

# Recovery of Germanium from a Coal Fly Ash Aqueous Leachate by Precipitation

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## ABSTRACT

The valorization of a coal gasification fly ash has been studied by leaching the fly ash with water and a subsequent precipitation of the solubilized germanium in the leachate. Experimental investigations were focused on the precipitation of a germanium–catechol (CAT) complex with cetyl trimethyl ammonium bromide (CTAB). The influence of pH and amount of CTAB and CAT on the precipitation yield was investigated. For a proper set of experiments, a statistical technique such as the response surface methodology has been used. A central composite rotatable design was employed for experimental design and analysis of the results. The independent and combined effects of molar ratio CAT/Ge, molar ratio CTAB/Ge and pH were investigated and optimized using a quadratic mathematical model. The optimum values of these factors were found to be 12, 4 and 10 respectively, from which a germanium precipitation percent of 98.8% can be reached. The precipitation of germanium as an organic complex with catechol and CTAB results to be selective towards germanium so that this element can be effectively separated from As, Mo, Sb, V or Zn. Thermo-gravimetric analyses of the solid germanium precipitates have been performed as a consequence of which 600°C was determined as the minimum temperature to remove completely the organic matter of the precipitates.

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