Non-exhaust emissions from road traffic in Lisbon: Characterization and pollution indexes

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Vehicle emissions are one of the main sources of air pollutants in urban areas (Pant and Harrison, 2013). Non-exhaust emissions from road transport include particles from brake and tyre wear, road surface abrasion and dust resuspension (Thorpe and Harrison, 2008). Road dust loads and their chemical properties are heterogeneous and their knowledge is still scarce. This type of emission is an increasing concern since there is no policy. This study aims to characterize, the thoracic fraction of road dust (PM_{10}), for the first time in Lisbon, Portugal.

Measurements were performed by collecting samples directly from road pavements by an *in situ* resuspension chamber (Amato et al, 2009). PM mass concentrations were gravimetrically determined and filters were then chemically analysed for the elemental composition and carbonaceous content.

The highest PM_{10} load (15.6 ± 8.75 mg m^{-2}) was obtained on a cobblestone pavement, while for asphalt roads the mean PM_{10} load was 4.40 ± 0.16 mg m^{-2}. Emission factors for asphalt pavements ranged from 83.5 to 274 mg veh^{-1} km^{-1}. The elements in their oxidized form and carbonaceous constituents reconstructed, on average, 65.7% of the PM_{10} mass (Figure 1). The thoracic fraction of road dust was predominantly composed of anthropogenic compounds, organic matter and mineral dust. The heavy metal PM_{10} mass fractions for most elements in urban street dust were much higher than the soil background values (EnF), indicating that road dust is highly contaminated by anthropogenic sources. Cu and Zn, associated with brake and tyre wear, were the most enriched elements in relation to the soil composition (EnF = 440 and 184, respectively) and revealed extremely high pollution indexes in all road sampling sites. The highest potential ecological risk factor of individual metals (Eri) was also observed for Cu (Eri_{Cu} = 393) followed by As with a considerable risk (Table 1). In 90% of the streets, the total carcinogenic risk was higher than 1E-4 for As, suggesting that exposure to this hazardous constituent may contribute to the development of cancer over a lifetime.

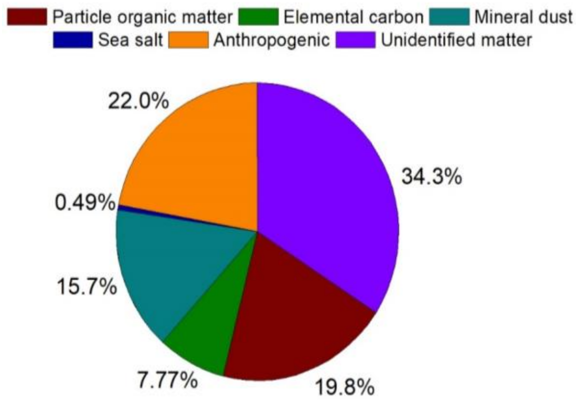

Figure 1. Mass closure of the PM_{10} fraction of road dust.

Table 1. Average Eri for heavy metals.

Average Er_i								
As	Cu	Ni	Pb	Cr	V	Zn	Mn	Ba
100	393	8	29	16	4	33	1	1

The results of this study show that non-exhaust emissions have an important impact on the environment and health due to the high contribution of several hazardous chemical constituents associated with road dust resuspension particles. This new data set can contribute to European emission inventories and source apportionment models, to assess the impact of traffic generated PM on human health and the environment, and to help implement mitigation and control measures.

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