An All-Solid-State Ammonium Ion-Selective Electrode Based on Polyaniline as Transducer and Poly (o-phenylenediamine) as Sensitive Membrane

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An all-solid-state ammonium ion-selective electrode, with silver/nano-silver wire as the substrate, polyaniline as transducer and poly (o-phenylenediamine) as sensitive membrane, is presented. The nano-silver was prepared by electrodeposition in 0.1 M AgNO₃ standard solution with the half-sine wave at amplitude of 500 mV, frequency of 50 HZ and action time of 1 min. The polyaniline and poly (o-phenylenediamine) were electropolymerized on the surface of the silver/nano-silver substrate by cyclic voltammetry with the scanning potential from 0 to 0.45 V in solutions of 1.0 M aniline hydrochloride and 0.08 M o-phenylenediamine hydrochloride, respectively. Under the SEM, poly (o-phenylenediamine) with 0.5-5 μm in size was evenly and firmly embedded on the surface of the PANI. This ammonium electrode exhibited low impedance of approximately 70 Ohm. It can detect as low as 1.2×10⁻⁵ M of ammonium ion, with the slopes of 54.99-55.70 mV per decade ($R^2 > 0.99$) within a linear range between 2×10⁻⁵ M to 0.1 M. It responds as quickly as 0.5-2 s, as well as its lifespan extends to at least 147 days. The electrode showed a superior selectivity toward NH₄⁺, and was successfully applied to detect the NH₄⁺ concentration in real samples. In addition, this electrode is miniature and convenient for package and assembly, which will enable *in-situ* measurement and long-term monitoring of NH₄⁺ concentration in rivers, lakes and industrial sewage.

Keywords: All-solid-state ammonium electrode; Low impedance; In-situ detection and longtime monitoring; Poly (o-phenylenediamine); Polyaniline

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