Supplementary information

Novel nanostructured Hematite-Spongin Composite developed using Extreme Biomimetic approach

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Materials and Methods

Particles size distribution

In order to measure size of hematite particles a Zetasizer Nano ZS analyzer was used. The measurement is based on Brownian motion, and is performed by colloidal particles. The frequency of those movements increases with decreasing particle size, thus enabling their size to be measured. The motion is registered by Non-invasive Back Scattering (NIBS) method.

For sample preparation, 10 mg of synthesized hematite was added to 25 cm^3 of isopropyl alcohol and dispersed with an ultrasonic bath (Elmasonic GmbH, Germany) for 15 minutes in order to break down agglomerates and achieve a high degree of dispersion.

XRD measurements

X-ray diffraction (XRD) analysis was employed to determine the crystalline structure of the hematite as well as the α-Fe_2O_3-spongin composite. The measurements were performed using a TUR-M62 diffractometer, operating at 30 kV and 25 mA, with CuKα (a = 1.5418 Å) radiation, Ni filtered. The XRD pattern data were collected in step-scanning mode with steps of $\Delta 2\Theta = 0.04°$.

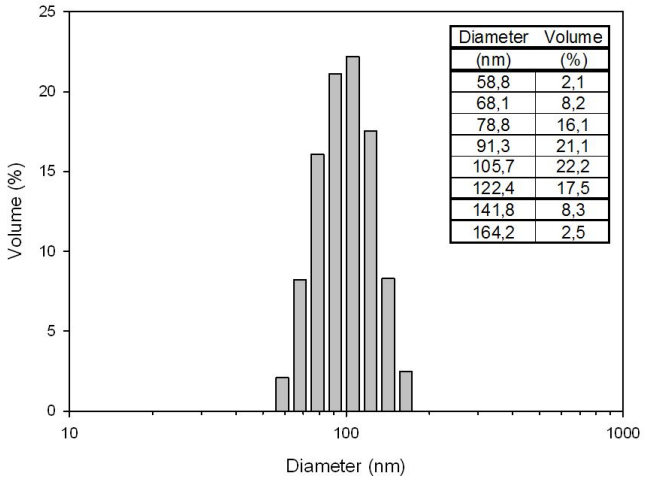
Thermogravimetric analysis

For investigation of the thermal behavior of the samples a thermogravimetric analyzer (TG, model Jupiter STA 449F3, Netzsch) was used. Measurements were carried out under air atmosphere at a flow rate equal to 10 cm^3/min. The heating rate was set to 10 °C/min in a temperature range of 25–1000 °C, with an initial sample weight of approximately 5.5 mg.

X-ray Photoelectron Spectroscopy

X-ray photoelectron spectroscopy was performed with an ESCALAB 250Xi (Thermo Scientific, USA), equipped with a monochromatic Al Kα X-ray source (1486.6 eV), which was focused to spot size of 650 μm and operated at 14,8 kV and 19,1 mA. Scans were taken with a pass energy of 20 eV. The binding energies were corrected for the charge shift using the C1s peak (BE= 284,6 eV) as reference.

Results



Diameter (nm)	Volume (%)
58,8	2,1
68,1	8,2
78,8	16,1
91,3	21,1
105,7	22,2
122,4	17,5
141,8	8,3
164,2	2,5

Fig. S1 Particle size distribution of hematite nanoparticles obtained via the hydrothermal route.

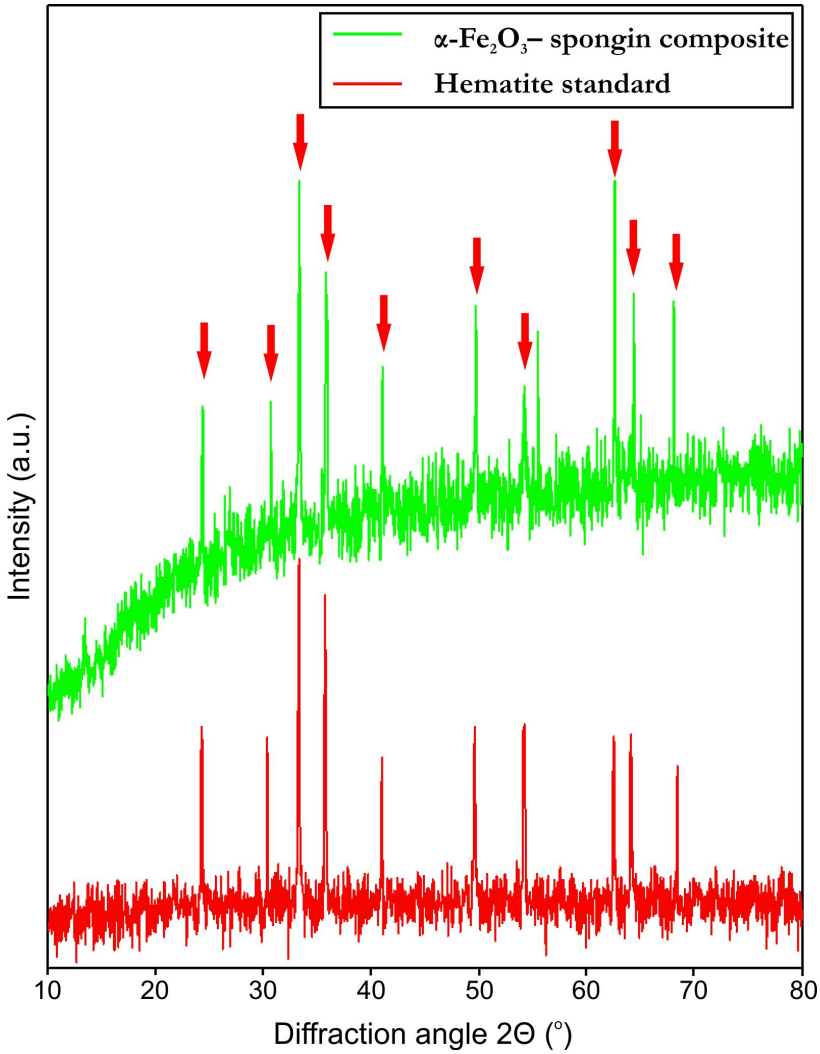


Fig. S2 XRD patterns of α-Fe_2O_3–spongin composite and hematite standard.

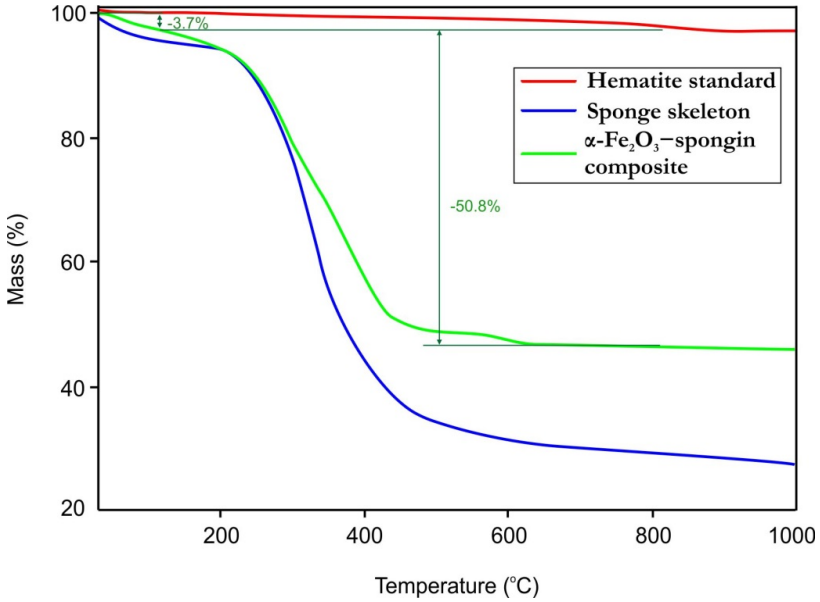


Fig. S3 Thermogravimetric (TG) curves of hematite standard, spongin, and α-Fe_2O_3–spongin composite.

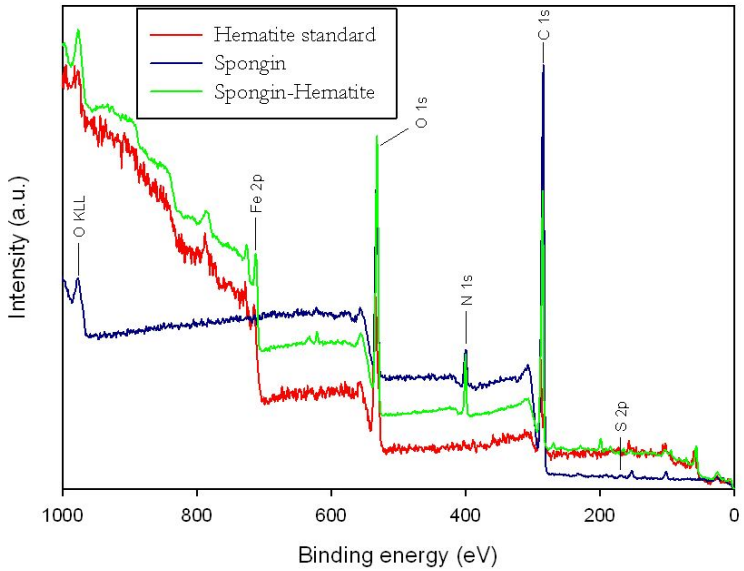


Fig. S4 XPS wide scan of hematite standard, spongin, and α-Fe_2O_3−spongin.