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Suitability of humic substances recovered from sewage sludge to remedy soils from a former As mining area- a novel approach

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Highlights

- Humic substances (HS) from sewage sludge are promising washing agent for soils
- HS are extremely effective in removal of most toxic As(III) (96%, on average)
- Organic As is removed with HS only from the most organic soil
- Double soil washing increased As stability (based on I_r) in soils

Abstract

Batch washing experiments were performed to evaluate the feasibility of using a solution of humic substances (HS) extracted from municipal sewage sludge as a washing agent to remove As from soils at a former As mining area. Soils (S1, S2, S3) differed in organic matter content, pH and As concentration. At pH 4 and a HS concentration of 4000 mg TOC L⁻¹, As removal efficiency ranged from 18% (S2) to 27% (S3). In all cases, As removal proceeded according to pseudo-second-order kinetics (equilibrium As concentrations ranged from 625 mg kg⁻¹ (S3) to 1250 mg kg⁻¹ (S3); rate constants, from 1.02·10⁻⁵ kg mg⁻¹·min⁻¹ (S1) to 2.05·10⁻⁵ kgmg⁻¹·min⁻¹ (S3). The time needed to reach equilibrium was 12 h. With double washing, the efficiency of As removal was 1.5-times higher (on average) than with single washing. Double washing increased As stability, as indicated by the reduced partition index, especially in soils S1 and S3. Moreover, HS effectively decreased the content of the most toxic As(III) (by 95-97%).

Keywords: soil washing; humic substances; arsenic; distribution; reduced partition index (I_r)

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