Evaluation of the Chromium speciation in Israeli coal fly ashes

H.A. van der Sloot, R.P.J.J. Rietra, J.J. Dijkstra and D. Hoede, 2001

Energy Research Center of the Netherlands (ECN)

Upon the request of the Israeli National Coal Board the Cr speciation in Israeli coal fly ashes was evaluted. Six fly ashes - fresh ash, fly ash used in road application and fly ash collected from an embankment were tested. For this purpose, the ash leaching behaviour has been characterized as a function of the pH in a so-called pH dependence test, which forms the basis for the evaluation of chromate leaching behaviour though modelling of solubility controlling phases. The Israeli coal fly ashes are not different from other coal fly ashes generated by coal in power plants from world wide coal sources. The chromium in coal fly ash is partially available as chromate. This species is particularly relevant for leaching in the pH domain pH 5 – 12. At pH < 5 Cr^{+++} is becoming a more predominant species. The fresh Israeli coal fly ash do not exceed 20 mg/kg leachable Cr VI, which amouts to about 10 % of the total Cr in coal fly ash. Geochemical modelling has shown that a solid solution of $BaSO_4$-$BaCrO_4$ (S96%) is a dominant solubility controlling phase under oxidised conditions. The significantly reduced chromate levels in the aged roadbase material is possibly explained by adsorption of Cr III on hydrated ironhydroxide at the neutral pH developing with time. This reaction will pull the equilibrium Cr^{VI} to Cr^{+++} towards the Cr^{+++} side. The in-situ transformation leads to a significantly reduced Cr leachability of less than 1 mg/kg leachable chromate, which amouts to less than about 0.5 % of the total Cr. Only by field verification under the roadbase leaching can be ruled out. In the embankment, the lack of measuring significant Cr levels under the Hadara embankment over the last 20 years would support in-situ transformation. However, the ash sample taken deep into the Hadeira embankment may well have a very different coal source for its production, which could explain the difference between the two samples analysed. Measuring CO_2 liberated by acidification would allow to draw conclusions on the different origin of the two ash samples.