Supporting Information

Colorimetric sensing of Fe^{3+} and Hg^{2+} and photocatalytic activity of green synthesized silver nanoparticles from leaf extract of *Sonchus arvensis* L.

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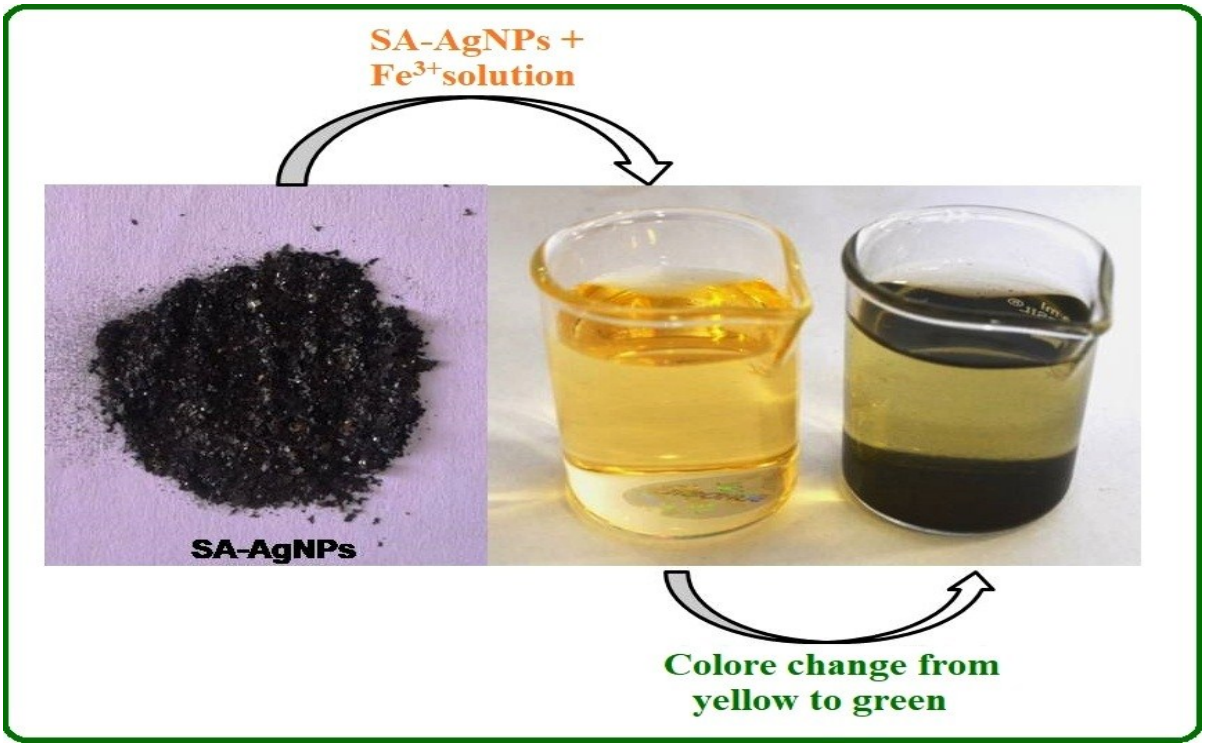
Practical Application

Wastewater, tap water and drinking water are tested by green synthesized SA-AgNPs to detect heavy metal ions and it is an application of the colorimetric sensor. Heavy metals ions are easily dissolved in drinking water. Detection of heavy metals from the wastewater, tap water and drinking water by the colorimetric sensor is one of the easiest and cheapest processes. Different concentration (equal to or more than 10^{-3}M) of metals ions (Fe^{3+} and Hg^{2+}) is detected by green synthesized SA-AgNPs. It is interesting that the 10^{-3} M solution of Fe^{3+} in drinking water is yellow in colour but when we added solid powder of green synthesized SA-AgNPs and visualized colour is changed to greenish yellow. The solid form of AgNPs work as solid sensor and it is detected Fe^{3+} metals ion in visualized without the help of any kind of instruments. It is shown in ESI- 1.



ESI- 1 Fe^{3+} ion detection through visualized

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ESI-2: Sensing Video:


Fe3+.mp4


Hg2+.mp4

Proposed mechanism of dye degradation (MB) by SA-AgNPs

The proposed mechanism of dye degradation by SA-AgNPs in presence of sunlight is given below in scheme-1.

Scheme-1 Proposed mechanism for dye degradation by SA-AgNPs

$$\text{AgNPs} + h\upsilon \longrightarrow e^-(\text{CB}) + h^+(\text{VB}) \quad (2)$$

$$O_2 + e^- \longrightarrow O_2^{\cdot -} \quad (3)$$

$$H_2O + h^+ \longrightarrow H^+ + OH^- \quad (4)$$

$$h^+ + H_2O \longrightarrow \cdot OH \quad (5)$$

$$\text{MB} + h\upsilon \longrightarrow \text{MB}^* \quad (6)$$

$$\text{MB}^* \longrightarrow \text{MB}^+ + e \quad (7)$$

$$\text{MB}^+ + \cdot OH \longrightarrow \text{Degradation product} \quad (8)$$

$$\text{MB}^+ + O_2^{\cdot -} \longrightarrow \text{Degradation product} \quad (9)$$

In the first step SA-AgNPs react with UV light and generate electron-hole (e^- / h+) shown in equation-2. The photoelectron generates in conduction band react with oxygen molecule which is adsorbed in the surface on SA-AgNPs and produced superoxide radicals (O_2.-) (Eq-3). The holes generation in valence band reacts with the water molecule to generate hydrogen ion (H^+) and hydroxyl ion (-OH) shown in equation-4. Further the holes spilt the water molecule and formed highly active hydroxyl radicals (.OH) which are represented in equation-5. At the same time, Methyl blue (MB) react with UV light and generate MB* (Eq-6) and simultaneously loss of one electron and formed MB+ (Eq-7). MB+ reacts with highly

reactive superoxide radicals ($O_2^{\cdot -}$) and hydroxyl radicals (.OH) to generate degradation product shown in equation 8 and 9.[1]

Reference

1. Botta, S. G.; Navío, J. A.; Hidalgo, M. C.;Restrepo, G. M.; Litter, M. I. Photocatalytic properties of ZrO2 and Fe/ZrO2 semiconductors prepared by a sol–gel technique. *J. Photochem. Photobiol. A: Chem.* **1999**, 129, 89-99, DOI: org/10.1016/S1010-6030 (99)00150-1.