Área: AMB

Characterization of atmospheric particulate matter in São José do Rio Preto

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Highlights

Air samples collected in the pandemic period presented health risk. Main sources of pollutants are biomass burning and vehicle emissions. Long range transport of the pollutants influenced the air quality.

Abstract

$PM_{2.5}$ consists of particles with a complex composition and a diameter smaller than or equal to 2.5 μm, which can pass through the respiratory tract and reach the lung alveoli, potentially causing health damage. In 2021, São José do Rio Preto showed the highest number of hospital admissions for respiratory problems per thousand inhabitants among the ten most populous cities in the state of São Paulo [1]. Therefore, it is important to determine the composition of the PM, the sources and the associated health risk. $PM_{2.5}$ samples were collected in the wintertime (2021) during the pandemic period and organic and inorganic pollutants were determined.

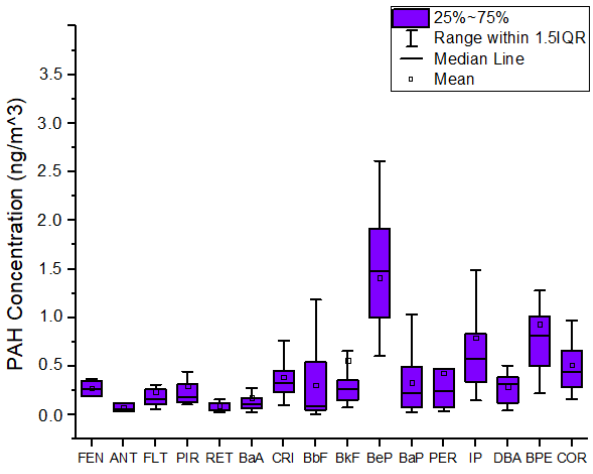

Fig 1. PAH concentrations for São José do Rio Preto

The fine particle concentrations ranged from 10 to 43 μm m^{-3}, with an average of 20 μm m^{-3}. Of the collected samples, 71% showed concentrations above the limit established by the WHO recommendations [2] and 100% of samples below the CONAMA legislation. The concentrations found were slightly lower compared to other cities in the state of São Paulo (Ribeirão Preto and Limeira) [3]. PAHs were determined using chromatographic methods. Total PAH concentrations ranged from 2 ng m^{-3} to 15 ng m^{-3} and high concentrations of BeP were observed as seen in Fig 1, indicating photochemical degradation of BaP. This latter PAH is known as highly mutagenic and presented average concentration of 0.33 ng m^{-3}. The Benzo(a)pyrene equivalent index indicated health risk in 50% of the samples with values above the limit established by the WHO [2]. The presence of retene (RET), a compound that has been considered mutagenic, in a few samples is an indication of biomass burning [4]. Diagnostic ratios indicated fuel burning sources and aging of the samples.

Among the ionic species, the most abundant cations were K^+ (av. 467 ng m^{-3}) Na^+ (av. 381 ng m^{-3}) and NH_4^+ (av. 323 ng m^{-3}), while the most abundant anions were SO_4^{2-} (av. 728 ng m^{-3}) and NO_3^- (av. 530 ng m^{-3}). K^+ presence is associated with biomass burning and soil resuspension, non-sea-salt Na^+ is related to vehicular emissions and NH_4^+ is a secondary product of NH3, originated from a range of anthropic activities. Furthermore, the anions are also associated to vehicular emissions and secondary reactions [5]. HYSPLIT calculations show samples coming from long range distances. To conclude, the samples collected during the COVID pandemic period were influenced by long range transport and local sources. Mutagenic compounds were emitted by anthropic activities such as biomass burning and vehicular emissions and other species found were formed by secondary reactions.

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