Heavy metal quantification of classroom dust in school environment and its impacts on children health from Rawang (Malaysia)

ABSTRACT

This study aimed to determine bioavailable heavy metal concentrations (As, Cd, Co, Cu, Cr, Ni, Pb, Zn) and their potential sources in classroom dust collected from children's hand palms in Rawang (Malaysia). This study also aimed to determine the association between bioavailable heavy metal concentration in classroom dust and children's respiratory symptoms. Health risk assessment (HRA) was applied to evaluate health risks (non-carcinogenic and carcinogenic) due to heavy metals in classroom dust. The mean of bioavailable heavy metal concentrations in classroom dust found on children's hand palms was shown in the following order: Zn (1.25E + 01 μg/g) > Cu (9.59E-01 μg/g) > Ni (5.34E-01 μg/g) > Cr (4.72E-02 μg/g) > Co (2.34E-02 μg/g) > As (1.77E-02 μg/g) > Cd (9.60E-03 μg/g) > Pb (5.00E-03 μg/g). Hierarchical cluster analysis has clustered 17 sampling locations into three clusters, whereby cluster 1 (S3, S4, S6, S15) located in residential areas and near to roads exposed to vehicle emissions, cluster 2 (S10, S12, S9, S7) located near Rawang town and cluster 3 (S13, S16, S1, S2, S8, S14, S11, S17, S5) located near industrial, residential and plantation areas. Emissions from vehicles, plantations and industrial activities were found as the main sources of heavy metals in classroom dust in Rawang. There is no association found between bioavailable heavy metal concentrations and respiratory symptoms, except for Cu (OR = 0.03). Health risks (non-carcinogenic and carcinogenic risks) indicated that there are no potential non-carcinogenic and carcinogenic risks of heavy metals in classroom dust toward children health.

Keyword: Heavy metal; Classroom dust; Children; Respiratory symptoms; Health risks; Carcinogenic; Non-carcinogenic