Technogenic magnetic particles in the enviroment as of pollution sources

T. MAGIERA, M. SZUSZKIEWICZ, M. RACHWAŁ

Institute of Environmental Engineering, Polish Academy of Sciences, M. Skłodowska-Curie 34, 41-819 Zabrze, Poland, e-mai:l tadeusz.magiera@ipis.zabrze.pl

Technogenic magnetic particles (TMPs) are defined as different mineral forms of iron that exhibit ferro-, or ferrimagnetic properties and were formed during wide variety of high temperature technological processes (metallurgy, fuel combustion, ceramic, cement and coke industry etc), when iron, present in different mineral forms in raw materials, fuels or additives has been transformed to oxide forms. Their magnetic properties enable to use them as tracers of industrial pollution because their presence, even in trace amounts, in dusts, soils, or sediments can be easily detected by simple measurement of magnetic susceptibility. This parameter is directly proportional to quantity and a mode of magnetic minerals present in the measured sample. The TMPs formed in high temperatures are non-stoichiometric mineral phases with magnetite- or ferrite-like crystal lattice, what enables many elements to be incorporated within the structure. Geochemical study of fly ashes has proved also that many potentially toxic elements (PTEs) are adsorbed on particles' surfaces. Especially the finest fraction of dust having a large active surface, were found to be enriched in such PTEs as Cr, Mn, Pb, V, Zn. If the elements are bound in a crystal lattice their potential mobility is low. The other situation is the case of elements adsorbed on the surface of iron oxides or connected with the amorphous phase of iron oxides or hydroxides. From such forms of binding the elements could be easily released, especially in the acid forest topsoil where alkaline dusts are usually deposited. Our studies revealed that the different technological processes applied in many kinds of industries are sources of very specific morphological and mineralogical forms of TMPs, which are carriers of specific set of PTEs. Their different internal structure is reflected in their magnetic properties, which may be useful for identification of the sources of pollution and can serve as a tracer of dust origin in particles deposited in soil or sediments.