# ULTRAFINE PARTICLES FROM CHEMICAL REACTIONS IN INDOOR AIR: INPUT FOR PARAMETERIZATION OF A SIMPLE

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Atmospheric aerosols play a key role in many environmental processes. Detailed information on the organic content of atmospheric aerosol is thus required in order to fully understand its impact on climate and human health.

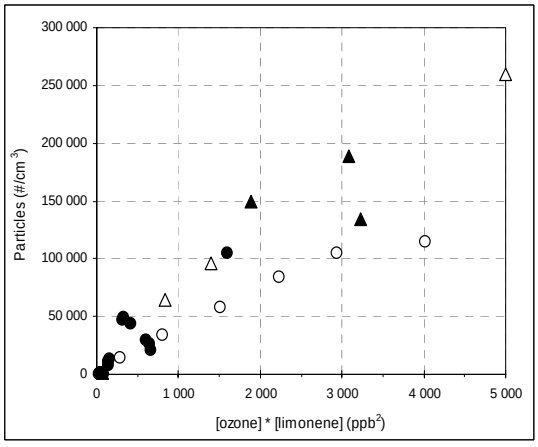
The practical part of the work consisted of a series of experiments where particle number concentration was measured as a function of limonene and ozone at realistic indoor air concentrations according to the equation:

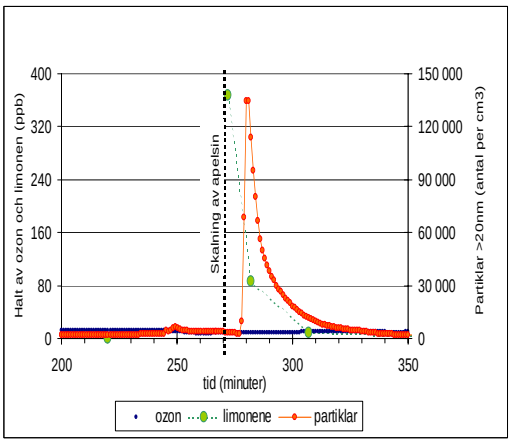
$$\text{Ozone} + \text{Limonene} \rightarrow \text{product}_0$$

The experiments were performed at two stainless steel environmental chambers with volume of 1 $m^3$ and 14 $m^3$. The other parameters that varied were air change rate (0.1 – 2.5 $h^{-1}$) and relative humidity (20%, 40% or 60%); the chamber/reaction temperature was 23 ± 2 $^oC$ in all experiments. The size distribution and number concentration of the particles formed were followed by an optical particle counter (P-Trak instrument) and a Scanning Mobility Particle Sizer (SMPS) system.

Results show that maximum particle number concentration is a function of the $product_0$ of initial mixing ratios of ozone and limonene: [ozone] x [limonene]; in $ppb^2$. The size of the formed particles was in the ultrafine size region (< 100 nm). The number of particles also increased with relative humidity and decreased with higher ventilation rates. Taking experimental uncertainties and model simplification into account, significant nucleation appears to start when the mixing ratio of *product*$_0$ exceeds 0.5 – 1 ppb at RH ~ 20%. It is suggested that this rather easily evaluated criterion may be used to decide if significant aerosol formation is expected.

To simulate “real life”, peeling of an orange and use of limonene-scented detergent were used as the source of limonene. Measurements of number concentration revealed a limited contribution of chemically formed particles of the detergent but significant one from the orange to the total particle load in a room.




Figures: Left: Particle number concentration as a function of [ozone] * [limonene].
Right: Orange experiment

Langer, S.; Moldanová, J.; Arrhenius, K.; Ljungström, E.; Ekberg, L.”Ultrafine Particles Produced by Ozone/Limonene Reactions in Indoor Air under Low/Closed Ventilation Conditions.” *Atmospheric Environment* **2008**, 42(18), 4149-4159.