DETERMINATION OF PCDD/F IN TOTAL SUSPENDED PARTICULES IN RIO DE JANEIRO: A PRELIMINARY STUDY

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Introduction

Special attention is normally given to total suspended particles (TSP) during any scientific research related to air contamination, because of several respiratory problems as well as the adsorption of toxic organic contaminants. TSP are normally emitted by stationary or mobile sources, resuspension of particles present in the soil and also by biogenic sources.

Substances that show low vapor pressure as metals, PAHs and PCDD/F are always associated to TSP, especially in areas with high traffic or industrial activities that may involve burning of residue or fossil fuel[1,2]. Therefore, the analysis of a filter responsible for TSP retention can be considered reasonable for the evaluation of those contaminants in ambient air.

Thus, the present work studies PCDD/F levels in ambient air in Rio de Janeiro, Brazil using TSP as main matrix. Three different locations were chosen: Belford Roxo (BR), a city with residue burning plant; Cinelandia (CN), situated at downtown, with high car traffic and Nova Iguacu (NI), a typical rural area.

Materials and Methods

Five samplings in Belford Roxo (BR) were performed with glass fiber filters and high volume samplers between January, 31st and February, 24th 2002, during 24 hours. For the others sites, Cinelandia (CN) and Nova Iguacu (NI), only one sampling was performed within this period. Standard isotope dilution techniques were used for all samples. Thus, glass fiber were spiked with 0,5 ng of ^{13}C labelled internal standards and extracted with dichloromethane using ASE, according to EPA method 3545. Extracts were passed through an acid silica column and florisil).

Following addition of recovery standards, samples were analysed by selected ion monitoring GC-MS at 10000 resolution (10% valley definition) using a Micromass Ultima Mass Spectrometer. The GC column used was a DB-5MS.

Results

Samples collected in BR showed very similar results, except for the one sampled on february, 18th, where a higher level was detected, as shown at figure 1.

Comparing the congener distribution for samples collected at BR, it can be noticed that the higher level (on the 18th) shows a slightly different pattern, which can indicate a possible second source of PCDD/F contamination.

Unfortunately a atmospheric dispersion test was not performed before the TSP sampling. All results found in BR were below the expected values, once that region is a known residue burning area. Thus, the sampling location can be far from the contamination plume.

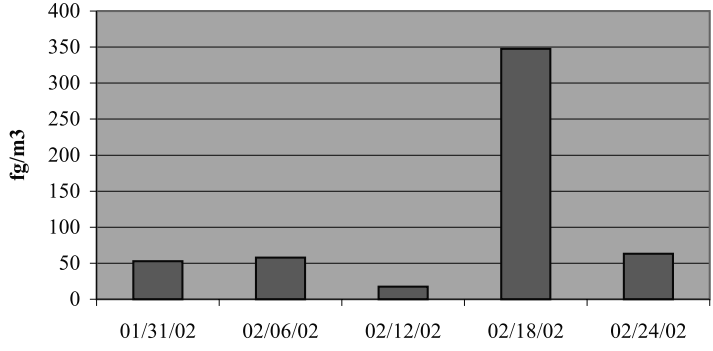

Figure 1. Total 2,3,7,8-substituted PCDD/F detected in five samples in Belford Roxo (BR)

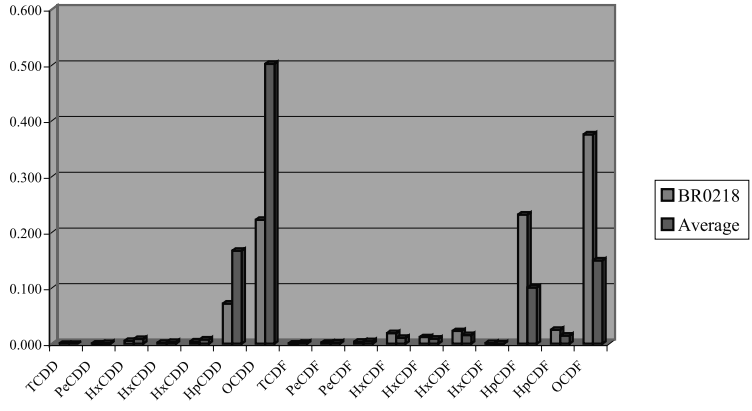

Figure 2. Comparison between the average of four samples from Belford Roxo and the sample collected on Feb 18th

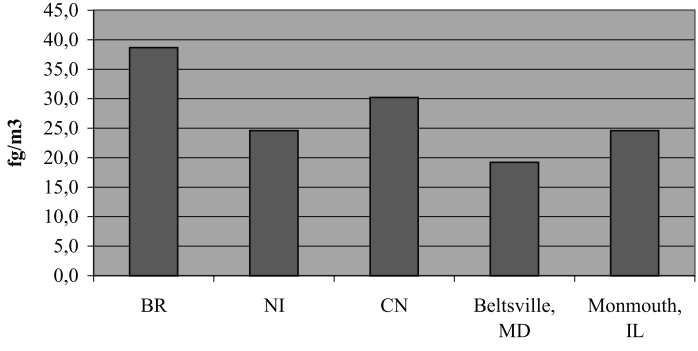

Figure 3. Typical values for rural and urban ambients and values obtained for Rio de Janeiro.

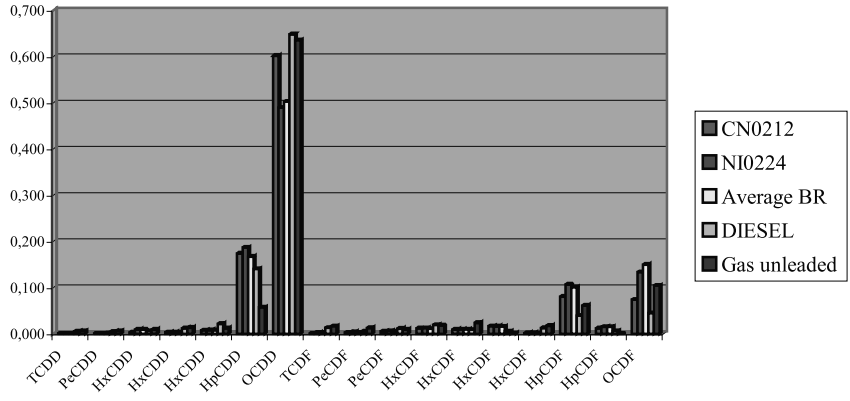

Figure 4. PCDD/F pattern found in samples from Rio de Janeiro and in emissions from diesel and unleaded gasoline

The levels found for BR, CN and NI can be considered low when compared to rural (Beltsville) and urban (Monmouth) areas in the United States [3].

According to previous studies reported by Gertler et al. and Hagenmaier et al., diesel type vehicules are the one of the main PCDD/F sources, where the emission can be higher than 200 times the unleaded gasoline[3]. According to the congener distribution found in all samples, the main source may be the emission from cars using unleaded gasoline and diesel.

Conclusions

This work shows preliminary results for PCDD/F in ambient air in Rio de Janeiro. Levels were found to be similar to rural areas in USA, and showed low results in general, ranging from 25 to 60 fg/m^3. One of the results for Belford Roxo showed high levels (ca 350 fg/m^3), indicating the need for a more detailed study considering also the plume of PCDD/F contamination.

All patterns indicate that the main source may be the emissions from cars using unleaded gasoline and diesel.

References

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