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The most commonly cited sources for particle emission indoor are: cigarette smoke, cooking, heating with fuel, fireplace, candles or incense burning, use of vacuum cleaner, use of spray (He et al., 2004 ; Hussein et al., 2006, Afshari et al., 2005). Some other sources are also quoted, like the laser printers, the heater and sauna heating. There is very few results on size number distribution emission rate in the range between 5 nm and 1 µm (fine and ultrafine particles) despite the fact that exposure to fine and ultrafine airborne particles has been identified as a factor that could affect human health (See and Balasubramaniana, 2006). We present here a comparison of particles emission rate (diameter in the range 5 nm to 1 µm) on 8 different cooking activities (cooking with electric stove or oven). All the necessary staff for the activities was purchased from common chain stores and the test procedure is most of possible representative of the usual way.

The experiments were carried out in the laboratory of the Centre Scientifique et Technique du Bâtiment (CSTB) in an hexagonal experimental chamber. An ascending current of filtered air is created in the chamber (average vertical air velocity of 10 cm.s^{-1}). In order to create realistic conditions of sources emission all the cooking activities are done from outside of the chamber with airtight gloves. The particle size spectrometer used in this study is a DMS500 (Cambustion) which measure particle concentration as a function of the equivalent electrical mobility diameter (16 size fraction per decade) from 5 nm to 1000 nm at a maximum rate of 10 samples/second. The particle concentrations are measured every second for minimizing RMS noise.

Assuming that the air in the chamber is well-mixed the particle size balance equation of the particle number concentration at time t is described by:

$$\frac{\partial N_{d,t}}{\partial t} = -\frac{Q}{V} \times N_{d,t} - k_d^{dep} \times N_{d,t} + \frac{q_{d,t}^{emi} + J_{d,t}^{coag} + J_{d,t}^{cond}}{V}$$

Where Q is the ventilation rate in the chamber, $N_{d,t}$ is the number concentration (cm^{-3}) of particle with diameter between d and (d+dd), $q_{d,t}^{emi}$ is a global emission rate (s^{-1}) for particle with diameter between d and ($d+dd$) including emission rate of the source, nucleation, re-suspension, sinks. k_d^{dep} is the deposition rate of the particles on the surfaces of the experimental chamber. $j_{d,t}^{coag}$ and $j_{d,t}^{cond}$ are the change rate of particles with diameter between d and (d+dd) due to coagulation and condensation effects. The emission rate is measured during all the cooking activity and a mean equivalent emission rate (MEER) is calculated by:

$$\overline{q_d^{equ}} = \frac{1}{(t_2 - t_1)} \times \int_{t_1}^{t_2} \left(q_{d,t}^{emi} + J_{d,t}^{coag} + J_{d,t}^{cond} \right) dt$$

The mean total decay rate ($k_d = \frac{Q}{V} + k_d^{dep}$) is determined experimentally and range between 0.0153 s^{-1} and 0.0184 s^{-1} with a minimum value for particles with a diameter of 350 nm.

The MEER of cooking activities present a mode around 20-40 nm with a maximum between 10^9 s^{-1} and 10^{12} s^{-1}. Frying meat or fish lead to a total mean equivalent emission rate of $(9\pm6)\times10^{10}$ s^{-1} while cooking meat or fish in an oven lead to total mean equivalent emission rate of $(9\pm4)\times10^{10}$ s^{-1}. Cooking pasta or heat the stove will lead to total mean equivalent emission rate equal to $(7\pm5)\times10^{9}$ s^{-1}. These emission rates are comparable to what was observed by Afshari et al. (2005). They reported emission rates for particles with a diameter between 20 nm and 1 µm of 1.38×10^{10} s^{-1} for frying meat on an electric stove and 1.13×10^{10} s^{-1} when heating the electric stove.

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