"Nanoporous Bioelectrochemical Sensors for Small Molecule Redox Sensing in Biologic Fluids" VCU #13-084

Applications

- Device to measure the redox status of biological samples
- Applied to point-of-care diagnosing and therapeutics for:
  - Critically ill and injured patients
  - Wound and burn care
  - Organ health monitoring
  - Monitoring blood supply
- Applied to other industries such as food and drug development and water quality assessment and control

Advantages

- Resists biofouling in biological media
- Does not require surface modifications such as biofilms
- Accurately makes electrochemical measurements in complex fluids

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Market Need

In order to measure redox potentials within complex fluids, an electrochemical sensor capable of freely exchanging electrons with redox species in a solution must be used. Often during biological measurements, these sensors are susceptible to biofouling due to protein adsorption resulting in undesired surface modification. This can cause adverse effects since this additional layer typically impedes electron exchange to the original surface, thereby causing the sensor to lose its effectiveness. Current sensor designs account for biofouling by employing a protective film that inhibits protein adsorption. Although this solves the problem of biofouling, this solution by surface modification can adversely cause biased results. Therefore, there exists an unmet need to produce an electrochemical sensor that resists the effect of protein adsorption and allows electrochemical redox measurements to be reproducibly made in blood and plasma without resorting to surface modification.

Technology Summary

This technology provides a way to effectively measure redox potentials and/or the concentrations of small redox molecules within a complex solution while minimizing the effect of protein adsorption. It is a unique design from other redox sensors in that it requires no surface modification, but instead relies on properly defined pore structures. These porous structures inhibit protein adsorption while allowing electron exchange and range in size in order to measure electrochemical reactions in various environments. Since this technology resists biofouling and can range in size, it can be appropriate for several medical and consumer applications such as: patient diagnosing, patient monitoring, drug development, and water quality assessment and control.

Technology Status

Electrochemical Properties of Nanostructured Porous Gold Electrodes in Biofouling Solutions. Jay Patel, Logudurai Radhakrishnan,[1] Bo Zhao,[2] Badharinadh Uppalapati, Rodney C. Daniels[3], Kevin R.Ward,[4] and Maryanne M. Collinson . Analytical Chemistry, 2013, 85(23), pp 11610-11618. Available from: http://pubs.acs.org/doi/full/10.1021/ac403013r

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This technology is available for licensing to industry for further development and commercialization.