## Supplementary Materials

### Text S1. Chemicals and instrument

Chitosan (Ch: degree of deacetylation: ≥ 75%), silver nitrate, ethylene diamine tetraacetic acid (EDTA), acetic acid glacial, lead acetate, glycine (GLY), sodium acetate anhydrous chloroform, were procured from HiMedia Chemicals, Mumbai (India). Sodium hydroxide pellets, Ethyl alcohol (99.9%), glutaralehyde (25% solution in water), ferric chloride, oxalic acid (OA), potassium ferricyanide, potassium ferrocyanide, copper sulfate, lead nitrate, sulphuric acid, zinc sulfate, chromium chloride, *N,N*-dimethylformamide, ethanol, nickel chloride, methanol were precured from Merck, Mumbai (India) products. Trimethoxyoctylsilane (96%) was purchased from Sigma Aldrich (USA). Procured chemicals are of analytical grade and used without purifying. The surface morphology of a nanocomposite-coated plate was investigated using a GC plate (1 mm thick, type 1: CAS no. 7440-44-0; Alfa Aesar (USA)). Cyclic voltammetry (CV) and Electrochemical impedance spectroscopy (EIS) was studied using three electrode system consisting GC electrode (working), Platinum electrode (Counter) and lastly Ag/AgCl/KCL (3.5 M) electrode (Reference). All electrochemical studies are performed with SP-200 Biologic Instrument with in-built EC-Lab® software. pH meter was used for maintaining required pH solution (Model: LT-50 Maker: Labtronics, India). Collected natural water (Springwater and Groundwater; collected from Aizawl (India)) samples were extensively analysed using Multiparameter photometer (Model: Hi83300, Make: Hanna, USA), AAS (Atomic Absorption Spectroscopy, Model: AA-7000, Make: Shimadzu, Japan), Multiparameter waterproof meter (probe) (Model: Hi98194, Make: Hanna, USA) and TOC (Total Organic Carbon, Model: TOC-V CPH, Make: Shimadzu, Japan). Synthesized material, composite and nanocomposite are characterised using XRD (X-Ray Diffraction, Maker: PANalytical, Almelo, Netherland), FT-IR (Fourier transform infrared, Model: IR Affinity-1S, Make: Shimadzu, Japan), TEM (Transmission Electron Microscopy, Model: Oxford xtreme) and SEM-EDX (Scanning Electron Microscopy with Energy Dispersive X-ray analyzer, Model: Oxford xmax).

**Table S1.** Phytochemical screening results. (+) = present

| Phytochemicals | Results |
|---|---|
| Alkaloids | + |
| Glycosides | + |
| Steroids | + |
| Flavonoids | + |
| Saponin | + |
| Quinones | + |
| Tannin | + |
| Terpenoids | + |

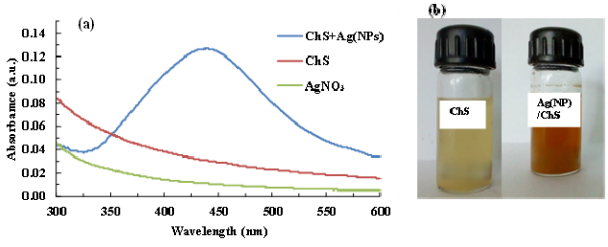


**Fig. S1.** (a) UV visible absorption spectrum of $AgNO_3$, ChS and Ag(NPs)/ChS; and (b) suspensions of ChS and Ag(NPs)/ChS.

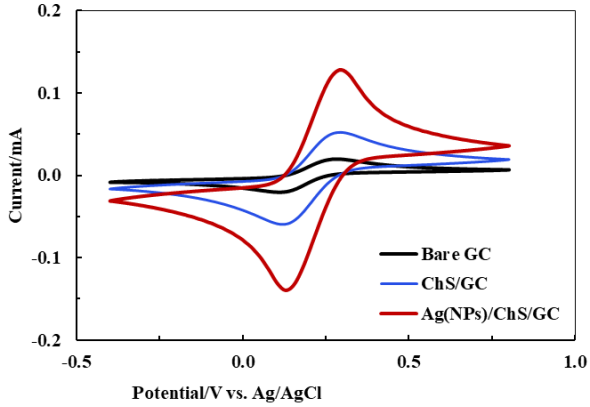


**Fig. S2.** Voltammograms obtained using the bare GC, ChS/GC and Ag(NP)/ChS/GC in 2.0 mmol/L redox pair $[Fe(CN)_6]^{3-/4-}$ at applied potential between -0.4 to 0.8 V.

**Table S2.** Calculated relative standard deviation for each stipulated time in presence of 50.0 $\mu$g/L $Pb^{2+}$ in aqueous media

| Hours | RSD (%) (n=5) |
|---|---|
| 0 | 2.43 |
| 12 | 2.43 |
| 24 | 2.49 |
| 48 | 2.56 |

**Table S3.** Analysis of real water sample using different instruments

| AAS (mg/L) | Spring water | Ground water |
|---|---|---|
| Copper | 0.02 | 0.02 |
| Calcium | 11.16 | 12.31 |
| Zinc | ND | 0.14 |
| Lead | ND | ND |
| Nickel | ND | ND |
| Iron | 0.02 | 0.95 |
| Manganese | ND | 0.04 |
| **TOC (mg/L)** | | |
| NPOC | 13.17 | 1.35 |
| IC | 12.18 | 11.85 |
| TC | 25.35 | 13.20 |
| **Multiparameter** | | |
| Nitrate | 6.0 $\mu$g/L | 5.0 mg/L |
| Phosphate | 0.03 mg/L | 0.06 mg/L |
| Sulphate | 0.03 mg/L | 0.02 mg/L |
| **Multiparameter Probe** | | |
| pH | 7.97 | 8.21 |
| OPR | 6.4 MV | 160.4 MV |
| Conductivity | 460.0 $\mu SCm^{-1}$ | 199.0 $\mu SCm^{-1}$ |
| Resistivity | 0.0022 mΩ Cm | 0.0045 mΩ Cm |
| TDS | 230.0 mg | 100.0 mg |
| Salinity | 0.24 PSU | 0.1 PSU |

ND-Not Detected

**Table S4.** Recovery percentage of $Pb^{2+}$ in spiked natural water samples

| Natural water sample | Spiked concentration of $Pb^{2+}$ ($\mu$g/L) | $Pb^{2+}$ found ($\mu$g/L) (n=3) | $Pb^{2+}$ Recovery (%) |
|---|---|---|---|
| Spring water | 5.0 | 4.78 | 95.52±0.14 |
| | 10.0 | 9.66 | 96.62±0.21 |
| | 20.0 | 19.21 | 96.06±0.15 |
| Ground water | 5.0 | 4.65 | 92.95±0.17 |
| | 10.0 | 10.26 | 102.57±0.13 |
| | 20.0 | 20.40 | 102.0±0.16 |