

Exposure to particulate matter in various types of bakeries in Finland

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Introduction

In Finland, the bakery sector is the largest food sub-industry. Cereal flour dust may cause respiratory, dermal and conjunctival reactions among bakery workers. Studies on the variation of the mass concentrations (C_m) of flour dust in various types of Finnish bakeries are scarce. In this work, the C_m of inhalable dust (aerodynamic diameter $D_{ae} < 100 \mu\text{m}$) and PM_{10} particles ($D_{ae} < 10 \mu\text{m}$) were determined in industrial, grocery store and traditional bakeries. The objective was to examine whether there are differences in exposure levels between these bakeries.

Materials and methods

The C_m of particulate matter was determined during three working days in four Finnish bakeries: one industrial and grocery store bakery, and two traditional bakeries. Full shift inhalable dust samples were collected gravimetrically using IOM samplers at the breathing zone (BZ) and stationary locations (S). Real-time, full shift monitoring of the C_m of PM_{10} particles was performed with a DustTrak DRX Aerosol Monitor 8533 (traditional bakeries and industrial bakery) and Optical Particle Sizer Model 3330 (grocery store bakery) at S.

Results

The C_m of inhalable dust was 1.3–15.1 mg/m^3 at BZ and 0.1–3.0 mg/m^3 at S (Table 1). These concentrations were 64–756 and 3–148% of the Finnish occupational exposure limit (8 h) of 2 mg/m^3 for flour dust, respectively. Considering the real-time monitoring, the C_m of PM_{10} particles ranged between <0.1 and 28.3 mg/m^3 (Table 1). The average C_m was lower than the indoor air guideline value of WHO (50 $\mu\text{g}/\text{m}^3$) for PM_{10} (24-h mean) in the grocery store bakery only.

Conclusions

The results showed that the average C_m of inhalable dust and PM_{10} particles was the highest in the traditional bakeries. Control measures are required for all the bakeries to reduce exposure to inhalable dust and peak concentrations of PM_{10} particles.

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Table 1. Mass concentration (C_m) of inhalable dust and PM_{10} particles in the bakeries (AM = arithmetic mean, BZ = breathing zone, S = stationary location).

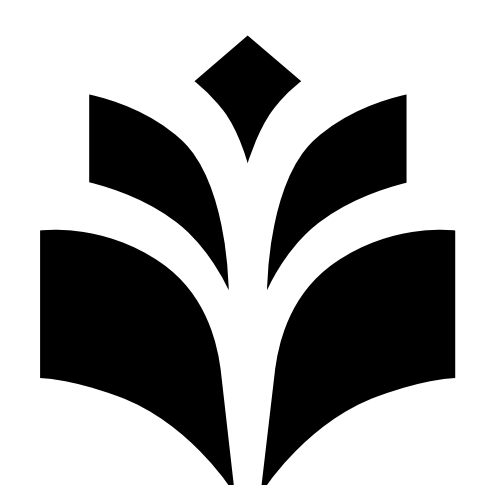
Bakery	C_m (mg/m^3), AM (Range)		
	Inhalable dust, BZ	Inhalable dust, S	PM_{10} , S
Industrial bakery (n=1)	1.2 (1.3–2.0)	0.5 (0.3–0.7)	0.3 (<0.1–8.1)
Grocery store bakery (n=1)	5.4 (4.5–5.9)	0.3 (0.1–0.5)	<0.1 (<0.1–2.5)
Traditional bakery (n=2)	10.5 (6.8–15.1)	1.9 (0.6–3.0)	0.4 (<0.1–28.3)

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FURTHER INFORMATION

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