Analytical Instrumentation, Methods & Materials

Use of Nanomaterials to Enrich Phosphopeptides for Mass Spectrometry-Based Proteomics

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing materials and methods to enrich low abundance post-translationally modified proteins, specifically phosphopeptides, for use in mass spectrometry-based proteomics.

Overview

Proteomics is a relatively new discipline that is a large scale study of proteins. It includes systematically identifying the sequence, characterizing the structure and evaluating the function of all the different proteins in cells and tissues. Research in this field is expanding quickly due to its potential for developing drugs, therapies and diagnostic methods. Mass spectrometry has emerged in recent years as the preferred experimental tool for protein identification and characterization given its sensitivity, speed, versatility and specificity.

Recently, interest has focused on characterizing proteins with complex post-translational modifications, such as protein phosphorylation, as these modifications are known to have a critical role in the function and regulation of proteins. Protein phosphorylation specifically is of interest because it has been linked to many human diseases, including cancer and heart disease. However, the application of advanced mass spectrometry methods to selectively identify and characterize the phosphorylation state of proteins has been limited given the low abundance and low stoichiometry of phosphoproteins observed in many biological environments. Therefore, a method to concentrate or enrich phosphorylated proteins/peptides to allow for effective application of mass spectrometric techniques is needed.

The Invention

UW–Madison researchers have developed a method and materials for isolating, purifying and enriching the concentration of compounds containing phosphate groups, including phosphorylated peptides and proteins. The mesoporous nanomaterials are made from transition metal oxides, which selectively and reversibly bind phosphorylated compounds. These materials are relatively easy to prepare and have nanopore structures attractive for enrichment due to large surface area, high flow-through capacity, chemical stability and robustness.

In practice, the enrichment materials are contacted with a sample containing a mixture of phosphorylated and non-phosphorylated compounds. When contacted with the mesoporous enrichment material, the phosphorylated compounds reversibly bind to the surface while the remainder of the solution passes through the column. Once separated, the phosphorylated compounds are then removed from the mesoporous metal oxide enrichment material via controlled release.

These methods and materials are highly versatile and can be used for highly efficient enrichment, purification and effective analysis of phosphorylated compounds in a variety of biological environments. They also are highly complementary to both bottom-up and top-down mass spectrometric-based protein identification methods and can be used to effectively apply these methods in the study of proteomics.

Applications

- Enrichment of phosphorylated proteins and peptides for analysis with high resolution mass spectrometry
- Use in minicolumns or pipette tip-based chromatographic products
- Potential use through *in situ* preparation to form monolithic columns

Key Benefits

- Low cost, simple and effective method for enrichment of phosphorylated peptides and proteins
- Mesoporous metal oxides are chemically stable and mechanically robust.

Additional Information

For More Information About the Inventors

- Song Jin

Tech Fields

- Analytical Instrumentation, Methods & Materials : Mass spectrometry
- Research Tools : Genomics & proteomics

For current licensing status, please contact Jennifer Gottwald at jennifer@warf.org or 608-960-9854