Natural Material-Mediated Synthesis of AgNPs for Sensitive Mercury Detection in Wastewater

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ABSTRACT

Introduction: Nano particles possess many different properties unlike macro particles. Their interactions and sensing behavior is highly sensitive than other materials.

Objective: Research idea is to synthesis such a nanomaterial which is not just cost effective but sensitive to metal detection as well.

Methodology: A novel biodegradable material was used to synthesize capped silver nanoparticles (AgNPs) and tested for the detection of various metal ions in real water samples. Different characterization methods were used to determine the formation of nanoparticles and its detection behavior.

Key Findings: The resulting nanomaterial was found to be highly stable for up to 12 months. The material was analyzed using SEM and TEM techniques and found to have reef-like shapes with sizes ranging from 20-200 nm. Colorimetric changes were observed in the presence of Hg^{2+}, turning from yellowish brown to colorless. The AgNPs exhibited selective interaction with Hg^{2+} even in the presence of potential interfering ions such as Ni^{2+}, Fe^{2+}, Cr^{2+}, Pb^{2+}, Fe^{3+}, Cd^{2+}, La^{3+}, Mg^{2+}, Zn^{2+}, Cu^{2+}, Na^{+}, and K^{+}. The system was able to detect Hg^{2+} with detection limits of 10 µM, and was not affected by variations in pH, temperature, or the presence of other metals.

Conclusion: The method was successfully applied to detect ultratrace levels of Hg^{2+} in different matrices such as tap water, hard water, industrial wastewater, and heavy metal-rich water and was found to be selective, simple, and sensitive.

Keywords: Sensing, Nanoparticles, Ultratrace Detection, Hg Sensing.

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