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Self-powered biosensor for direct detection of cysteine using functionalized BaTiO₃ nanoparticles

Sophia Selvarajan, Nagamalleswara Rao Alluri, Arunkumar Chandrasekhar and Sang-Jae Kim
Jeju National University, South Korea

Cysteine being an essential amino acid, source of sulfide, biomarker and a precursor has vital role in homeostasis. Abnormality in cysteine levels leads to chronic diseases such as rheumatoid arthritis, Parkinson's disease, cardiovascular disease, Alzheimer's disease and adverse pregnancy outcomes. Various cysteine detection techniques have been developed based on fluorometry, electrochemical voltammetry and fluorescence-coupled HPLC techniques involving tedious procedures limiting their practical applications. Self-powered nano sensors are gaining interest due to its own merits such as battery less operation, portability, point of care diagnosis, implantable applications and so on. First of its kind, direct detection and facile fabrication of cysteine responsive film based self-powered device has been reported. NH₂ functionalized BaTiO₃ NPs (BT- NH₂ NPs) suspended in a 3D matrix of Agarose film (Ag) serves as the sensing element for cysteine detection. The change in surface charge properties of the film with respect to cysteine concentrations were determined using I-V technique. The current response increased with increase in cysteine concentrations (linear concentration range is 10 μM to 1 mM). The composite's properties invoked interest in developing Piezoelectric Nano-Generator (PNG) which eventually lead to the fabrication of self-powered cysteine sensor (PNG's output voltage was used for driving the sensor). The potential drop across the sensor was measured as a function of different cysteine concentrations in self-powered cysteine sensor. Real time analysis was performed using urine samples. The proposed sensor has good selectivity and detection limits down to 147 nM.

Biography

Sophia Selvarajan is currently pursuing her PhD in Department of Advanced Convergence Technology and Science at Jeju National University, South Korea. She completed her Master of Technology in Nanotechnology at Karunya University, India and Bachelor of Technology in Biotechnology at Centre for Plant Molecular Biology and Biotechnology, Tamil Nadu Agricultural University, India. Her research areas of interest include "Nano-biosensors, self-powered systems for theranostics and drug delivery system.

sofi.numbers@gmail.com

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