Skysong Innovations
Advancing the Arizona State University Knowledge Enterprise

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Fully Electronic, Sensitive, Chemical and Biological Sensor

Microfluidic devices and systems have been used extensively for biological analyses driven in part by limitations in diagnostic methods, particularly the need for large sample volumes, extensive processing times, and low resolution and sensitivity. These devices are often highly portable and have been shown to work on a variety of diverse analytes including cells, proteins, nucleic acids, exosomes, bacteria, vesicles, glycans and more. While there are microfluidic devices that can separate a complex sample matrix into individual components, current systems don't have mechanisms to characterize the separated components.

Researchers at Arizona State University and collaborators have developed a compact, all-electronic sensor capable of monitoring a diverse range of chemical and biochemical species and signals. Using ultra high-resolution separations of micro and nanoparticles coupled with an information-rich all-electronic sensing mechanism, these sensors are able to detect single molecules, nanoparticles, viruses and microbes from a myriad of stationary and mobile locations. For analytes of interest at a concentration insufficient for detection, a concentration step can be incorporated to enable detection. High resolution unbiased characterization, isolation, concentration and purification of sub-micron particles is provided with this small, portable and inexpensive sensor.

This fully electronic, programmable, sensor system can simultaneously separate and detect a diverse array of analytes in a highly deployable and sensitive manner and as such has applications in many fields.

Potential Applications

- Diagnostics
  - Can determine the type of bacterial infection by separating different

serotypes
- Analyte separations
- Wearable sensors to detect human agents
- Utilized in IoT devices
  - Water supplies - smart taps
  - Plumbing - smart toilets & drains to monitor human health and environmental risk
  - Light/electricity posts
- Research tools

Benefits and Advantages

- Simultaneous separation, concentration and characterization and/or detection of analytes of interest
- The separation and concentration step deliver pure sample fractions ranging from 3nm to 10 microns to nanopore sensing elements
- High resolution separation of micro and nanoparticles
- Does not experience bubbling or fouling as with existing separations devices
- Works with both AC or DC fields
- Small, portable, inexpensive and made of common materials for mass production
- Provides molecular-level information of the target analyte including identity, dimensions and physicochemical properties

For more information about the inventor(s) and their research, please see

Dr. Hayes' departmental webpage

Dr. Hayes' laboratory webpage