Environmental impact of heavy metals released from deposition of lignite and waste material ashes

D. VAMVUKA[1], D. PENTARI[2]

[1]School of Mineral Resources Engineering, Technical University of Crete, Chania 73100, Greece, corresponding author, vamvuka@mred.tuc.gr

[2]School of Mineral Resources Engineering, Technical University of Crete, Chania 73100, Greece, pentari@mred.tuc.gr

Given the trend to replace fossil carbon and gain additional revenue with minimum environmental impact, the power generation sector across the world is considering the use of waste materials as secondary fuels. Future co-firing applications of indigenous coals with such wastes may create problems related to the disposal of ashes, which contain harmful constituents. In this work, the environmental impact of ashes produced from combustion of various municipal, agricultural, and forestry wastes and one lignite from the area of Ptolemais in North Greece, during experiments in a fluidized bed unit, was investigated. Feed rate was 0.72kg/h, excess air ratio 1.4 and maximum temperature within the bed about 870°C. Continuous column leaching tests closely approximating field conditions were performed for soil-ash mixtures. Solid materials were characterized by mineralogical and chemical analyses using X-ray diffraction analysis and inductive coupled plasma mass spectrometer analysis, as well as by pH measurements. The concentrations of trace elements and the pH of the leachates were determined. The results showed that waste material ashes were rich in Cu, Zn, Sr, Mn, and Cr, in contrast to the lignitic ash. Sewage sludge ash contained an elevated amount of Pb too. Toxic metal ions were released in low quantities through the soil, below the legislative limit values. The low leachability of the elements was attributed to the high alkalinity of the extracts, basically due to Ca-bearing minerals, as well as the mineralogical and chemical composition of the solids involved. The higher mobility of Sr and Cr from all ashes and of Mn and Zn from the lignite and forestry waste ashes reveals their potential association with exchangeables, carbonates, sulphates or organic matter.