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Electroanalytical detection of heavy metals using metallophthalocyanine and silica coated iron oxide composites

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The monitoring of heavy metal ions particularly in water is important in safeguarding the environment and humans from the toxic effects these metal ions pose. This work describes the synthesis, characterization and electrocatalytic properties of silica coated iron oxide nanoparticles (Si-NP) in the presence of cobalt or iron phthalocyanines (MPc) for heavy metal (HM) detection. TEM, XRD, XPS and VSM confirmed the successful synthesis of Si-NP with an average diameter of 12.07 nm. The electrochemical sensing properties of MPc/Si-NP modified glassy carbon electrodes (GCE) were assessed for HM detection. Differential pulse anodic stripping voltammetry (DPASV) studies indicated detection limits that compared positively with literature. The FePc/Si-NP composite showed the lowest detection limits of 3.66 $\mu\text{g L}^{-1}$, 11.56 $\mu\text{g L}^{-1}$, 2.28 $\mu\text{g L}^{-1}$, 4.54 $\mu\text{g L}^{-1}$ for arsenic (As), cadmium (Cd), mercury (Hg) and lead (Pb), respectively. Both composites displayed reproducible signals for the simultaneous detection of the HMs. These composites offer a cheap and simplistic sensing alternative for HM analysis.

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