Mediator-Free Electroenzymatic Sensing with Enhanced Sensitivity and Selectivity for Wearable Metabolite and Nutrient Monitoring Applications

Tech ID: 31905 / UC Case 2020-362-0

SUMMARY

UCLA researchers in the Department of Electrical and Computer Engineering have developed a wearable electroenzymatic sensor for non-invasive monitoring of metabolites and nutrients. The sensor has been successfully tested in human subjects to be highly sensitive and selective, making it ideal for monitoring and improving individual well-being.

BACKGROUND

Wearable electroenzymatic sensors allow for non-invasive monitoring of metabolites and nutrients in complex biofluids (e.g. sweat). These measurements can provide an individual with personalized lifestyle feedback which, when monitored, analysed, and adjusted, can improve individual well-being. Conventional wearable enzymatic sensors rely on hydrogen peroxide oxidation and Prussian Blue as a redox mediator to prevent selection of undesired electroactive species. However, the use of Prussian Blue presents challenges including sensor response susceptibility to dynamic concentrations of ionic species and loss of sensor electrocatalytic activity due to Prussian Blue degradation. Improvements in electroenzymatic technology are needed to overcome the challenges faced by current electroenzymatic sensors.

INNOVATION

UCLA researchers have developed a mediator-free sensing interface for wearable biofluid sensing. The sensor can be adapted to a wide panel of metabolites and nutrients while its unique design prevents interference from electroactive species for enhanced detection sensitivity. The sensor has been successfully used to target glucose, lactate, and choline in patients against a panel of diverse physiologically relevant interfering species with minimal drift response (<6.5%) for more than 20 hours.

APPLICATIONS

- Metabolite sensing
- Nutrient sensing
- Wearable biological sensors

ADVANTAGES

- Highly selective
- High sensitivity
- Low background signal
- Platinum-based electrode
- Wide panel of metabolites and nutrients

STATE OF DEVELOPMENT

The wearable device prototype has been tested and optimized for minimal background signal from endogenous electroactive species present in a biofluid matrix. Three model drugs have been tested and detected at nano- to sub/low-micromolar levels using the anodic-treated BDDE *in vitro*(sweat samples).

RELATED MATERIALS

- Cheng, X., Wang, B., Zhao, Y., Hojaiji, H., Lin, S., Shih, R., Lin, H., Tamayosa, S., Ham, B., Stout, P., Salahi, K., Wang, Z., Zhao, C., Tan, J., Emaminejad, S., A Mediator-Free Electroenzymatic Sensing Methodology to Mitigate Ionic and Electroactive Interferents' Effects for

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INVENTORS

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OTHER INFORMATION

KEYWORDS

electroactive drug, monitoring, pharmacokinetic tracking, wearable device, voltammetric, sweat samples, drug monitoring

CATEGORIZED AS

- **Biotechnology**
  - Health
- **Medical**
  - Devices
  - Other
  - Software

RELATED CASES

2020-362-0

Reliable Wearable Metabolite and Nutrient Monitoring. Adv. Funct. Mater. 2019, 1908507.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Published Application	20210106260	04/15/2021	2020-362

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Wearable Voltammetric Monitoring of Electroactive Drugs
- A Wearable Freestanding Electrochemical Sensing System
- Multiplexed Sweat Extraction And Sensing Wearable Interface For Normalized And Periodic Analysis
- A 3D Microfluidic Actuation and Sensing Wearable Technology for In-Situ Biofluid Processing and Analysis
- A Wearable Platform for In-Situ Analysis of Hormones
- Ultra-Low Cost, Transferrable and Thermally Stable Sensor Array Patterned on Conductive Substrate for Biofluid Analysis
- In-Situ Sweat Rate Monitoring For Normalization Of Sweat Analyte Concentrations

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