Sensitive detection of Nampt(PBEF/Visfatin) in human serum for Point-Of-Care applications using aptamer based capacitive biosensor

J. H. Niazi, J. W. Park, S. S. Kallempudi, A. Qureshi, Y. Gurbuz, M. B. Gu

NAMPT is a multifunctional protein, also known as visfatin or pre-B cell colony-enhancing factor, which exists as the rate-limiting intracellular enzyme for nicotinamide adenine dinucleotide (NAD) synthesis starting from nicotinamide [1]. The plasma Nampt levels are reported to have correlation with obesity and obese related metabolic disease, such as Type 2 diabetes mellitus (T2DM), cardiovascular diseases [2] and hyperlipidemia [3] due to association with lipoprotein and cholesterol. Therefore, sensitive detection of Nampt potentially enable accurate diagnosis of T2DM, cardiovascular and hyperlipidemia diseases.

In this study, for the first time, we developed an ssDNA aptamer that specifically bind Nampt (K_d=72.52 nM) in human serum by systematic evolution of ligands by exponential enrichment (SELEX) process. Nampt-specific ssDNA aptamers were then applied as the recognition molecules for the development of a capacitive biosensor using non-Faradaic impedance spectroscopy (nFIES), which converts the biological binding event into a quantifiable signal for sensitive and efficient detection of the Nampt (Fig. 1). The interaction of aptamer-Nampt induced the change in dielectric properties, charge distribution, and conductivity. The limit of detection was 1 ng/ml with a dynamic range of upto 50 ng/ml in serum and this range is under the clinical requirements both in the normal Nampt levels, which is 15.8 ng/ml, and in the T2DM patients level, which is 31.9 ng/ml. This assay system for Nampt detection using aptamers is a potential alternative approach for applications in clinical studies and Point-Of-Care health technologies.

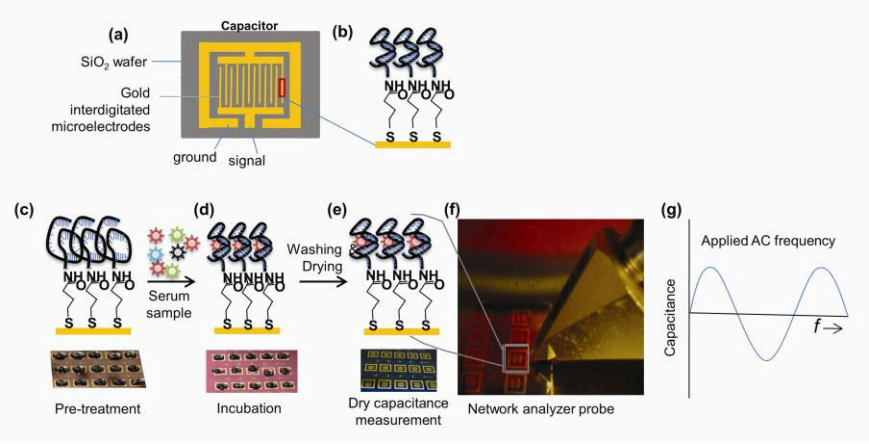

Figure 1. Schematic diagram of the working mechanism of the aptamer-based capacitive detection of target Nampt.

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J. H. Niazi, S.S. Kallempudi, A. Qureshi, and Y. Gurbuz are with the Sabanci Univeristy, Nanotechnology Research & Application center; Faculty of Engineering & Natural Sciences, Istanbul, Turkey (corresponding author phone: +90-216-483-9879; fax: +90-216-483-9879; e-mail: javed@ sabanciuniv.edu).

J. W. Park and M. B. Gu are with Department of Life Sciences & Biotechnology, Korea Unviersity, Seoul, Korea.

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