

Heavy metal exposure from co-processing of hazardous wastes for cement production and associated human risk assessment

ABSTRACT

This study was carried out to determine the concentration of heavy metals (Cd, Ni, Pb, Cr, Ni and Zn) in ordinary Portland cement (OPC) produced from the co-processing with hazardous waste in comparison with OPC produced using natural raw materials. The results showed that the concentration of heavy metals in cement produced from natural raw material was in the order of $Zn > Pb > Cr > Ni > Cu > Cd$. Zn and Cd were the highest and the lowest concentrations, respectively, in cements produced from the co-processing activity. The difference between heavy metals concentrations in OPC produced with and without co-processing was found to be statistically significant. The concentration of heavy metals in the cement produced is generally factory dependent. The human risk assessment associated with the heavy metals for non-carcinogenic and carcinogenic risks has been evaluated. The calculated hazard index (HI) and total lifetime cancer risks (LCR) were lower than the acceptable threshold reference values, $HI < 1$ and $LCR < 1 \times 10^{-4}$, respectively. Thus, it is anticipated that there is no potential of non-carcinogenic and carcinogenic risks for both adult and children. However, the findings indicated that there is a need for regulatory monitoring. The exposure pathway for both non-carcinogenic and carcinogenic risks are both in the order of ingestion > dermal > inhalation.

Keyword: Heavy metals; Hazardous wastes; Human risk assessment; Co-processing; Cement