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System to Rapidly Screen and Detect Small Molecules

The analysis of small-molecule metabolites and drugs in body fluids and tissue extracts plays a vital role in human health, food safety and environmental monitoring. The current gold standard for small molecule detection is mass spectrometry, which is expensive, time consuming, and requires trained personnel. Universal point-of-care (POC) testing would be the ideal solution, however, developing a POC testing system for any given small-molecule analyte with sufficient sensitivity and selectivity remains challenging.

Researchers at Arizona State University have developed a portable optoelectronic small-molecule sensor system utilizing gold nanoparticle (AuNPs) functionalized with chemically induced dimerization (CID) nanobody binders. The functionalized AuNPs target non-competing epitopes on the same molecule, which triggers aggregation and precipitation of the AuNP sensors, which increases solution transparency. The change in solution color can be quantified using a portable optoelectronic readout system. This system has a limit of detection (LOD) of < 100 picomolar (pM) in urine and saliva, a large dynamic range (5 logs), and high specificity. Proof-of-principle for this system was achieved with the creation of a cannabidiol (CBD) sensor which showed high sensitivity and specificity.

This sensitive, low-cost, and versatile sensing system holds great promise for portable, rapid, and wide molecular diagnostic applications.

Potential Applications

- Small molecule sensing
 - Diagnostics
 - Health screening/monitoring
 - Drug and toxin detection
 - Food safety
 - Environmental or agricultural monitoring
 - Drug discovery
 - Biomarker diagnostics
 - More

Benefits and Advantages

- Increased sensitivity (limit of detection (LOD) of < 100 picomolar (pM) in

urine and saliva)

- The incubation, centrifugation and electronic detection (ICED) scheme transports small molecules to the reaction zone, boosting concentration prior to detection
- Large dynamic range (5 logs)
- High specificity
- Broadly applicable to different small molecule analytes
- Inexpensive optoelectronic readout
- Detection time in under 2 hours
- ICED also decreases detection time
- Multivalent AuNP sensors improve effective binding affinity
- Portable electronic readout
 - Does not collect signals from background minimizing noise
- Eliminates long incubation or cumbersome washing steps
- Ideal platform for affordable and accessible detection in resource-limited regions

For more information about this opportunity, please see

[Ikbāl et al – ACS Sens - 2023](#)

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

[Dr. Wang's departmental webpage](#)

[Dr. Wang's laboratory webpage](#)