HB 2006
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Creating a healthy indoor environment for people

Lisboa, 4-8 June 2006

Abstracts

Editors

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Official Conference of:

ISIAQ

International Society of Indoor Air Quality and Climate

Organized by:

IDMEC

Instituto de Engenharia Mecânica
Pólo FEUP

Universidade do Porto, Portugal

Published in Portugal in May 2006 by
E. de Oliveira Fernandes
M. Gameiro da Silva
J. Rosado Pinto

Printed in Portugal
ISBN 978-989-95067-0-1
Legal Deposit – 243327/06

Tobacco Smoke Influence on Indoor Particulate Matter

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Summary: *This study aims to investigate the influence of tobacco smoke on indoor air quality. Three fractions of particles (PM_{10}, $PM_{2.5}$ and PM_1) in different indoor Portuguese environments are sampled using low volume samplers. The specific objectives are: (1) to study and characterize different indoor environments; (2) to evaluate the influence of tobacco smoke on the size distribution of indoor PM.*

Keywords: *indoor air quality, particulate matter, tobacco smoke*

1 Introduction

The indoor concentrations of particles have recently become a matter of great importance since the populations in developed countries spend most of their time in indoor environments with specific characteristics (e.g. domestic ambiences, schools, offices and industries). Environmental tobacco smoke is one of the most common indoor pollution sources. In Portugal the percentage of smoking adult prevalence is 32.8 % and 9.5 % for male and female, respectively [1], whilst figures of 17.6 % and 26.2 % are found for young male and females [2]. Despite the existence of Portuguese legislation on smoking free areas in public places like hospitals, education facilities, cinemas or governmental facilities, the control of law fulfilling is not rigorous which leads to higher exposure than in other European countries.

In Latin countries it is typical to spend on a daily basis much of the free time in cafes, bars and restaurants, where non-smoking environment simply does not exist. Moreover, very close family relationships (so characteristic in Latin countries) often implies the presence of kids in social activities which leads to high tobacco exposure not only of grown adults but also of risk groups as infants and children. To protect public health the information on indoor air quality is, therefore, very important. Nevertheless, at this moment such information is almost non-existing in Portugal, namely concerning the influence of tobacco smoke on indoor air. The impact of tobacco related particulate matter is the fundamental question to be analyzed in this study.

2 Methodology

TCR TECORA Bravo H2 constant flow samplers combined with PM_{10}, $PM_{2.5}$ and PM_1 EN LVS sampling heads in compliance with EN12341 are used to collect the indoor particulate matter. The sampling air flow rate of 38.3 $L.min^{-1}$ and polytetrafluoroethylene (PTFE) membrane filters with polymethylpentene support ring (2 µm porosity, Pall Life Science Teflo™) are applied. The steps of gravimetric mass determination are: 24 hours to equilibrate filters before weighing at the room temperature followed by three times weighing (Mettler Toledo AG245 analytical balance) during the next 24-48 hours. If the values differ more than 60 µg, they are discarded and filters are repeatedly weighed until three reproducible values are obtained.

PM masses are determined by subtracting the initial mass of the blank filter from the final mass of the sampled filter (average); the difference is then divided by the total volume of air passed through filter (at 25°C, 101.3 kPa).

The sampling is performed in a cafe in Porto in district of Paranhos and in a reference place in the same area (a non-smoking family apartment/non-smoking single person apartment).

3 Conclusion

We may conclude that smoking influences concentrations of studied particles, especially those which are smaller than 2.5 µm; however, other activities like cooking can also influence the increase of indoor particle concentrations.

Acknowledgments

Authors are grateful to Fundação Calouste Gulbenkian for the material support of this work.

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Objectives

- to characterize particulate matter (PM) in different indoor environments
- to evaluate the influence of tobacco smoke on size distribution of indoor particulate matter

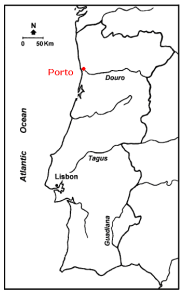
Experimental

SITES

Smoking environment:
- room dimension: 14 m^2 × 2.6 m
- the exact number of smoked cigarettes were counted
- no air conditioning system or ventilation

Coffee house:
- localization: district of Paranhos Porto, Portugal
- ventilation through an open window

Non-smoking apartment:
- localization: district of Paranhos, Porto, Portugal
- ventilation through an open window
- a reference site to coffee house



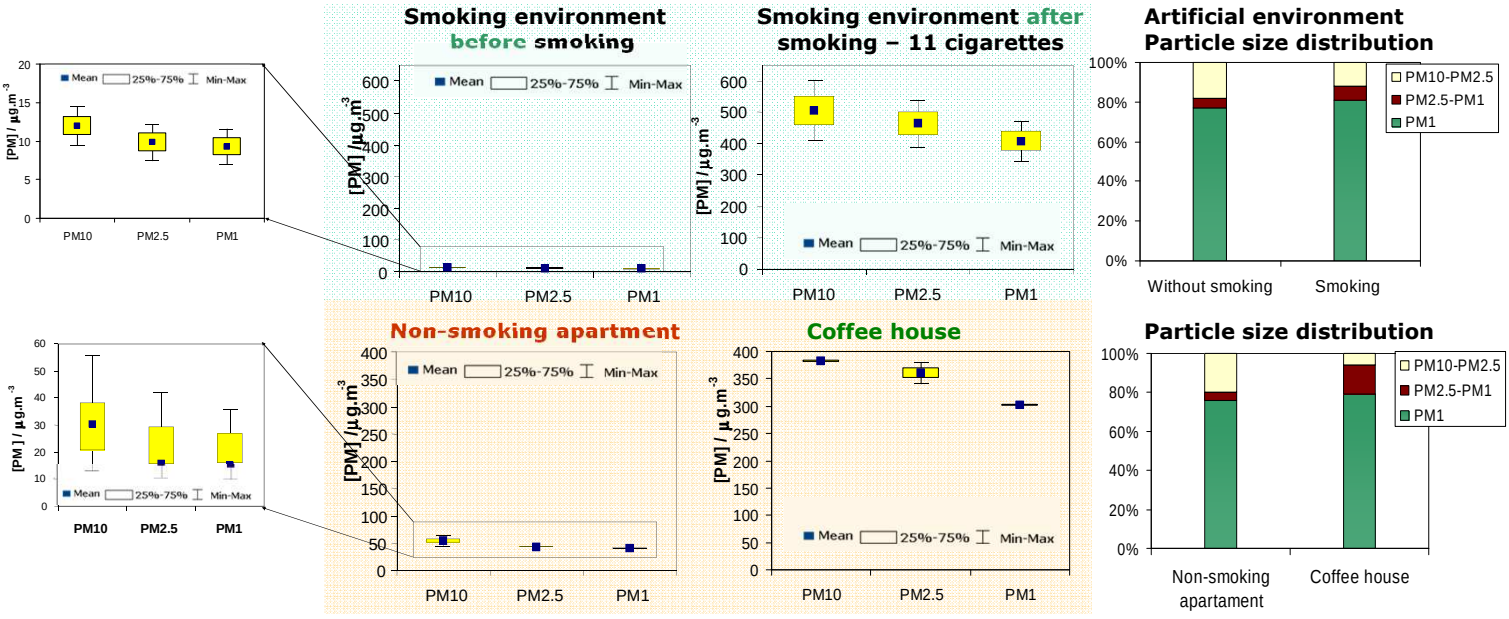
METHODOLOGY

Gravimetric mass determination

TCR TECORA Bravo H2 constant flow samplers combined with PM_{10}, $PM_{2.5}$ and PM_1 sampling heads in accordance with norm EN12341

Polytetrafluoroethylene (PTFE) membrane filters (2 µm porosity), and quartz fibre filters

Results



Conclusion

Smoking cigarettes highly increased the concentration of particulate matter in air: **each cigarette** increased the **PM_{10}** concentration by **374%, $PM_{2.5}$** by **420% and PM_1** by **389%.**

In the non-smoking apartment **indoor PM_{10}** fraction **was mostly composed of fine particles**. Having in mind epidemiological evidence that the fine fraction ($PM_{2.5}$) of PM_{10} is the most important for causes of adverse health effects, these measurements are a relevant tool to evaluate the impact of indoor PM on public health.

PM concentrations in the coffee house were **616% higher** for **PM_{10}**, **762%** for **$PM_{2.5}$** and **662%** for **PM_1** than in the non-smoking apartment. In Latin countries it is typical to spend on a daily basis much of the free time in coffee houses, where non-smoking environment is nearly non-existent. More importantly, very close family relationships often implies the presence of kids in social activities leading to high tobacco smoke exposure not only for adults but also for risk groups. Thus, to protect public health it is fundamental to forbid smoking in closed environments.

Acknowledgments: Authors are grateful to Fundação Calouste Gulbenkian and to Fundação para Ciência e Tecnologia (SFRH/BD/24228/2005) for the financial support of this work.