

Modified Fe₃O₄ Nanoparticles for Electrochemical Sensing of Heavy Metal Ions Pb²⁺, Hg²⁺, and Cd²⁺ in Water

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Abstract : Fe₃O₄@SiO₂@SB functionalized magnetic nanoparticles were synthesized and used to detect heavy metal ions such as Pb²⁺, Hg²⁺, and Cd²⁺ in water. The formation of Fe₃O₄@SiO₂@SB nanocatalyst was confirmed by XRD, SEM, TEM, and IR. The simultaneous determination of analyte cations was carried out using square wave anodic stripping voltammetry (SWASV). Investigation and optimisation were done to study how experimental variables affected the performance of the modified magnetic electrode. Pb²⁺, Hg²⁺, and Cd²⁺ were successfully detected using the designed sensor in the presence of various possibly interfering ions. The recovery rate was found to be 97.5% for Pb²⁺, 96.2% for Hg²⁺, 103.5% for Cd²⁺. The electrochemical sensor was also employed to determine the presence of heavy metal ions in drinking water samples, which are well below the World Health Organization (WHO) guidelines.

Keywords : magnetic nanoparticles, heavy metal ions, electrochemical sensor, environmental water samples

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