Granulated Coal Ash Can Effectively Adsorb Hydrogen Sulfide

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[1. Introduction] Sediments lying under enclosed water bodies often contain high amount of hydrogen sulfide due to sulfate reduction under anoxic conditions. In addition to their acute toxicity, hydrogen sulfide may cause depletion of dissolved oxygen in the bottom water and resulting deterioration of benthic ecosystems. Therefore, it is very important to reduce the concentration of hydrogen sulfide from sediments so as to maintain healthy ecosystems.

Although granulated coal ash (GCA), a byproduct from coal thermal electric power stations, is usually reused as construction materials, new uses of GCA should be explored in order to promote a recycling conscious society. The purpose of this study is to investigate hydrogen sulfide adsorption behavior onto GCA in terms of utilizing the latter as a remediation agent of organically enriched marine sediments.

[2. Experimental] GCA (0.2 g) was added to 50 mL of hydrogen sulfide (initial concentration;5-500 mg/L) de-aerated solution at pH 8.2 and agitated moderately at 100 rpm at 25^{o}C. Time course of hydrogen sulfide and sulfate concentrations, pH and oxidation reduction potential (ORP) were monitored. After the adsorption of hydrogen sulfide, the GCA samples were air-dried for 2 d in a dark place, and sulfur species adsorbed on the GCA were identified by X-ray adsorption fine structure analysis (XAFS).

[3. Results and discussion] Hydrogen sulfide (initial concentration: 8 mg/L) was removed completely within 45 hr after the addition of GCA. Accordingly, the ORP value and sulfate concentration in the liquid phase increased. In this case, it was estimated that ca. 20% of hydrogen sulfide was oxidized to sulfate ion in liquid phase while ca. 80% was adsorbed onto GCA. The sulfur K-edge XANES spectra of GCA (solid phase) revealed that a new peak at 2472 and 2478 eV were observed after hydrogen sulfide adsorption. These peaks represent sulfur and sulfite, suggesting that hydrogen sulfide was adsorbed onto the GCA and was successively oxidized to sulfur and sulfite.

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