

## Novel bionanocomposites - Chitosan Goethite Bead - for arsenic remediation

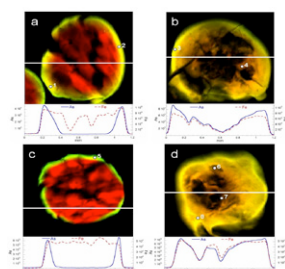
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Since iron oxides/hydroxides have high sorption affinity toward both As(V) and As(III), many scientific and industrial researches focus on the application of iron oxides/hydroxides as adsorbents in water treatment. Nevertheless, most iron oxides/hydroxides are fine powders, difficult to separate from solution after the adsorption process. In this study we develop a novel method for the synthesis of chitosan-iron hydroxide composite leading to chitosan-goethite bead (CGB). Goethite nanoparticles and chitosan gel-beads were prepared simultaneously, obtaining 1mm-sized spherical bionanocomposites, consisting of homogenous distribution of the goethite nanoparticles in the chitosan phase with enhanced mechanical properties compared to pure polymer/pure mineral. The macroscopic structure of the composite determines that it can overcome the difficulty of separation procedure in water treatment, while its microscopic structure retains the superiority of nanomaterial with regard to high sorption efficiency. CGBs were characterized by Mössbauer spectroscopy to confirm the presence of goethite phase, and their morphology was investigated by FE-SEM. Batch sorption and kinetic experiments on CGB reactivity toward arsenate and arsenite were performed to quantify the sorption and diffusion-controlled kinetics of CGB with respect to As. In addition, the mechanism of arsenic uptake onto CGB was investigated by X-ray Absorption Spectroscopy (XAS), and the diffusion of As(V) and As(III) from aqueous into solid phase was monitored by micro X-ray fluorescence ( $\mu$ XRF) (Fig.1) and micro X-ray Absorption Near Edge Spectroscopy ( $\mu$ XANES).



**Figure 1.** Color temperature distribution maps of As (green color) and Fe (red color) of As-loaded CGB samples, collected from kinetic experiments of As(V) sorption onto CGB a) at 1.5 h, b) at 120 h; As(III) sorption onto CGB c) at 1.5 h; d) at 120 h.

## C4 plants expansion and the enhanced aridity from the late Miocene to Pliocene on the Chinese Loess Plateau

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The Red Clay Formation, which underlies the well-known Quaternary loess sequence, extends the eolian deposits from 2.6Ma through the late Miocene making it a good archive to reconstruct Pliocene climate in North China. The carbon isotopic composition of carbonate nodules in the Red Clay Formation has been suggested as potential proxy for paleoecology. The spatial and temporal pattern of carbon isotopes will provide new evidence for the drying history from late Miocene to Pliocene.

We studied four continuous sections (Duanjiapo, Lingtai, Bajiazui and Jiaxian) of the Red Clay Formations on Chinese Loess Plateau (CLP) by stable isotope mass spectrometer. The averages of carbon isotopes were at -9.3‰, -8.0‰, -5.3‰ and -4.9‰, respectively. The carbon isotopes of carbonate nodules show a northward positive gradient on CLP, suggesting an increasing trend of C4 plants abundance, which may relate with increasing aridity.

Two C4 plants expansion events were revealed from our Red Clay carbon isotope records. C4 plants greatly expanded in two intervals at ~6.4Ma and ~3.6Ma on CLP. The enhanced aridity may account for the two events.

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