The role of organic matter in pollution catching in indoor dust

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Abstract: Indoor dust collected in 195 flats and houses in Warsaw, Poland shows an asymmetric distribution of magnetic susceptibility (χ) in the wide range of 20-1514·10^{-8} m^3kg^{-1}, with the mode value of 114·10^{-8} m^3kg^{-1}. The full histogram evidently includes two sets of data. The first set of indoor dust samples has the susceptibility less than 220·10^{-8} m^3kg^{-1}, and the statistical distribution close to normal. It includes more than 90% of samples and is characterized by roughly uniform magnetic mineralogy typical for fine grained magnetite of grain size between pseudo-single-domain and small multi-domain with small contribution of superparamagnetic particles (~10%). The second set includes samples with susceptibility higher than 220·10^{-8} m^3kg^{-1} and contains mainly magnetite and an anthropogenic metallic Fe with T_C >700°C. Correlations of susceptibility and magnetization with concentration of heavy metals indicate that these magnetic parameters are good indicators of heavy metals in household dust. To analyze the correlation of heavy metal (HM) and trace elements (TE) concentration with values of magnetic parameters we used the Tomlinson Pollution Load Index (PLI, Tomlinson, 1980). The index PLI is defined as the geometric mean of the relative concentrations of analyzed elements:

$$PLI = \sqrt[n]{CF_1 \cdot CF_2 \cdot \ldots \cdot CF_n}$$

where: CF_n is the ratio of the concentration of F_n element to the background value adopted as the lowest concentration value for this element; *n* is the number of elements.

The magnetic susceptibility correlates linearly with the concentration of toxic HM and TE expressed by PLI values (see Fig.1a). The Pearson's correlation coefficient is R=0.88 for the 1st group and 0.98 for the 2nd group. The second group shows different slope. Correlation with saturation remanent magnetization - M_{rs}, saturation magnetization - M_s revealed also the linear relation.

Evaluation of organic matter content of indoor dust was approximated by measurement of LOI (loss on ignition) parameter. This parameter is used in soil study for rough estimation of organic matter content. LOI in relation to susceptibility also roughly brakes into two groups, however, they are not the same as in the case of PLI vs. susceptibility relation. There is also different tendency for strongly polluted samples (decreasing) and for weakly polluted samples (increasing). The study is in

progress, however, the preliminary results indicates that the organic matter participates in couching and keeping of pollutants particles.

Keywords: pollution, indoor dust, magnetic properties, organic matter, heavy metals

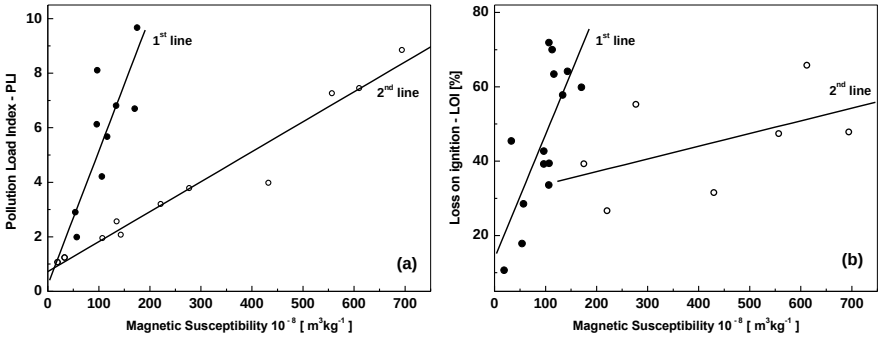

Figure 1: Correlation between the magnetic susceptibility and (a) concentrations of heavy metals (HM) and toxic trace elements (TE) expressed by PLI index and (b) organic matter content of indoor dust approximated by LOI (loss on ignition) parameter. The 1st and 2nd group of samples are denoted by closed (•) and open (o) circles respectively.

References :

Tomilson, D.C., Wilson, J.G., Harris, C.R. & Jeffrey, D.W., 1980: Problems in assessment of heavy metals in estuaries and the formation of a pollution index. Helgol. Meeresunlters, 33, 566–575.