Nano Biosensing System

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BRIEF DESCRIPTION

Metabolites can provide real-time information about the state of a person's health. Devices that can detect metabolites are commercially available, but are unable to detect very low concentrations of metabolites. Researchers at UCI have developed surfaces that use nanosensors to detect much lower concentrations of such metabolites.

FULL DESCRIPTION

Advances in the understanding of genomics has led to the knowledge that within each person resides a unique microbial community, known as the microbiome, that encodes great metabolic and genetic diversity through dynamic sets of small molecules called metabolites. Detection of metabolites can provide real-time information about health states (i.e. glucose levels indicate diabetes, different molecules are biomarkers of respiratory distress), making them valuable in diagnosing and tracking disease progression. A method called mass spectroscopy is used to detect low levels of metabolites in research settings. This method is expensive and requires extensive training, making it inconvenient for use in clinical or other settings. Moreover, while several optical sensors for metabolite detection are commercially available, they are limited in their ability to detect low concentrations of metabolites. This is a significant hindrance as many samples contain trace amounts of metabolites that could go undetected.

To address this issue, the inventors at UCI have produced nanosensing surfaces with lower detection limits using a low-cost fabrication method. These nanosensors can detect low levels of metabolites in breath, saliva and blood samples within seconds to minutes. This method generates Surface Enhanced Raman Scattering (SERS) surfaces, which measure vibrational modes of bonds in molecules via light scattered from the molecules on surfaces, thus providing a molecular fingerprint. Thus, they can achieve higher detection levels with high reproducibility. These nanosensors can be applied to medical devices for diagnostics, but also have applications in law enforcement and environmental capacities.

SUGGESTED USES

· Detection of metabolites in biological samples (saliva, breath, blood) for the diagnosis of infections (respiratory, blood-borne, wounds).

· Detection of bacteria and other metabolites in environmental samples (air/water contamination, pollution, etc).

ADVANTAGES

· Increasing detection capability by 100-fold over commercially available sensors: achieves parts per billion detection levels with high reproducibility

· Uses low-cost fabrication method to make disposable SERS surfaces

PATENT STATUS

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OTHER INFORMATION

CATEGORIZED AS

» **Optics and Photonics**
» All Optics and Photonics
» **Materials & Chemicals**
» Nanomaterials
» **Medical**
» Diagnostics
» Research Tools
» Screening
» **Nanotechnology**
» Materials
» NanoBio
» **Sensors & Instrumentation**
» Biosensors

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,162,902	11/02/2021	2017-410

» Environmental Sensors

» Medical

» Scientific/Research

STATE OF DEVELOPMENT

Working prototype: demonstrated a parts per billion detection limit for a set of metabolites of interest. The enhancement of optical signals in this prototype has been characterized. The inventors are developing analysis programs that can be paired with the nanosensors for future use in diagnostics.

RELATED CASES

2017-410-0

RELATED MATERIALS

» Nguyen, C.Q., et. al. Longitudinal Monitoring of Biofilm Formation via Robust Surface-Enhanced Raman Scattering Quantification of Pseudomonas aeruginosa-Produced Metabolites. ACS Appl. Mater. Interfaces. 2018, 10, 12364 - 03/28/2018

» Thrift, W.J., et. al. Driving Chemical Reactions in Plasmonic Nanogaps with Electrohydrodynamic Flow. ACS Nano. 2017, 11, 11317 - 10/20/2017

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