

The effect of controlled indoor activities on the particulate matter mass and number concentrations

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Keywords: indoor aerosols, indoor aerosol emissions

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Characterization of indoor particulate matter is complex and requires knowledge of particle origin, sink, temporal and spatial variation, and dynamics. Source characterization and emission rates from different indoor activities are factors which affect the indoor concentration of particulate matter.

The objective of the current study was to determine the influence of different controlled indoor activities on the number and mass particle concentrations. Burning candle and incense, smoking, printing and boiling water were chosen as typical indoor activities.

Number concentration was measured using a P-Track (TSI) instrument, while, PM_{2.5} mass concentration was measured using a Dust-Track II (TSI) instrument. All measurements took place in a laboratory room.

Table 1 shows the average number concentration of particles before (background level) the emissions and during the emission period. Indoor activities produce aerosol particle, which are emitted to ambient air and therefore influence the background concentration. The results are in agreement with previous experimental studies (Hussein, 2006, Glytsos, 2010).

Table 1. Average number concentration of particles before the emissions (Background) and during emission periods for each activity source.

Source	Background, #/cm ³	Emission period, #/cm ³
Candle burning	1411	2019
Incense burning	5276	30563
Smoking	2818	41435
Printing	5186	10468
Water boiling	2498	4908

An increase of the aerosol concentration was observed in all experiments. The increase fluctuated from 30% to 93%. The highest increase on the concentration was observed during burning of an incense stick and smoking cigarette with measured number concentrations equal to 61,828 particles/cm³ and 65,830 particles/cm³ respectively.

Increase of the particle mass concentration was also observed during the simulated activities. Figure 1 presents the particle number and mass concentration in parallel versus time for incense burning and cigarette smoking.

The average mass concentration during incense burning was $174 \pm 92 \mu\text{g}/\text{m}^3$. Before the start of the

experiment the average ambient concentration was $26 \mu\text{g}/\text{m}^3$. This indicates an increase of 85% in mass concentration of particles. Moreover, the aerosol mass concentration remained high for several minutes after the end of the incense burning.

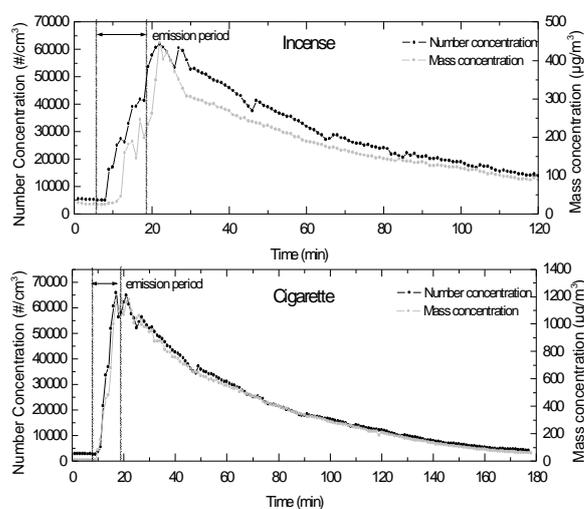


Figure 1. Number and mass concentration versus time for incense burning and cigarette smoking.

The highest indoor aerosol mass concentration was observed during cigarette smoking with total average mass concentration $376 \pm 309 \mu\text{g}/\text{m}^3$. The aerosol mass concentration before the activity was $16 \mu\text{g}/\text{m}^3$ and on average $802 \mu\text{g}/\text{m}^3$ during the emission activity.

From this study, major particulate sources identified to be incense burning and smoking cigarette. Future studies will focus on the effect of indoor sources on the aerosol particle number size distribution under specific scenarios.

The research leading to these results has received funding from the European Union Seventh Framework Programme HEXACOMM FP7/2007-2013 under grant agreement n° 315760.

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