

Ash Surface Characteristics for Metal Adsorption

Xinjun Teng, Hao Wang, Jianmin Wang and Heng Ban

University of Alabama at Birmingham, School of Engineering, BEC 356D, 1530 3rd Ave. South, Birmingham, Al 35294-4461

KEYWORDS: fly ash, site density, acidity constant, adsorption constant, heavy metal

ABSTRACT

The metal adsorption characteristics of fly ash determine the leaching potential of metals from fly ash. This study focused on the surface physical-chemical characteristics relevant to heavy metal adsorption, such as surface site density, surface acidity constant, and the percent adsorption of metals (Cu, Ni, Pb, and Cd). A power plant ash was washed to remove most of the original leachable metals. A batch equilibrium alkalimetric titration method was employed to determine the site density and acidity constant of the sample. Results showed that the fly ash contained three types of acid sites potentially available for metal binding. Equilibrium metal adsorption was determined experimentally by the adding different amount of metal standards in the solution. The uptake of all heavy metals was found to increase with increasing pH. Results also showed that the percent metal adsorption was independent of the amount of metal added, which indicated that the metal concentration was within the linear range of the Langmuir isotherm. Based on surface acidity data and the metal adsorption results, the metal adsorption constants (pK_s) were calculated. These constants can show the contribution of each type of acid sites to the total metal adsorption, and provide a basis for the prediction of metal adsorption, or leaching characteristics from the ash.