

Dual-probe sandwich for Lewy body detection on nano-composite modified dielectric surface to determine Parkinson's disease

Abstract

Parkinson's disorder (PD) is a chronic and central nervous system disorder that occurs when neurons in the area of the brain impairs or dies, in particular, it affects the dopamine-producing neurons. People having PD also loose chemical messenger norepinephrine, which involves in regulating the main function of physiological systems, such as heart rate and blood pressure. Researchers are working on to identify PD with a suitable biomarker and alpha-synuclein is the presynaptic neuronal protein, in the neurological lesions (Lewy bodies). This research was focused to develop an alpha-synuclein biosensor on an iron oxide (IO) nanomaterial-modified interdigitated electrode surface. Anti-alpha-synuclein aptamer was attached on IO through the amine-linker and aggregated alpha-synuclein was sandwiched between aptamer and antibody. To enhance the analytical performance, antibody was modified with gold nanoparticles and reached the detection limit of 10 aM, determined on a linear range between 10¹ and 10⁷ aM [$y = 2.5812 \times 10^{-0.0081}$; $R^2 = 0.9729$]. Further, control molecules failed to increase the current responses indicating the specific detection of alpha-synuclein and the CSF-spiked alpha-synuclein increases the current responses, confirming the selective detection.

Keywords

Alpha-synuclein; Aptamer; Iron oxide; Nanomaterial; Neurodegenerative disorder