Graphene/Polyaniline Nanocomposite as an Electrochemical Sensor for Ultrasensitive Detection of Pb(II)

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This work describes the development of an electrochemical sensor for the ultrasensitive detection of Pb(II) using a graphene/polyaniline (GN/PANI) nanocomposite electrode prepared by a reverse-phase suspension polymerization technique in the presence of polyvinylpyrrolidone (PVP). The obtained GN/PANI nanocomposite was characterized by scanning electron microscopy (SEM) and Fourier transform infrared (FT-IR) spectroscopy. The electrochemical behavior of lead ions (Pb^{2+}) was determined by cyclic voltammetry and differential pulse voltammetry. The GN/PANI nanocomposite showed evidence of increased surface area under SEM. The GN/PANI-modified electrode exhibited high electrochemical conductivity, producing a four-fold increase in peak current (vs. the unmodified electrode). The largest current response was obtained when the weight fraction of graphene was 0.49%. A linear working range of 1.0×10^{-9} to 1.0×10^{-4} M was established between current and Pb^{2+} concentration with detection limits ($\text{S/N} = 3$) of 0.06088 nM. The large specific surface area, satisfactory repeatability, long-term stability and simple synthesis promote the GN/PANI nanocomposite as a promising electrochemical sensor for the determination of Pb^{2+} .

Keywords: Heavy metal; Reverse-phase suspension polymerization; Graphene/polyaniline nanocomposite; electrochemical sensor

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