PHTHALIC ACID ESTERS AND POLYCYCLIC AROMATIC HYDROCARBONS IN HOUSEHOLD DUST

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1 INTRODUCTION

Household dust is a complex mixture of particles of both indoor and outdoor origin, including organic, inorganic and biological components (Naspinski et al., 2008). Its composition depends on numerous conditions, such as environmental and seasonal factors, ventilation and air filtration, homeowner activities, and in- and outdoor sources (Maertens et al., 2004). Residential dust is recognized as a major source of environmental contaminants, including polycyclic aromatic hydrocarbons (PAHs) and phthalic acid esters (PAEs) (Roberts et al., 2009). The selection of appropriate techniques to assess household dust amount and composition is a major challenge since several different methodologies have been employed. The methodologies used for indoor dust collection include passive (dust settling) and active techniques (surface wiping, press sampling, sweeping, or vacuuming) (Lioy et al., 2002; Morawska and Salthammer, 2003). The aim of the present study was to assess the variation of the PM_{10} fraction of household dust in chemical composition within a home and in homes with different outdoor surroundings. An active sampling methodology was applied to collect the deposited PM_{10} fraction directly from the floor.

2 METHODOLOGY

Sampling Sites

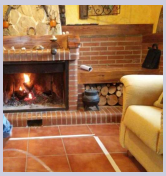
4 Houses

House 1	Suburban two-story house with well ventilated kitchen. Two occupants.
House 2	Single story apartment located in the city center. Two occupants.
House 3	Rural two-story house with open fireplace in the living room. Two occupants.
House 4	Single story apartment with small kitchen open to the living room. One occupant.

3 Rooms

Kitchen

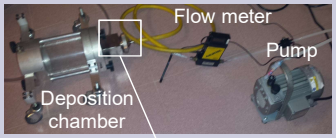
Bedroom

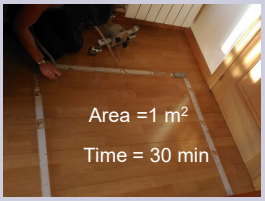


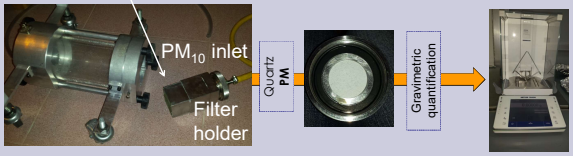
Living Room

Two Sampling Periods

Sampling Methodology







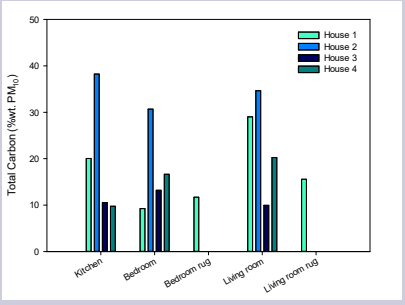
Analysis

Thermo-optical method: Total Carbon (TC)

GC-MS: PAHs and PAEs

3 RESULTS

1st Sampling



2nd Sampling

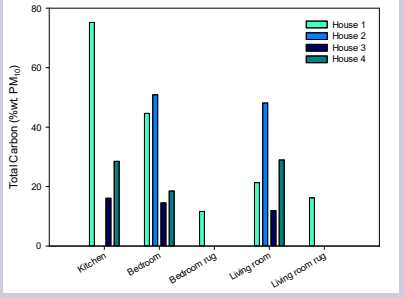
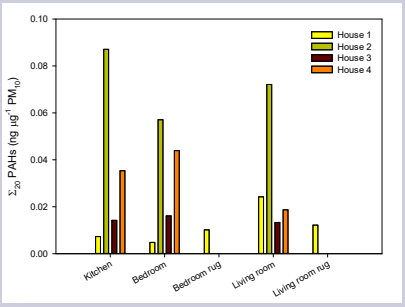


Fig. 1. PAEs mass fractions (ng μg^{-1}) in PM_{10} dust samples collected in two different sampling periods



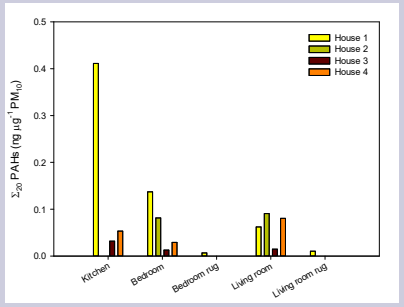
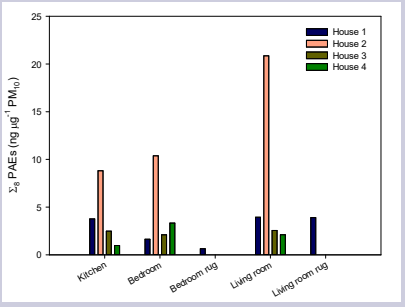


Fig. 2. PAHs mass fractions (ng μg^{-1}) in PM_{10} dust samples collected in two different sampling periods.



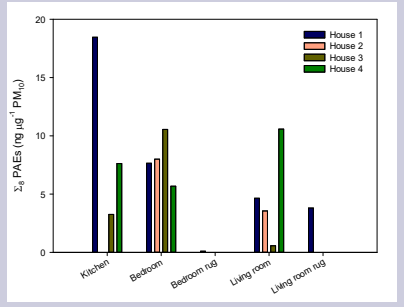


Fig. 3. PAEs mass fractions (ng μg^{-1}) in PM_{10} dust samples collected in two different sampling periods.

4 CONCLUSIONS

- Total carbon contribution to the PM_{10} mass showed temporal and spatial variability ranging from 9.3 to 75%wt.
- Bis(2-ethylhexyl) phthalate (DEHP, n.d.–9.42 ng μg^{-1} PM_{10}) and di-n-butyl phthalate (DnBP, 0.00–10.2 ng μg^{-1} PM_{10}) were the major phthalates in the household dust. DnBP has been reported to be largely present in cosmetic and personal care products (Koniecki et al., 2011), while DEHP was the most abundant phthalate compound found in food products and packaging materials (Fierens et al., 2012).
- PAHs had a smaller fractional contribution to indoor dust (Σ_{20}PAH 0.005-0.411 ng μg^{-1} PM_{10}). The main PAHs contributing to the household dust mass were pyrene (n.d.–0.089 ng μg^{-1} PM_{10}) and retene (n.d.–0.082 ng μg^{-1} PM_{10}).
- Although the highest dust loads were recorded for rugs, PAEs and PAHs had the lowest contributions to the total dust levels compared to the ones recorded in hard floorings.
- Although this study is based on a small number of samples, the findings underline the importance of organic pollutants accumulated in indoor dust. Larger studies, covering more homes, are needed in order to better understand the indoor dynamics of these pollutants.

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