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Distribution of hazardous trace elements during coal beneficiation

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Various methods are used in the beneficiation of coal to produce cleaned coal. The main aim is to reduce the mineral matter, that is, to lower the ash yield with a consequent lowering of transportation and other costs and to improve combustion. There is also a bonus with the reduction in the levels of various trace elements, notably those associated with sulfide and other minerals. So to me research results have shown that there are marked reductions in the concentrations of various trace elements after beneficiation. Concentrations for 11 trace elements (listed in the 1990 Clean Air Act Amendments) were determined in raw coal and in clean coal using commercial samples from several seams from eastern and mid-western USA and conventional methods of beneficiation. Other results have shown that the ash yields of 25–30% in the raw coals were reduced to 6–10% in the clean coals. Significant reductions were found for several trace elements, for example, As, Cr, Mn, Ni and Pb were reduced by 54–75%, Cd, Co and Be by 41–52% and lesser reductions were found for Hg, Sb and Se 14–34%, As expected, there was some connection between the reductions in trace element concentrations and ash yields.

Author had carried out washing experiments for determining trace elements in water from coal-washing factory in Yanzhou Mining Area. Before washing, the trace elements As, Hg, Cd, Cr, Cu and Pb in water (W1) were determined. After finishing the experiment, the trace elements As, Hg, Cd, Cr, Cu and Pb in washing-water (W2) were determined. According to Table 1, It is clearly shown that the content of trace elements As, Cr, Cu and Pb in water (W1) are lower than those in washing water (W2). For examples, the content of Cu, Pb in washing water are 15.22 times and 13.27 times those in W1, and the content of Cr and As in W2 are 3-4 times those in W1.

It is concluded that parts of hazardous trace elements will release out from coal and enter into washing water during coal washing processing. Because the content of hazardous trace elements in washing water is higher, the washing water must be done in the good methods, or it will pollute water environment.

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Anion uptake by mixed-metal (hydr)oxides

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Atomistic simulations of the mechanistic controls over mineral double layer properties point to mixed valence (II and III) metal (hydr)oxides as high efficiency sorbers of anions such as arsenate, chromate, and iodide. In particular, high-surface area Cu(II) and Zn(II)-doped spinels show elevated selectivity for arsenate while possessing low solubilities and dissolution rates. Cu(II) and Zn(II) (hydr)oxides are themselves reasonably insoluble and exhibit pH_{zpc}'s higher than trivalent Fe and Al (hydr)oxides suggesting that Cu and Zn sites impart a locally elevated anion exchange capacity to a multi-oxide spinel.

Doping of Fe/Al coagulants with Cu(II) and Zn(II) elevates As(V) uptake from As-contaminated drinking waters pointing to a secondary role of crystal structure. Injection of Cu(II) salts into Fe(III)-containing soils lowers ambient As(V) levels and raises the bulk sorption coefficients that control subsequent flushing of As(V) through the system. The accumulated results point to the potential importance of transition metals in affecting anion transport in the subsurface and novel means for removing As(V) from drinking water.

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