COMPARATIVE ANALYSIS OF SMALL SIZE PARTICLE CONCENTRATIONS IN URBAN ENVIRONMENT

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INTRODUCTION

Various studies have identified and quantified sources of mass concentrations for particulate matter with aerodynamic diameters of ≤10 µm and ≤2.5 µm in different cities and regions worldwide (e.g., Amato et al., 2016; Pancras et al., 2013). However, there is limited knowledge regarding the sources and their contributions to mass and number concentrations of finer particles with diameters of ≤1.0 µm (Vu et al., 2015).

The size of particles plays a crucial role in determining their adverse effects on health and the environment, emphasizing the significance of understanding fine particles (Pope and Dockery, 2002). It is essential to evaluate the health risks associated with them separately from $PM_{2.5}$ and PM_{10}, as their deposition upon inhalation differs. Unlike larger particles, finer particles have the potential to translocate from the lungs to the circulatory system and other organs. In the context of the nPETS EC project, a measurement campaign took place at the city of Thessaloniki, Greece.

METHODS

The city is characterized by dense construction, including tall buildings, narrow streets, and virtually no uncovered spaces (e.g. parks). High concentrations for certain pollutants, such as nitrogen dioxide and particulate matters, are often notified by the city authorities (Kassomenos et al., 2011; Vlachokostas et al., 2009). Both mass and number concentrations were measured at two distinct locations in the city: a background site and an area adjacent to a busy road. Over a four-week period during winter at each site, Dekati DGI and Dekati ELPI devices were employed.

RESULTS

The average total particle concentration for the background scenario is higher compared to the road. The road scenario generally exhibits more variability in hourly concentrations compared to the background. Significantly higher concentrations have been recorded at the road site during the morning rush hours (06:00-08:00). 21:00 appears to have the highest concentration for both background and road. This might be explained by the closing of shops in the city center and the peak in house heating at that time.

In terms of mass for particles of sizes 30 and 63 nm (D50%), the concertation was about 50% higher in the road than in the background environment. For particles of 173 nm diameter (D50%), the difference was five times higher at background.

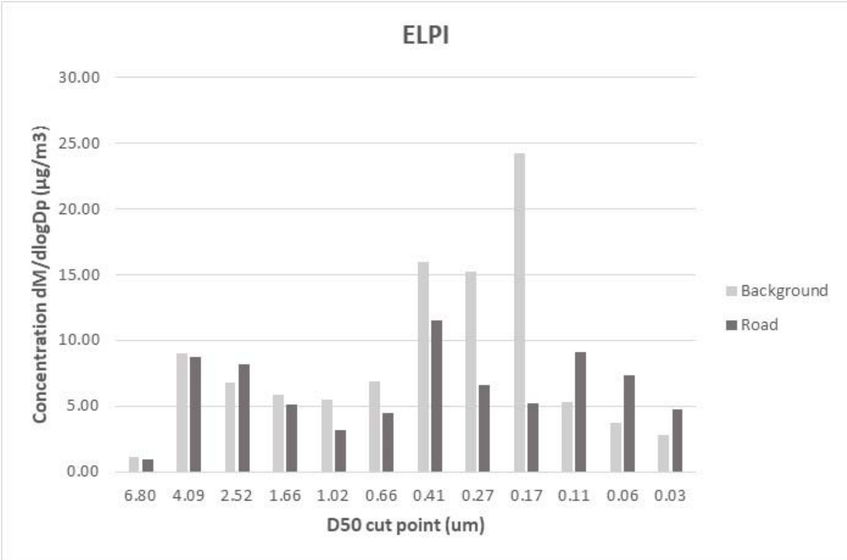

Figure 1: Mass lognormal distribution for the different particle size aerodynamic diameter.

CONCLUSIONS

The particle mass concentration is notably elevated for sizes ranging from 30-110 nm at the road site. Interestingly, this trend is reversed for particles in the 170-410 nm range, where higher concentrations are observed at the background. When examining particle number concentration, a parallel trend emerges, mirroring the patterns seen in exhaust gas emissions: peak values coincide with morning rush hours, while concentrations dip during the afternoon hours.

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