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Evaluation of trace elements and particle size distribution in residential in-house dust in Mexico

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Indoor house dust has recently received significant attention, particularly after COVID 19 confinement. Several studies have reported that the concentration of some metals increases indoors relative to outdoors. However, to date, no study has addressed the particle size distribution of indoor dust to assess people´s exposure. This work studies 30 trace metals from indoor samples from homes in Mexico. We used a citizen science approach for sample collection. We conducted metal analyses with X-ray fluorescence with miniaturized tubes. At the same time, particle size distribution was obtained by resuspending the dust in an air chamber and then studying it with scanning electron microscopy. The results show enrichment in the indoor dust with respect to the street dust as follows: Co>Fe>Cr>Mn>V>Zn>Cu. Mn, Cu, Zn, and Fe can be associated with mobile sources or traffic, while V is associated with combustion processes. Principal component analysis on indoor dust shows the following associations linked to different sources: Zr-Sr-Rb-Co-Fe-Y-V-V-Ti-S-Ba by F1 (28% of the total variance), possibly associated with a mixture of geogenic dust (Sr-Rb-Y-Ti), residential indoor combustion sources (V-Fe-Co), and non-exhaustive traffic emissions (S-Ba-Zr) associated with brake and catalytic converter wear. The second component (18.6%) shows an association of Mo-Pb-Zn-W-Cu-Mn-Sn-Nb, which also represents a mixture of geogenic and anthropogenic elements possibly associated with vehicular emissions. The particle size distribution indicates that 70% of indoor dust corresponds to particles smaller than 1µm (PM_1). Some of these particles derived from non-exhaustive emissions, and they are crystalline and biodurable. They may be considered emerging pollutants because chronic exposure may lead to pneumoconiosis. This research highlights the risk of indoor exposure to particles that can penetrate alveolar macrophages, so the study of household dust fractions is recommended.