Fiber Optic Chromatography Sensing



Overview

Explores the challenges and potential applications of optical fiber biosensors. This review can help readers understand the latest advances in the field.

Key Takeaways

Fiber optic chromatography sensing enables real-time, in-line detection of analytes by integrating optical fiber sensors with chromatography systems, improving speed, sensitivity, and operational efficiency.

Principles of Fiber Optic Chromatography Sensing

Fiber optic chromatography sensing combines chromatographic separation with fiber-optic detection. Optical fibers transmit light to and from the sample, allowing detection of changes in refractive index, fluorescence, or surface plasmon resonance (SPR) signals as analytes elute from the column. For example, a SPR fiber-sensing probe can detect dynamic changes in the refractive index of a gel during column chromatography, enabling real-time monitoring of protein or small molecule separation.

This approach eliminates the need for manual sampling and post-separation analysis. Integration with MicrofluidicsRecent advances integrate fiber-optic sensors with microfluidic devices, allowing separation, enrichment, and detection on a single micro-device. These systems can use Raman, UV-vis, fluorescence, SPR, or localized SPR (LSPR) for detection, providing rapid, portable, and cost-effective analysis suitable for on-site applications.



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Microfluidic integration enhances sensitivity and reduces sample volume requirements, making it ideal for biological, environmental, and food safety monitoring.

Applications

Protein and Biomolecule Detection: In-line fiber-optic sensors can monitor protein aggregation, such as IgG aggregates, during affinity chromatography, providing real-time quality control in biopharmaceutical production. Environmental Monitoring: Fiber-optic sensors detect chemical or biological contaminants in water or air when integrated with separation systems. Industrial and Field Applications: Fiber-optic sensing is used for continuous monitoring of chemical processes, leveraging its flexibility, small size, and ability to operate in harsh environments.

AdvantagesReal-time, in-line detection reduces analysis time and manual intervention. High sensitivity and specificity due to functionalized fiber coatings and optical detection methods. Portability and miniaturization when combined with microfluidics, enabling on-site analysis.

Versatility across multiple analytes and detection methods, including proteins, small molecules, and environmental contaminants. Fiber optic chromatography sensing represents a powerful tool for modern analytical chemistry, combining the separation capabilities of chromatography with the precision and flexibility of optical fiber detection, suitable for laboratory and field applications alike.

Article Content

Selective enrichment for sensitivity enhancement in nanocomposite ...

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Turning Fiber into a Sensing System: The Magic of

Imagine a world where the Internet doesn''t just connect but senses—detecting earthquakes, monitoring battery health, or safeguarding

On-line dynamic detection in the column chromatography separation

In this design, we introduced a surface plasmon resonance (SPR) fiber-sensing probe into a column chromatography (CC) system to realize on-line dynamic detection in sample separation.

Recent Progress on Microfluidics Integrated with Fiber

This review introduces a micro-integrated device of microfluidics and fiber-optic sensors for on-site detection, which can detect certain or several

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Selection of Optical Fiber for Chromatographic Detectors and Remote ...

Fiber has allowed advances such as remote sensing, where in the “detection cell” no longer has to reside inside the detector itself, with dissolution sampling probes being a prime example.

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