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Outdoor and indoor sources to ultrafine and fine particles in an urban apartment

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Introduction

Aerosols in the indoor environment are of concern due to their potential effects on comfort and health.

We investigated the sources of particles in an inhabited apartment at a busy street in Copenhagen, Denmark. The apartment was situated on the third floor of a five-storey building. Indoor measurements were carried out simultaneously with outdoor measurements at a nearby street site and an urban background site.

Methods

Measurements of particles (10-700 nm) and CO were carried out for two weeks (23 October – 5 November 2003) using Vienna type Differential Mobility Particle Sizers and CO-monitors, respectively. Both the occupant and some of the neighbours kept a diary of their indoor activities. Weekly-averaged ventilation rates of the study apartment were measured using the perfluoro tracer technique.

A previously developed model (Schneider et al., 2004) was used to calculate indoor particle concentrations from penetration of outdoor air, and the difference between measured and penetrated particle concentrations was used to identify episodes with indoor particle sources.

Results and Discussion

The results show that indoor particle volume concentrations are only partly explained by the

outdoor concentrations. The variations in particle concentration seem more related to indoor activities in the study apartment and activities in the neighbouring apartments than outdoor levels. Generally sharp increases in particle volume and numbers could be explained by opening of windows and cooking in the apartment studied or by smoking in neighbouring apartments (Glasius et al., 2008).

Particle lifetimes according to size and source were determined from highly time-resolved measurements (5 min). Nanoparticles (<20 nm) from traffic showed a very fast decay within 10-30 minutes to background concentrations in indoor air, while concentrations of larger particles (up to 700 nm) decayed much slower during several hours to background levels. This difference in decay rates is caused by the particle size dependent differences in chemical composition and removal processes.

Glasius M., Wåhlin P., Jensen K.A., Schneider T., Gunnarsen L., Nielsen O.J., and Palmgren F. 2008. Outdoor and indoor sources to ultrafine and fine particles in an urban apartment; in preparation.

Schneider T., Jensen K.A., Clausen P.A., Afshari A., Gunnarsen L., Wåhlin P., Glasius M., Palmgren F., Nielsen O.J., Fogh C.L. 2004. Prediction of indoor concentration of 0.5-4 µm particles of outdoor origin in an uninhabited apartment. *Atmos Environ* 2004; 38:6349-6359.