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Clemson University Research Foundation

Improved Chemical Functionality of Nylon C-CP Fibers via Microwave Energy (2016-042)

Nylon-6 C-CP fibers exhibit improved chemical functionality for use as chromatographic stationary phases

Market Overview

These modified nylon-6 capillary-channeled polymer (C-CP) fibers exhibit greater chemical versatility and higher binding capacity without compromising the physical structure that provides very high throughput and yield in analytical protein separations and downstream processing in comparison to conventional phases. This modification uses microwave-assisted grafting polymerization to enhance the nylon-6 C-CP fibers for use as chromatographic stationary phases. Protein purification, which includes ion-exchange chromatography, is a growing market expected to reach $6,370 million by 2020. Due to its lower degree of hydrophobicity than polypropylene and polyester, nylon-6 C-CP fibers are of great interest for use in hydrophobic interaction chromatography and mixed-mode stationary phases for protein separations. However, when researchers attempt standard nylon surface modifications they find it causes structural damage, compromising the fibers. Clemson University researchers have developed a microwave-assisted modification to enhance nylon-6 C-CP fibers without compromising the fiber structure. The modified fibers demonstrate greater chemical versatility and higher binding capacities without sacrificing the highly efficient hydrodynamic transport properties of C-CP fiber columns.

Application

Chromatography; downstream processing; protein analytics

Stage of Development

Prototype

Advantages

- Exhibits higher ligand densities than other nylon modifications, allowing greater chemical versatility and higher binding capacity
- Reduces downstream processing costs, enhancing utility of C-CP fiber phases in various applications
- Surface is protein-friendly and has a high level of hydrophilicity

Technical Summary

Clemson University researchers have modified nylon-6 C-CP fibers with sulfonic acid by a microwave-assisted grafting polymerization of 2-acrylamido-2-methylpropanesulfonic acid (AMPS) to yield a strong cation exchange (SCX) phase for protein separations. The same chemistry, using acrylic acid, provides for a high-density weak cation exchange (WCX) surface. The combined use of simple vinyl group chemistry in a microwave oven affords much greater binding capacity, while imparting the vital ability to affect ion exchange separations in a cost-effective manner. The large number of commercially available vinyl monomers makes the microwave-assisted grafting polymerization a very versatile, but simple method to offer nylon C-CP fibers different types of surface chemistry. This microwave-assisted grafting polymerization holds promise for creation of phases for both analytical and preparative scale separations, with the promise of further diversification of the potential C-CP fiber surface modalities.

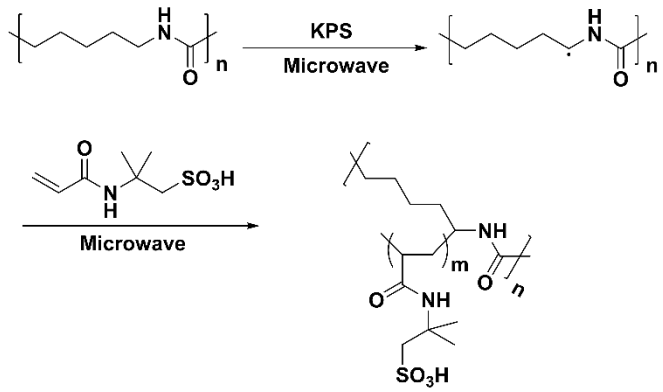

Figure 1: Exhibits a strong cation exchange surface

App Type	Country	Serial No.	Patent No.	CURF Ref. Number	Inventors
Provisional	United States	62/352,247	NA	2016-042	Richard Kenneth Marcus, Liuwei Jiang

About the Inventor

Dr. Marcus is a Professor of Analytical Chemistry in the Department of Chemistry at Clemson University. He 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, a Fellow of the American Association for the Advancement of Science (FAAAS) in 2012, and a Fellow of the Society for Applied Spectroscopy (FSAS) in 2016. 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 atomic spectroscopic analysis and liquid chromatography.

For More Information

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