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A non-enzymatic electrochemical sensor for detection of sialic acid based on a porphine/graphene oxide modified electrode via indicator displacement assay

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Abstract: A simple, convenient operation, and high selective non-enzymatic sialic acid (SA) electrochemical sensor has been developed based on indicator displacement assay (IDA) of dopamine (DA) for the first time. Principle of SA detection is via a reversible covalent binding of boronic acid-diol by IDA, namely, SA can compete with DA to bind 2-fluorophenylboronic acid (FPBA) through the displacement of the 1, 2-diols. The electrode was fabricated by modifing composite material of tetra (4-carboxyphenyl) porphine-graphene oxide (TCPP-GO), DA and FPBA at a glassy carbon electrode (GCE), respectively. The novel composite material TCPP-GO has improved markedly the sensitivity of the electrochemical sensor. The recovered anodic current response of DA is linear to the SA concentration in the range of 0.1-7.5 mM with a detection limit of 28.5 μM. In addition, in order to eliminate some interferences in practice, mainly structural analogs ascorbic acid, glucose and uric acid, real samples was purified by ion exchange extraction. So, the proposed sensor was applied successfully for determination of SA in human blood and urine samples by differential pulse voltammetry (DPV). The recoveries of 98.0%-104.0% are satisfactory. This new strategy for non-enzymatic detection of SA is firstly proposed in this paper.

Key words: Sialic acid; Non-enzymatic electrochemical sensor; Indicator displacement assay; Dopamine; 2-fluorophenylboronic acid

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