

Arsenic species in fly ash and soil near ash dump from a lignite fired power plant in Inner Mongolia, China

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Arsenic is an environmentally sensitive element in the coal combustion process. The toxicity of trivalent arsenic (As(III)) is much greater than that of pentavalent arsenic (As(V)), and the arsenic species have different influence on the environmental and human health. A high-arsenic coal-fired power plant in Inner Mongolia, China is selected to investigate the transformation of arsenic species during coal combustion, analyze the arsenic species in the fly ash and the soil samples nearby the ash dump of high-arsenic fly ash, and understand the migration of arsenic from fly ash to soil.

Totally sixteen samples are collected, including in four coal samples, four fly ash samples (FA), two bottom ash samples (BA), two flue gas desulfurization gypsum samples (FGDG), and four soil samples (SO). The chemical composition and mineral phases are analyzed by the X-ray fluorescence microprobe (XRF) and X-ray diffraction (XRD), respectively. The microstructure of the samples is characterized by the environment scanning electron microscopy equipped with energy dispersive X-ray spectrometry (ESEM-EDX). The arsenic species in high-As fly ash is quantitatively analyzed by high performance liquid chromatography coupled with hydride generation atomic fluorescence spectroscopy (HPLC-HG-AFS) method.

The arsenic content in the high-arsenic lignite reaches up to 40 $\mu\text{g/g}$, and that in the high-arsenic fly ash can reach 110 $\mu\text{g/g}$. The arsenic is enriched in the fine size fraction of fly ash, up to 1.9% by ESEM-EDX. The arsenic migration occurs from the fly ash to environment after long-term stacked. The fresh fly ash mainly contains As(V), with a small proportion of As(III), only 1.22%. After the fly ash was stacked in the atmospheric environment for long times, the As(III) in fly ash will be oxidized to As(V). The As(III) is enriched in the ferrospheres of fly ash. The As(III) in the fresh bottom ash is higher than in the fresh fly ash. The arsenic species in flue gas desulfurization gypsum is just As(V). The proportion of As(III) in soil surrounding the ash pile is higher than that in the fly ash, and the As(III) and As(V) can transform to each other in the environment.