HEALTH RISK ASSESSMENT OF HEAVY METALS IN AIR-CONDITIONER FILTER DUST FROM OFFICE ENVIRONMENT AT THE STATE SECRETARIAT, ABEOKUTA, OGUN STATE, NIGERIA

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ABSTRACT

Indoor air quality is a significant environmental health concern, as individuals increasingly spend more time indoors: at homes, offices, and schools, making use of air conditioners. Filtered dust in air conditioners can act as a reservoir for heavy metals, which are toxic pollutants that can accumulate in such environments, posing health risks to occupants. This study assessed the health risk of heavy metals in air-conditioner filtered dust in office environment at the State Secretariat, Oke Mosan, Abeokuta, Ogun State, Nigeria. A total of eighty air conditioner filters were sampled and collected from sixteen Ministries, Departments, and Agencies (MDAs). Samples were digested using perchloric acid and concentrated nitric acid after which they were analysed for eight heavy metals (Pb, Cr, Mn, Zn, Cu, Co, Fe, and Ni) using Atomic Absorption Spectroscopy (AAS). Health risks were evaluated using Hazard Quotient (HQ), Hazard Index (HI), and Lifetime Cancer Risk (LCR). The results showed that the mean concentrations of Pb, Cr, Mn, Zn, Cu, Fe, and Ni in the air conditioner filter dust were; 7.609±0.40, 2.358±0.18, 0.450±0.03, 3.473±0.21, 1.284±0.16, 7.469±0.35 and 2.436±0.08 mg/kg, respectively, while Co has mean concentration below the detection limit of the analytical instrument. Heavy metal concentrations of air conditioner filter dust in this study were lower than values from cities around the world. The highest concentrations were observed in filters from the air conditioners in Teaching Service Commission (Fe: 12.092±0.14 and Ni: 4.796±0.13 mg/kg), Hospital Management Board (Pb: 10.211±0.08 mg/kg), Ogun State House of Assembly Service Commission (Mn: 0.865±0.05 mg/kg) and Hospital Management Board (Ni: 4.509±0.17 mg/kg) while relatively lower concentrations were observed at Ogun State Planning and Development Authority (Mn: 0.275±0.04 mg/kg), Ministry of Rural Development (Ni: 2.436±0.08 mg/kg), and Ogun State Environmental Protection Agency ((Fe: 4.228±0.09, Pb: 2.339±0.18, Zn: 2.187±0.17, Cu: 0.598±0.07, and Cr: 1.1813±0.08 mg/kg). The HQ values for different exposure pathways

decreased in the order of dermal>ingestion>inhalation. Fe had the highest value of HI (1.37E-02) and therefore presented the highest non-carcinogenic risk. In all sampling points, HQ and HI values were lower than the acceptable limit of 1.00, indicating non-carcinogenic health effect. Cancer risk value of Cr was same as that of the United States Environmental Protection Agency (USEPA) lower limit of 1×10^{-6}, indicating that prolong exposure may result in minimal health effect. In addition, LCR values of other metals were below the USEPA limit of 1×10^{-6} to 10^{-4} showing no carcinogenic risk. The study concluded that heavy metal concentrations in the air-conditioner filter dust were relatively low with respect to the sampled offices.