

Input of Tyre Abrasion Particles into Roadside Soils

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Abstract:

Wear-off particles of tyres are one of the main sources of dust emissions caused by road traffic. Estimations of the annual emission in Germany average out at about 111 000 t/a, most of it sedimentable dust (103 000 t/a), only a small part is estimated to be airborne dust. The main part of the dust forms deposits on the road surface and near the road, and road runoff, spray water and airborne transport lead to accumulation of this dust on the grassy road bank and the soils near the road. The contaminant content of the tyre wear particles is not well known, few data exist to other than zinc and cadmium content.

In this investigation, material was taken from the tyre tread of 65 car-tyres originating from the 1980ies to 2005 including a lot of common brands and a broad range of applications. It was completely digested and tested for the concentrations of Al, As, Cd, Cr, Cu, Fe, Mo, Na, Ni, Sb, Pb, V and Zn. A thermogravimetric analysis was performed giving proportions of total organic content, black carbon and ignition residues.

Results show that zinc is added to tyre treads in partly high concentrations, but they also show that cadmium and lead occur in quite low concentrations compared to the ratio Cd/Zn and Pb/Zn common in natural sources. According to literature and producer's information the emissions of copper and lead from tyres had been expected to be a relevant source for these metals in diffuse emissions. Based upon the measurements and an estimation of the emitted mass of the two elements this expectation could not be confirmed. Critical contents or emissions of the other elements could not be found.

The chronological sequence of the zinc and cadmium concentrations in tyre treads shows slightly decreasing values since the 1980ies and represents the producer's efforts for lower zinc emissions. Decreasing proportions of black carbon and increasing ignition residues reflect the growing application of new filler materials like silica in tyres.

Recent studies show good sorption properties of the particular fraction in road runoff. The role of the rubber and black carbon components of tyre wear as a part of the organic matter of the particular fraction in road runoff and in roadside soils and its efficiency for contaminant retention should be looked upon closer.

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