Exposure assessment to air pollutants in Elderly Care Centers

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According to the United Nations the proportion of total population aged 60 years or over for the Europe is 22% for the year 2012 and prospects 34% for 2050[1]. In general, people spend about 19-20 hours indoors. These values could increase considering the older people who are institutionalized in Elder Care Centers (ECC)[2]. By these reasons and by the fact that old people are considered a susceptible group becomes increasingly important to mitigate their exposure to air pollutants. The main goal of this work was to characterize the indoor air quality in ECC in order to understand the elderly exposure to air pollutants. The current study was developed in Loures and Lisbon (Fig. 1).

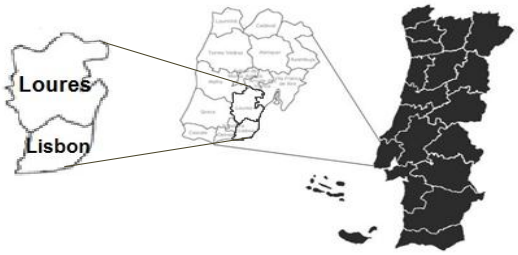

Figure 1 - Localization of the sampling sites

A time-budget survey was carried out with more than 300 elderly in order to define the time spent by the old people. This data will be used to achieve the exposure to air pollutants, according to the follow equation:

$$Exposure = \sum_{i=n}^{n} C_{z,n} \cdot t_n$$

Where *n* corresponds to the different micro-environments, *C* is the concentration of the pollutant *z* and *t* is the time spends in each micro-environment.

A set of pollutants has been selected to characterize the indoor air quality inside two micro-environments – Room (R) and Living-Room (LR) – in 4 ECC, such as air temperature, relative humidity, carbon dioxide (CO_2), carbon monoxide, particulate matter with 5 different sizes, namely $PM_{0.5}$, PM_1, $PM_{2.5}$, PM_5, PM_{10}, total volatile organic compounds. Measurements in each outdoor environment were performed simultaneously.

PM_{10} were also collected in Teflon filters and were gravimetrically assessed in a clean room (class 10,000), as well their chemical content by Instrumental Neutron Activation Analysis, in Portuguese Research Reactor.

Results showed that CO_2 and PM_{10} exceeded the Portuguese legal value (1800 and 0.15 $mg.m^{-3}$, respectively) in some periods of the day.

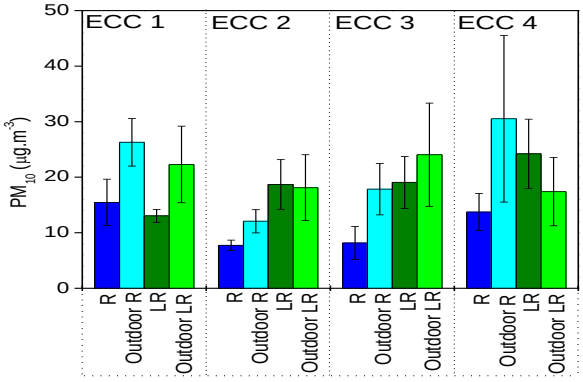

Figure 2 - Mass concentration in PM_{10} sampled for each ECC.

Fig. 2 shows the gravimetric PM_{10} concentration measured in each ECC. The outdoor levels associated with the R's were always higher, comparing with the PM_{10} concentrations determined inside the R's. In the other hand, two different ECC's presented higher values in the LR's than in the corresponding outdoors. This last evidence shows the importance of indoor sources inside of the LR's, e.g. elderly, collaborators, plants, etc.

In/Out ratio are showed in Fig. 3. Ratios for R and LR in EEC2 presented the best correlation (0.78 and 0.90, respectively) and confirm an outdoor origin of the PM_{10}.

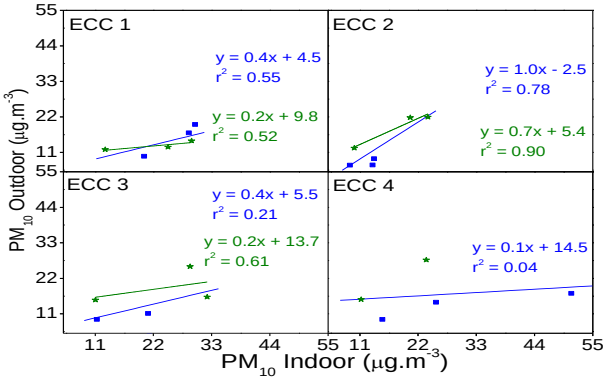

Figure 3 - Ratio In/Out per ECC for R (--) and LR (--).

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