

São Paulo aerosol composition collected during biomass burning pollution events

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Highlights

São Paulo pollution events associated with forest fires occurring in the Amazon Forest and inner cities.

The most abundant PAH were BbF, BPE, and BeP.

High concentration of biomass burning markers.

Abstract

The air quality in São Paulo, the most populous city in Brazil is affected by different pollutant sources, such as vehicular traffic, industrial emissions, biomass burning, and secondary reactions. Despite the greater influence of vehicular emissions, in 2024 the city recorded pollution events associated with forest fires. In São Paulo state, there was an increase of more than 500% in fires this year compared to the period from June to September 2023, with days registering conditions similar to desert regions, with relative humidity close to 12% [1]. Anthropogenic activities in inner cities and plumes from natural forest fires coming from Amazon Forest in September contributed to São Paulo being the metropolis with the worst air quality in the world during a day [2]. From June to September, over 90 thousand hospital admissions due to respiratory diseases were registered [3]. To evaluate the impact of these events on pollutants emissions, fine particulate matter samples (PM_{2.5}) were collected in the most polluted period using high-vol sampler at the Institute of Chemistry, in the University of São Paulo campus, from June to September in 2024 (n=37). The concentration of polycyclic aromatic hydrocarbons (PAHs), derivatives Oxy and Nitro-PAH, water-soluble ions (cations and anions), anhydride monosaccharides (levoglucosan, mannosan, and galactosan) and primary monosaccharides (glucose, mannose, galactose, xylose, fucose, rhamnose, and arabinose) was determined. For PAH and derivatives determination, the samples were extracted, fractioned and analysed using GC-MS. Ions and monosaccharides were determined through ion chromatography using conductivity and amperometric detection. The results showed over 90% of the samples exceeded the WHO recommendation and a median PM_{2.5} concentration of 37 µg.m⁻³. On days with peak concentrations, HYSPLIT backward trajectories showed the influence of air masses passing through fires in the North and Central West of Brazil. The most abundant PAH were BbF, BPE, and BeP, associated with combustion sources and the distribution suggests a greater contribution of biomass burning in 2024 [4]. BaP index was above 1 ng.m⁻³ in over 60% of the samples, indicating samples cancer risk. Water-soluble ions presented species coming from different emission sources. Monosaccharides concentrations varied, as levoglucosan (from 39 ng.m⁻³ to 1.421 ng.m⁻³) exhibited its highest concentrations on days with an increased number of fire occurrences in the state. Overall, the events occurring in this period impacted the life quality by inputting harmful species in the atmosphere.

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[2] IQAir (2024). Available at: <<https://www.iqair.com/>>

[3] DATASUS (2024). Available at: <<http://tabnet.datasus.gov.br/cgi/tabcgi.exe?sih/cnv/niuf.def>>

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