Indoor air quality in the sleeping environments of Lisbon dwellings, Portugal – preliminary results of HypnosAIR project

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Introduction

Given that people spend a third of their lives sleeping and that sleep is essential for the wellbeing, performance and health of individuals, the sleeping environments have attracted the attention of the scientific community in recent years to assess exposure levels and how they may affect sleep quality - a question that remains unanswered. In addition, this micro-environment is poorly characterized (Canha et al., 2021), leading to an inaccurate assessment of the integrated daily exposure of individuals.

Most studies focus on comfort parameters (temperature and humidity) or single pollutants, such as carbon dioxide (CO_2). The characterization of indoor air quality (IAQ) during sleep faces several challenges that make it difficult to achieve (such as the noise interference of monitoring equipment in the sleep of individuals) and it is therefore essential to implement monitoring strategies that overcome them.

The HypnosAIR research project (www.hypnosair.com) aims to address this challenge by providing an overview of IAQ (focusing on several parameters) in the sleeping environments of 30 dwellings in Lisbon area, Portugal. This work presents the results obtained so far.

Materials and methods

A monitoring campaign is being done in bedrooms (occupied by two adults) of 30 selected dwellings in the metropolitan area of Lisbon (Portugal), during the sleeping hours (weeknights only). Real-time monitoring in real-time is being done for: temperature, relative humidity, carbon dioxide, carbon monoxide, formaldehyde, total volatile organic compounds, particulate matter (including ultrafine particles) and black carbon. $PM_{2.5}$ sampling is also being done, using silent $PM_{2.5}$ samplers (SILENT Sequential Air Sampler - FAI Instruments S.r.l., Italy) for indoors, while for parallel outdoor sampling, medium volume samplers (MVS6, Leckel, Sven Leckel, Germany) are being used.

Results

The present work provides an overview of the IAQ assessment in the dwellings already assessed. For example, for the first 7 dwellings, mean $PM_{2.5}$ levels during sleep were found to be 8.9 ± 2.8 µg.m^{-3}

(ranging from 5.1 to 14.1 µg.m^{-3}), with all bedrooms having PM$_{2.5}$ levels above the international guideline value of 5 µg.m^{-3} recommended by the World Health Organisation.

Conclusions

HypnosAIR aims to improve the knowledge of IAQ in sleep environments, by conducting a comprehensive assessment of the different parameters that characterize the complexity of indoor air. This work will contribute to the ultimate goal of HypnosAIR, which is to understand the impact of air quality on sleep quality, considering an integrated human exposure approach.

Acknowledgments

Reference

N. Canha, C. Teixeira, M. Figueira, C. Correia (2021) How is indoor air quality during sleep? A review of field studies. Atmosphere 12(1), 110. DOI: 10.3390/atmos12010110