Trends in arsenic, nickel and lead concentrations within particulate matter in Sao Paulo, Brazil

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INTRODUCTION

Air pollution is a critical public health problem [(1)]. Among atmospheric pollutants, the particulate matter (PM) is one the most important today. In many urban areas, vehicle emissions are the main source of PM, what occurs in Metropolitan Area of Sao Paulo (MASP)[(2)], where more than 8 million vehicles are burning a mix of fossil fuels and biofuels which may contain Potentially Toxic Elements (PTE)[(1)], such as arsenic, nickel, and lead in the PM that are recognized as a serious concern to human health due to its potential to induce carcinogenic and non-carcinogenic effects[(3)]. The vehicular traffic is the major environmental source to these pollutants in urban areas [(1)].

OBJECTIVE

The aim of this study was to analyze PTE (As, Ni, and Pb) concentrations trends in $PM_{10,}$ in Sao Paulo, Brazil, in a place located near a congested avenue, throughout the years 2002, 2006, 2009, and 2012, of all seasons.

METHODS

The dataset from the Environmental Agency of the State of Sao Paulo[(4)], composed by few air quality stations data, as part of specific studies of PTE concentrations, was analyzed. PTE concentrations were sampled in one of the stations of the monitoring network, the Cerqueira Cesar Station, which is located near a congested avenue (Fig.1), throughout the years 2002, 2006, 2009, and 2012.

PM_{10} samples were collected using a Dichotomous air sampler (47-mm diameter Teflon filter) and the elemental analysis was performed by energy dispersive X-ray fluorescence. Linear regression was applied to evaluate these trends and the t-Student test was used to verify the significance of the model.

Fig. 1 - The Cerqueira Cesar Station installed at the School of Public Health, University of Sao Paulo, Brazil

RESULTS

The statistical analysis indicated no significant differences in concentration PTE between by stations of the year, the only exception was Lead, which showed significant differences between Win/Aut seasons. Besides, there were indicated significant correlations in winter/autumn seasons. The Lead values were correlated with Arsenic and Nickel (Pearson's coef. 0.79 to 0.87, 0.61 to 0.56, $p<0.01$, respectively) and Arsenic values was correlated with Nickel (Pearson´ coef. 0,47 to 0.57, $p<0.01$).

CONCLUSIONS

There is a lot of scientific evidence that associates vehicle emissions, in high traffic routes, the worsening of air quality parameters [(1,4)]. Our findings indicate that PTE concentrations are high and reinforce the importance of further studies on PTE exposure and health risks of all population beyond the evaluation of public policies for risk management.

REFERENCES

(1) Landrigan, P. J., *et al*., The Lancet Commission on pollution and health. *The Lancet*, *391*(10119), 462–512. https://doi.org/10.1016/S0140-6736(17)32345-0

(2) Nogueira, T., Dominutti, P. A., Fornaro, A., & de Fatima Andrade, M. (2017). Seasonal trends of formaldehyde and acetaldehyde in the megacity of São Paulo. *Atmosphere*, *8*(8). https://doi.org/10.3390/atmos8080144

(3) Ribeiro, A. G*., et al*. (2019). Incidence and mortality for respiratory cancer and traffic-related air pollution in São Paulo, Brazil. *Environmental Research*, *170*(September 2018), 243–251. https://doi.org/10.1016/j.envres.2018.12.034

(4) Companhia Ambiental do Estado de São Paulo (CETESB, Sao Paulo State Environmental Protection Agency) Air Quality Report in the State of Sao Paulo (CETESB-QUALAR) 2018 [website]. Sao Paulo: CETESB; 2018. p 214. Avaliable in: http://www.cetesb.sp.gov.br/ar/publicacoes.asp

RESULTS

Arsenic annual mean concentration indicated a downward trend ranging from 4.1 (2002) to 3.4 ng/m^3 (2012). Lead also showed the same trend, ranging from 38.5 (2002) to 24.6 ng/m^3 (2012). On the other hand, the Nickel showed an opposite trend, ranging from 7.6 (2002) to 10.2 ng/m^3 (2012) (Fig. 2).

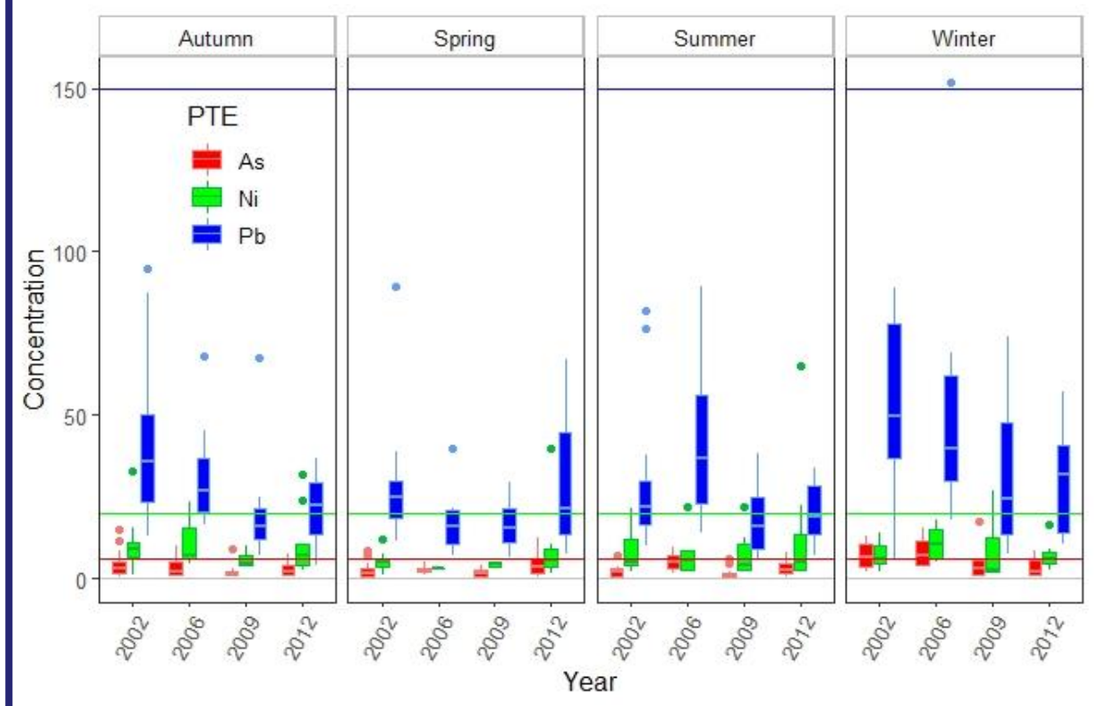

Fig. 2. PTE concentration (ng/m^3), by seasons, in all years.

The PM has a worsening of its parameters even more during the winter, due to the weather conditions being unfavorable to the dispersion of pollutants.

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As: 0.3 ng/m^3	As: 6 ng/ m^3 (EU)
Ni: 1.3 ng/m^3	Ni: 20 ng/m^3 (EU)
Pb: 3.8 ng/m^3	Pb: 150 ng/m^3 (USEPA)

The concentration analysis of this PTE by seasons, indicated higher concentrations during wintertime (Win). The seasonal mean concentration of As indicated higher concentrations during Win, whose values, were 6.9 ± 3.5 ng/m^3 (Win/2002) and 8.2 ± 4.4 ng/m^3 (Win/2006), both above the European Union (EU) reference value (6.0 ng/m^3). In all seasons the P90 were above the (EU) reference value (6.0 ng/m^3). Despite this, both Pb and Ni presented seasonal mean concentrations below the reference, in all seasons (Fig.3).

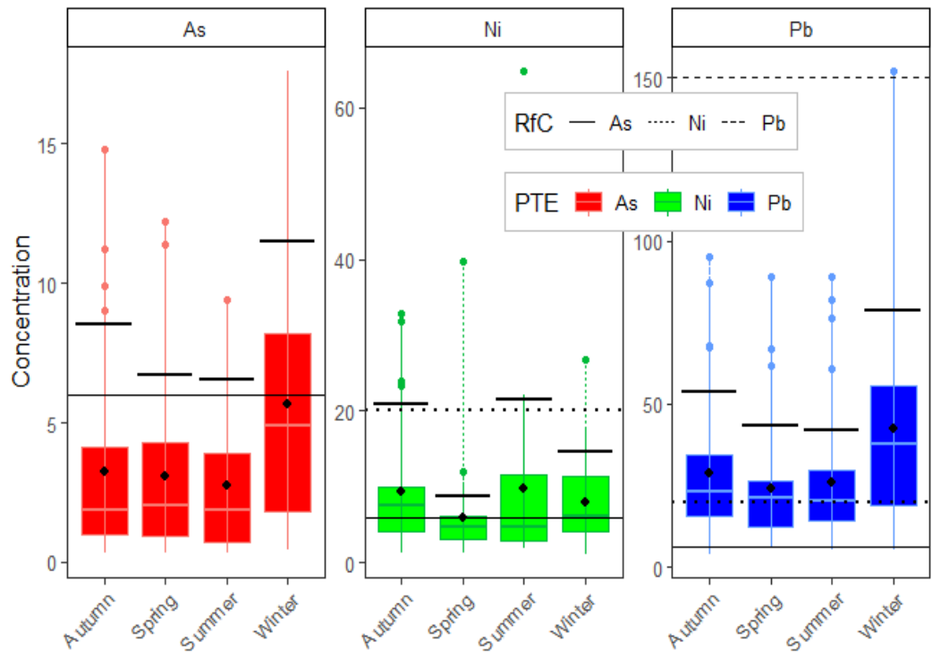

Fig. 3. PTE concentration with arithmetic mean (•) and P90 (-), (ng/m^3), by seasons.

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CAPES

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