibit the mass transfer kinetics, allowing for separations at the highest linear velocity without compromise in chromatographic quality. The high column permeability and low cost of C-CP fiber chromatography columns makes a promising choice for fast protein separations at various scales.

Application

Chromatography; Proteomics, Protein Therapeutics, Bioprocessing

Development Stage

Preliminary Prototype

Advantages

- Utilizes PET C-CP fibers treated with simple reactants, improving binding capacity and chemical versatility
- Does not inhibit mass transfer kinetics, allowing for separations at the high linear velocity (~100 mm $s_{\sim}{}^{1}$)

App Type	Country	Serial No.	Patent No.	CURF Ref. No.	Inventors
Utility	United States	62/131,431	NA	2015-044	Dr. Richard Kenneth Marcus Liuwei Jiang
Provisional	United States	15/067,339	NA		

About the Inventor

Dr. Richard Kenneth Marcus

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Dr. Marcus earned his Ph.D. in analytical chemistry from the University of Virginia. Dr. Marcus was named a Fellow of the Royal Society of Chemistry (FRSC) in 2010 and a Fellow of the American Association for the Advancement of Science (FAAAS) in 2012. He was also the recipient of the 2001 S.C. Governor’s Award for Excellence in Science Research. His research interests focus on new plasma techniques for the atomic spectroscopic analysis and liquid chromatography.

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