Coal Fly Ash: A Waste from Thermal Power Plants or Potential Secondary Source of Critical Minerals

Sarvesh Bisen
Amity Institute of Geo-Informatics & Remote Sensing, Noida, Uttar Pradesh, India

Dr. Rakesh Kumar Tiwari
Amity Institute of Geo-Informatics & Remote Sensing, Noida, Uttar Pradesh, India

Dr. Sabyasachi Chattopadhyay
Amity Institute of Geo-Informatics & Remote Sensing, Noida, Uttar Pradesh, India

Abstract:

Major chunk of electrical power is derived through coal-based power plants globally and especially in Asian countries. Burning of pulverized coal in these power plants, give rise to a waste material known as coal fly ash (CFA). CFA is partially used in construction materials like cement, bricks etc. however, some of it is dumped in landfills posing a serious risk to environment. During the last few years, CFA has been identified as a potential secondary source for the recovery of some critical minerals like Rare Earths, Copper, Cobalt, Manganese, Nickel etc. These minerals are critical to the energy transition through their application in modern sustainable technologies like turbine generators, electric vehicle, magnets, solar panels, batteries etc.

This study focusses on evaluating the potential of 5 CFA samples from different thermal power plants distributed across North and Central India for being the secondary source of critical minerals namely Cobalt, Copper, Nickel, Potassium, Strontium, Titanium and 7 Rare Earth Elements viz. Neodymium, Europium, Terbium, Dysprosium, Erbium, Scandium, Yttrium. These samples were analysed for critical minerals concentration in ICP-OES after digestion process and the resulting yield of different critical minerals was found in the range of 70-90%. The critical minerals in CFA samples used in this study have been found in measurable enriched quantities as compared to background concentrations of UCC and Chondrite and indicate quantities that can be utilized for modern day sustainable energy solutions. The study also highlights the need to think forward towards creating commercially feasible extraction methodologies for critical minerals from CFA at industrial scales.