Geophysical Research Abstracts
Vol. 19, EGU2017-3127, 2017
EGU General Assembly 2017

Effects of Coal Combustion Additives on the Forms and Recovery of Uranium in Coal Bottom Ash

Ye Tang and Yilian Li
School of Environmental Studies, China University of Geosciences, Wuhan, China

Recovering uranium from uranium-rich coal ash is an important way to utilize unconventional uranium resource. Although it might be expected that the uranium in residual form would prevent uranium recovery from coal ash, raising the recovery rate in way of controlling residual uranium has not yet been studied. In this study, three different kinds of combustion promoting additives were investigated by coal combustion experiments, in order to decrease the proportion of residual-form uranium in ash and increase the acid leaching rate. Analytical procedures included Tessier sequential extraction, acidleaching, and characterization(ICP-MS, XRF, BET and SEM-EDS). It was showed that the effects of additives in reducing residual uranium were as the following order: alkaline earth metal compounds $>$ transition metal compounds$>$ alkali metal compounds. Adding alkali metal additives(KCl, NaCl, K_2CO_3, Na_2CO_3) raised the percentage of residual uranium largely. Additionally, one transition metal additive(Fe_2O_3) reached a decreasing amplitude of 5.15%, while the other two additives(MnO_2 and Fe_3O_4)made the rates increased. However, coal combustion with alkaline earth metal compounds mixed had target effects. Among this kind of additives($Ca(OH)_2$, $CaCO_3$, CaO, $CaCl_2$), $CaCO_3$displayed the best effect on restricting the rising proportion of residual uranium by 18%. Moreover, the leaching recovery research indicated that $CaCO_3$ could raise the recovery rate by 10.8%. The XRF profiles supported that the $CaCO_3$ could lower the concentration of SiO_2 in the bottom ash from 79.76% to 49.69%. Besides, The BET and SEM revealed that the decomposition of $CaCO_3$ brought about a variation of surface structures and area, which promoted the contact between the leaching agent and bottom ash. The uranium content increase was determined by ICP-MS and EDS. These findings suggest that $CaCO_3$ could be a favorable additive for the controlling of residual uranium and improvement of uranium recovery rates.

Key words: uranium recovery; coal combustion additives; residual uranium