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OFFICE OF TECHNOLOGY TRANSFER AND ENTERPRISE DEVELOPMENT

On-Chip Polarimetry for High-Throughput Screening of Nanoliter & Smaller Sample Volumes

Summary

Using microfluidic technology developed by the Bornhop Lab at Vanderbilt, this invention enables the rapid determination of the optical activity of compounds and solutions. Due to the nature of this invention, it is possible to screen a multitude of samples in a high throughput manner in less time with less material and greater accuracy than the industry standards.

Since optical activity (stereochemistry) is an intrinsic property of most biologically active molecules, most biological reactions/interactions entail a change in net optical activity. However, this property has never been used as a high throughput detection property due to poor sensitivity of the existing technology. This invention has solved the sensitivity problem and provides a new high throughput detection technology that enables direct assay of enzymatic reactions, biomolecules and/or biological interactions. This is in contrast to current state-of-the art high throughput techniques, which are not generalizable and indirect. As such, this technology will provide the ability to assay drug targets that have been "invisible" to current technologies.

Description

Polarimetry is a technique that measures the optical activity exhibited by inorganic and organic compounds in solution in a nondestructive manner. When illuminated with linearly polarized light, an optically active compound will rotate this light to the left (levorotatory (L)) or right (dextrorotatory (D)). The molecular structure and concentration of chiral molecules within a substance determines the amount of optical rotation a compound possesses. Optical activity is extremely important within the pharmaceutical industry, as the FDA will only approve those drugs that are in single enantiomer form.

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On-chip polarimetry is a technique developed within Vanderbilt as a means to measure the optical activity of a solution passing through microfluidic channels using a polarized laser beam as the light source. As the compounds flow through the channels on the chip, they cause the incident polarized laser beam to rotate in one direction or the other, depending on ratio of enantiomers present. The interaction of the laser, the sample molecules and the channel walls create interference fringe patterns, which are detected by a photodetector and analyzed via a PC to determine the optical activity of the compounds.

The invention described here is well suited to high throughput screening, having one or more microfluidic channels allowing parallelization with low volume.

Potential Market Size

This technology will benefit any industrial manufacturing or research facility that requires the rapid assessment of the optical activity of substrates.

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Current Competitive Product(s)

HPLC and gas chromatography.

Value Proposition

The ability to perform new assays for previously inaccessible drug targets will provide a means to obtain new lead compounds for pharmaceutical development.

Polarimetry is a simple, accurate and, most importantly, nondestructive method for the investigation of structure in expensive and non-duplicable samples. The pharmaceutical, chemical, essential oil, flavor and food industries use polarimetry in quality control and process control, as well as research.

The standard method of determining sample purity is highperformance liquid chromatography (HPLC), or gas chromatography. However, the best that this can achieve is a few dozen samples a day at 10% accuracy. This technology uses flowing streams and as such can be used as a detector for capillary-scale separations and high throughput methods requiring real-time analysis of small volumes.

Intellectual Property Status

US patent pending.