Abstract

An increasing amount of people live in urban areas, and are thus affected by the sometimes health threatening urban air. The health effects of particles are unquestionable and today it is suspected that the ultrafine fraction (10-100 nm) particularly is harmful.

This study has covered urban air quality, source apportionment and aging effects of air pollutants, with focus on the urban aerosol and the traffic emitted submicrometer particles. Six field studies in the Göteborg area have been conducted, one focused on vertical distribution of Total Suspended Particles (by content and mass) and the gases HNO_3, SO_2, NO and NO_2. Four field campaigns were focused the ultrafine particles emitted by road traffic, first in a rural area, close to a road, and then in more urban areas. The effect of temperature inversion, that significantly enhance air pollution problems in Göteborg, was investigated in the last campaign by measurements conducted during the winter season.

From the results described in this thesis it can be concluded that the Göteborg area generally is defined as a low polluted area. However, winter inversions that are formed during some days every year in the area create a low ventilated situation, with increased concentrations of most pollutant.

A novel approach to determine size distributed particle number emission factors for traffic is presented. The reported emission factors are given both as size distributions and the total number emission factors for 10-100 nm particles, and are $(35\pm15)*10^{14}$ or $(24\pm8)*10^{14}$ particles per mole NO_x, respectively.

The particles in the nucleation mode are, in urban areas, often related to traffic exhaust at a nearby street, as was shown both by PCA and correlation analysis. The correlation between particles of different sizes was limited, as ultrafine particles did not correlate with $PM_{2.5}$ at the road side, while the correlation was much better between $PM_{2.5}$ and 100-370 nm particles. The concentrations of ultrafine particles and PM_{10} evolved in significantly different directions, during the break up of morning temperature inversions. The differences between legislation tools, such as PM_{10} and $PM_{2.5}$, and numbers of ultrafine particles are of concern since it is suspected that ultrafine particles are responsible for a significant portion of the health effects in urban air.

KEYWORDS: air quality, traffic emissions, emission factor, Göteborg, ultrafine particles, size distribution, winter inversion, vertical distribution, source apportionment

ISBN 91-628-6393-2