

Extraction of major soluble impurities from fly ash in open and closed leaching systems

Xavier Querol, Juan C. Umaña, Feliciano Plana, Andrés Alastuey, Angel Lopez-Soler, Carles Ayora

Institute of Earth Sciences "Jaume Almera", CSIC, C/ Lluís Solé Sabarís, s/n, 08028 Barcelona, Spain.

KEYWORDS: Fly ash, mineralogy, geochemistry, heavy metals, leaching

ABSTRACT

The study focuses on the behavior of major and trace water-soluble impurities in fly ash in open and closed (25 and 95°C) extraction systems in order to assess potential decontamination procedures to increase the potential industrial applications. Six different Spanish fly ashes were selected for this study on the basis of the mineralogical and geochemical characteristics (mainly calcium and iron oxides and heavy metals concentrations). Mineralogical changes undergone in the extraction experiments were investigated. The solubility of most heavy metals from fly ash is reduced given the high pH values induced by the free lime present in fly ash. This pH effect should be reduced in the open extraction system with respect to the closed system. The comparison between the extraction yields obtained from the open and closed leaching systems demonstrated that the closed system showed relatively high extraction yields for major impurities (i.e. Ca, S, Mg, B, Mo) using a simple and inexpensive extraction method. Higher extraction yields for calcium, and specially for some heavy metals (As, Cr, Mo, V) could be reached by using the open leaching system with higher water/solid ratios but the high water consumption may limit its industrial application. The improvement of the extraction ratios under heating with respect to the ambient extraction affected mainly to Al, Si, K, Na, Ba, Cr, Rb, Sr and V. However, the major impurities (Ca, S and Fe) and heavy metals did not increase considerably the mobility in the heated extraction with respect to the ambient extraction (generally <30%).