

# MULTIVARIATE EVALUATION OF PERSISTENT ORGANIC POLLUTANTS IN SOILS AND SEDIMENTS FROM THE BRAZILIAN AMAZON REGION

Gilmare A. da Silva<sup>1\*</sup> (PQ), João P. M. Torres<sup>2</sup> (PQ), Yago Guida<sup>2</sup> (PQ), Carla NG<sup>3</sup> (PQ), Olaf Malm<sup>2</sup> (PQ), George A. Reis<sup>2</sup> (PQ), Martin Scheringer<sup>3</sup> (PQ).

<sup>1</sup>Departamento de Química - Universidade Federal de Ouro Preto (UFOP), Ouro Preto/MG, Brasil.

<sup>2</sup>Instituto de Biofísica Carlos Chagas Filho - Universidade Federal do Rio de Janeiro (UFRJ), Rio de Janeiro/RJ, Brasil.

<sup>3</sup>Swiss Federal Institute of Technology in Zurich (ETHZ), Zurich, Switzerland.

Keywords: Persistent organic pollutants, Amazon Region/Brazil, Soils and sediments, Exploratory analysis.

## Introduction

Pollution by chemicals plays an important role among the main parameters estimated by the fact that exposure to certain substances is associated with risk of contamination. Persistent organic pollutants (POP) are most of these products; despite the restrictive measures adopted, POP continue to have wide environmental distribution because of its high potential for bioaccumulation, environmental persistence and high toxicity<sup>1</sup>. As an example, the heavy use of dichlorodiphenyltrichloroethane (DDT) against disease vectors since the end of the 40's had a deep impact in Amazon Region contamination.

Therefore, in this work, it will be presented the results of the multivariate exploratory evaluation of organochlorine pesticides, polychlorinated biphenyls and polycyclic aromatic hydrocarbons in rainforest and sub-urban soils and river bottom. Top soils and fluvial sediments were collected in two areas of the Amazon River basin, one in the northern part at the Negro River basin, and the other one at the southern part, at the Madeira River basin (Puruzinho Lake). The multivariate studies were performed applying Kohonen neural networks<sup>2</sup> and principal components analysis (PCA)<sup>3</sup>.

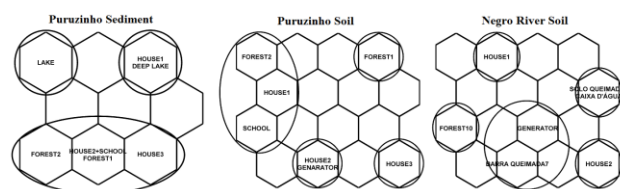
## Results and Discussion

Samples were maintained refrigerated in iceboxes during transport to laboratory and were submitted to Soxhlet extraction using non-polar solvents and to the clean-up based on the Jensen reaction (desulfurization step). All samples were oven-dried, macerated and sieved. Fractionation was performed using an open glass chromatographic (Florisil and anhydrous sodium sulfate). The cleaned extracts were evaporated and completed to with internal standard (TCMX) before are analyzed by means of split less injection on capillary gas chromatography coupled to an electron capture detector (GC-ECD) from Shimadzu (GC-14B and CG-2010, 63Ni).

It was obtained three sets of data: Puruzinho sediment, Puruzinho soil and Negro River soil. All data were auto-scaled before applying PCA and Kohonen network. To this last one, different architectures have been tested to optimize the network that was trained with the data using the batch training algorithm and Gaussian function.

38ª Reunião Anual da Sociedade Brasileira de Química

The analysis results were expressed in ng/g<sup>-1</sup> and showed that the levels are one order of magnitude higher in the southern part of the Amazon where development and overall incidence of malaria is increasing. Still, almost all samples presented contaminated with many of the evaluated POP. By the application of Kohonen neural network it was possible to verify the similarities of samples (Figure 1), the possible relations among the variables (62 substances to Puruzinho sediment, 65 to Puruzinho soil and 67 to Negro River soil), and the influence of the variables over the samples.



**Figure 1.** Amazon sample similarities in the evaluation of soil and sediment POP contamination.

It was possible to verify, as an example, that the sample FOREST1 from Puruzinho Soil (Figure 1) was located separately because it was only the one that presented the high levels of many substance as PCB 101, PCB 110, endosulfan II, among others.

PCA presented similar results but with the need of many principal components, making difficult data interpretation.

## Conclusions

The legacy of POP contamination in South American was proved in this study and the multivariate exploratory techniques utilized allowed an efficient data analysis, especially considering an easy and friendly data interpretation, with possible complex nonlinear relationships.

## Acknowledgments

CAPES, CNPq Brasil/Suíça, ETHZ/Switzerland, FAPEMIG, FAPERJ, Fogarty-NIH (Mount Sinai School of Medicine), INCT/INPETAm and UFOP.

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