Supporting Information

Electrochemical Detection and Catalytic Reduction of Nitrobenzene using Bimetallic NiS$_2$/Fe$_3$S$_4$ Magnetic Heterostructure: An Innovative Approach for Environmental Remediation

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Experimental Procedures

Instrumentation

Different characterization techniques were used to analyze the material. Rigaku's Smart Lab X-ray diffractometer was used to carry out X-ray diffraction measurements. The surface morphology was studied using ZEISS Gemini SEM 500 FE-SEM, while the morphology was further studied by tunnelling electron microscopy Hitachi (H-7500). The elemental state and oxidation state was determined by X-ray photoelectron spectroscopy using Physical Electronics' (PHI 5000 Versa Probe III),. Electrochemical behaviour was analyzed using a Biological SAS potentiostat SP-150 a three-electrode electrochemical set-up with Ag/AgCl as a reference electrode, platinum wire as the auxiliary electrode, and glassy carbon as the working electrode. BET surface area was measured using nitrogen adsorption/desorption on an ASAP 2460 analyzer (Micromeritics, USA). UV-Vis analysis was performed using the Shimadzu UV-Vis spectrophotometer.
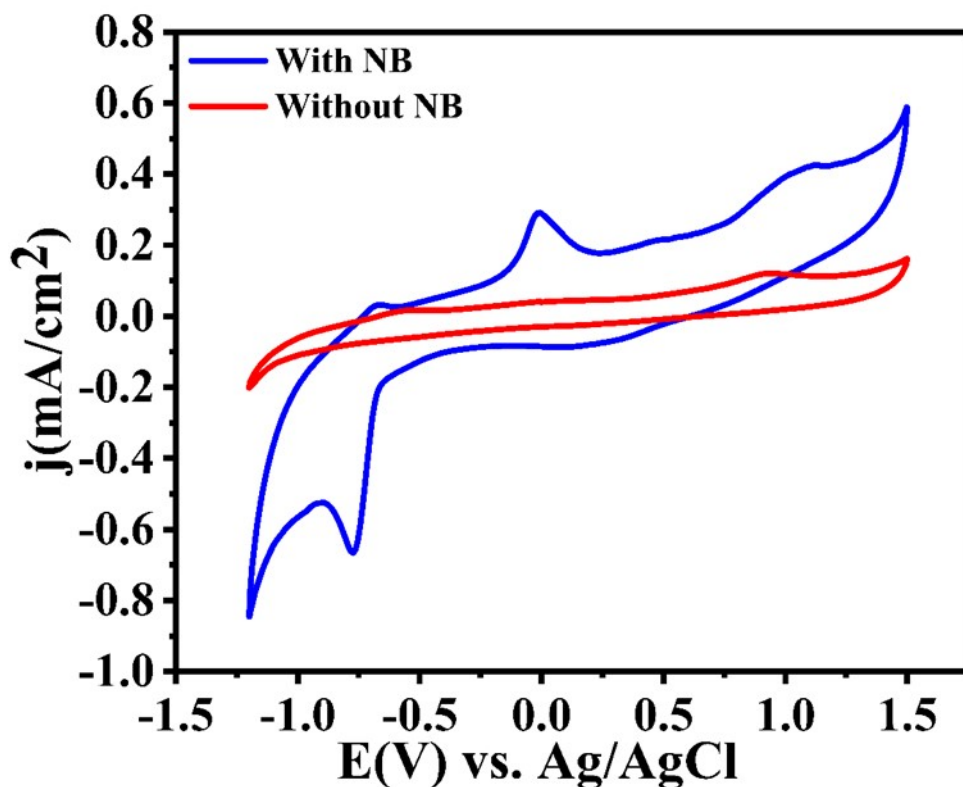
Fig. S1 CV of NiS$_2$/Fe$_3$S$_4$/GCE with and without nitrobenzene

Table S1 Sensing of NB in the natural samples by using the sensor NiS$_2$/ Fe$_3$S$_4$/GCE

Sample	Nitrobenzene (Real) µA	Before Spiking (Unspiked) µA	After Spiking (Spiked) µA	Recovery factor (%)
Water	-49.4	-169.8	-221.7	104
Honey	-49.4	-161.1	-209.1	97

We used the addition methodology to estimate the recovery factor using actual samples to validate the sensing platform. This spike/recovery method detects the trivial amounts of nitrobenzene in natural waters and honey. The recovery factor was estimated by Equation 1.

$$\frac{Unspiked - Spiked}{Real} \times 100 \qquad (1)$$

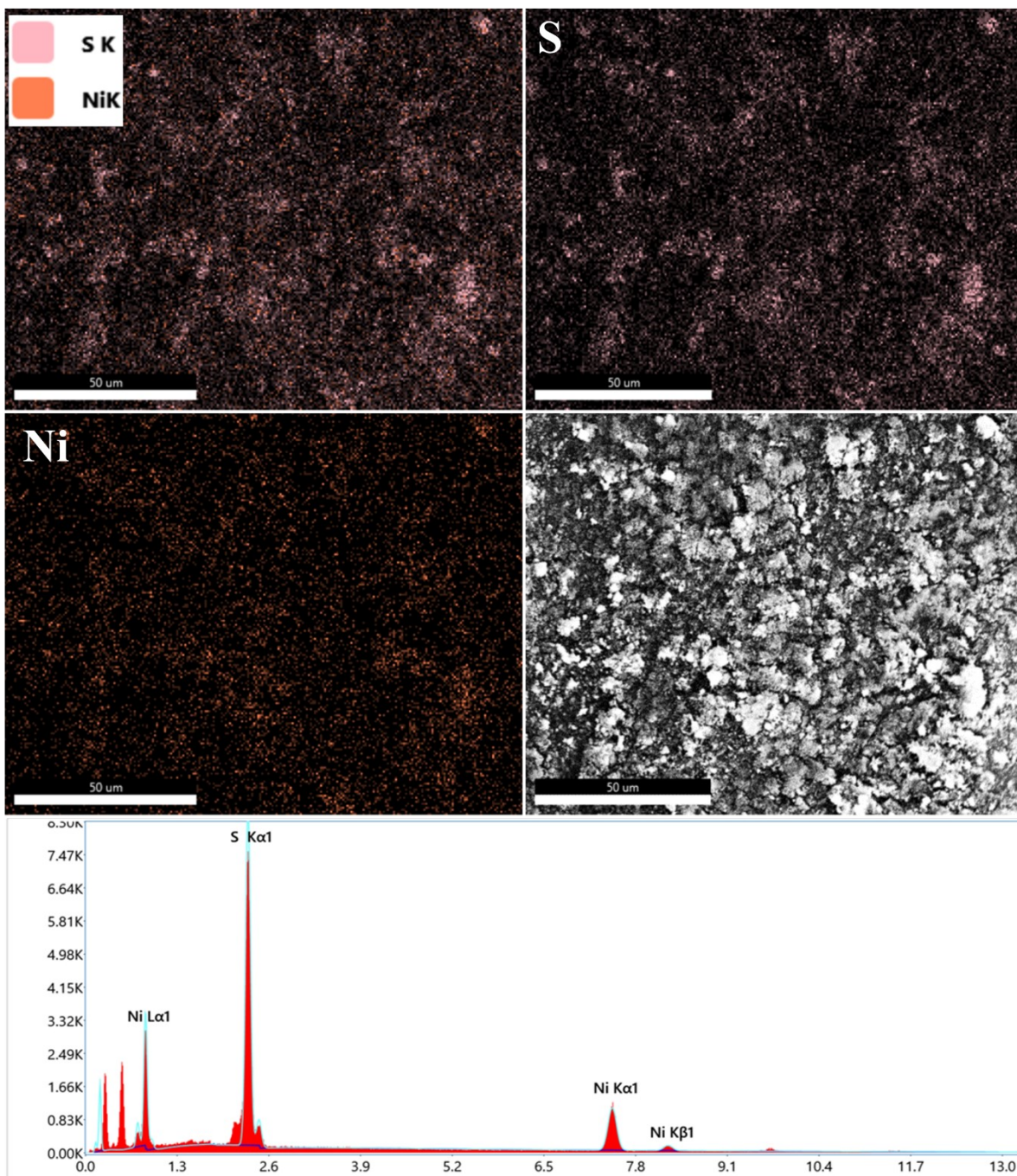**Fig.S2 elemental mapping and energy dispersive spectra of NiS$_2$**

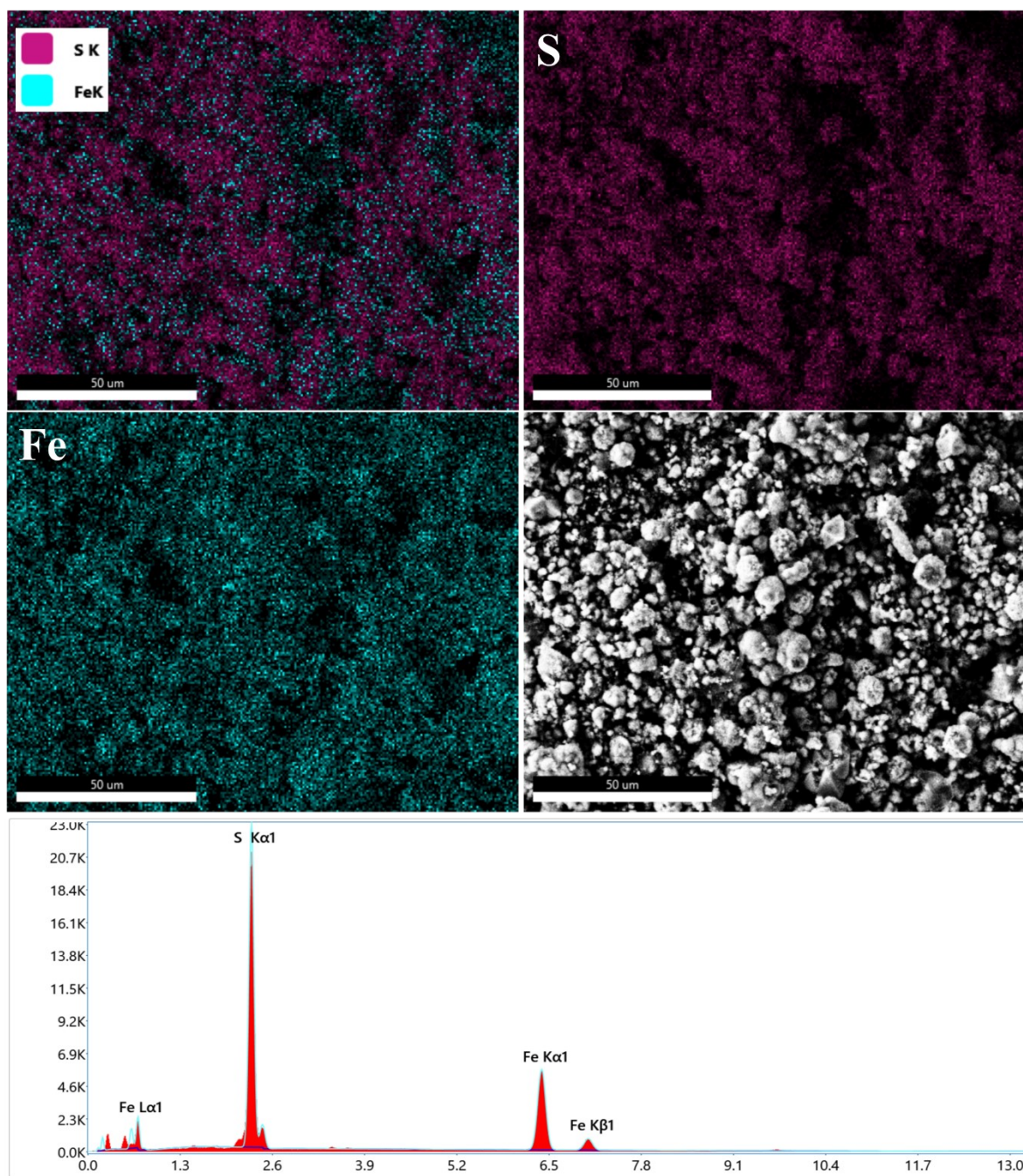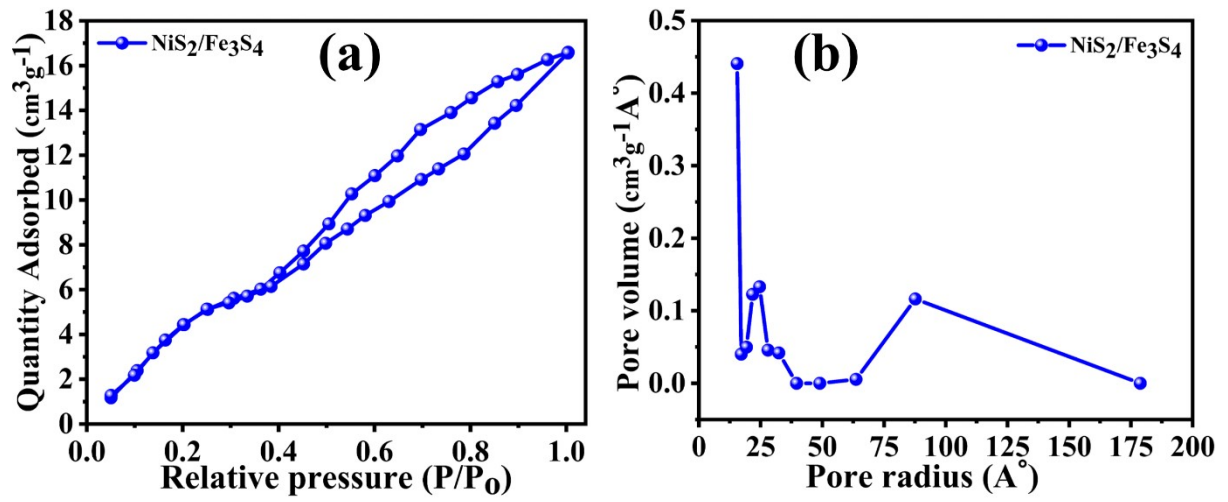**Fig.S3 elemental mapping and energy dispersive spectra of FeS$_2$**

Fig.S4 (a) N2 adsorption–desorption curve for NiS_2/Fe_3S_4. (b) Pore Distribution curve of NiS_2/Fe_3S_4.