Author's Accepted Manuscript

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yayay alcaviar com/locata/bios

PII: S0956-5663(17)30172-0

DOI: http://dx.doi.org/10.1016/j.bios.2017.03.021

Reference: BIOS9609

To appear in: Biosensors and Bioelectronic

Received date: 8 December 2016 Revised date: 8 March 2017 Accepted date: 9 March 2017

Cite this article as: Dongmei Li, Qinghua He, Yonghong He, Meiguo Xin Yilong Zhang and Zhiyuan Shen, Molecular imprinting sensor based on quantun weak measurement, *Biosensors and Bioelectronic* http://dx.doi.org/10.1016/j.bios.2017.03.021

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ACCEPTED MANUSCRIPT

Molecular imprinting sensor based on quantum weak

measurement

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Abstract

A new type of sensing protocol, based on a high precision metrology of quantum weak measurement, was first proposed for molecularly imprinted polymers (MIP) sensor. The feasibility, sensitivity and selectivity of weak measurement based MIP (WMMIP) sensor were experimentally demonstrated with bovine serum albumin (BSA). Weak measurement system exhibits high sensitivity to the optical phase shift corresponding to the refractive index change, which is induced by the specific capture of target protein molecules with its recognition sites. The recognition process can be finally characterized by the central wavelength shift of output spectra through weak value amplification. In our experiment, we prepared BSA@MIP with modified reversed-phase microemulsion method, and coated it on the internal surface of measuring channels assembled into the Mach-Zehnder (MZ) interferometer based optical weak measurement system. The design of this home-built optical system makes it possible to detect analyte in real time. The dynamic process of the specific adsorption and concentration response to BSA from 5×10^{-4} to 5×10^{-1} $\mu g/L$ was achieved with a limit of detection (LOD) of $8.01 \times 10^{-12} g/L$. This WMMIP shows superiority in accuracy, fast response and low cost. Furthermore, real-time monitoring system can creatively promote the performance of MIP in molecular analysis.

Graphical Abstract

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