IDENTIFICATION OF MAGNETIC PARTICULATES IN ROAD DUST ACCUMULATED ON ROADSIDE SNOW USING MAGNETIC, GEOCHEMICAL AND MICRO-MORPHOLOGICAL ANALYSES

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Road traffic is considered a significant emission source of anthropogenic particulates in urban areas. A strong connection exists between long-term exposure to urban air pollution and respiratory diseases, coronary atherosclerosis, and increased cancer and mortality risks. Dust discharged into the air by road traffic, contains strongly magnetic, iron-rich particles, which are commonly associated with heavy metal concentrations. This compels current studies to monitor vehicle-derived magnetic particles using fast and cost-efficient techniques such as magnetic measurements. In this study magnetic methods combined with geochemical and micro-morphological analyses were applied to examine road dust extracted from snow, collected near a busy urban highway and a low traffic road in a rural environment (southern Finland). Significant differences in horizontal distribution of mass specific magnetic susceptibility were observed for both sites. Furthermore, the magnetic methods revealed that coarse-grained, multi-domain (MD) magnetite is the primary magnetic mineral. Two groups of anthropogenic particulates were identified in the studied road dust samples: (1) iron-rich spherules (diameter~2–70 micrometres) and (2) angular-shaped particles (d~1–300 micrometres) mostly composed of Fe, Ni, Cr, Cu and Zn. The spherule-shaped particles occur mostly in emissions from industrial activities and residential wood combustion, while the angular-shaped particles are derived from vehicle emissions. Additionally, fine-grained (d<2 micrometres) tungsten-rich particles were identified in the road dust from both sites, possibly derived from the abrasion of tyre studs. A decreasing trend in magnetic susceptibility and selected trace elements with increasing distance from the road edge was observed in the investigated road dust samples. This study demonstrates that the combination of magnetic, geochemical and micro-morphological methods may be applied as an effective tool in monitoring vehicle-derived particulates, especially those posing serious threats to human health.

Keywords: vehicle emissions, magnetic properties, geochemical analyses