

Air Pollution in Railway Environments: Metal-enriched nature of Nanoparticles and Black Carbon.

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Abstract

The use of the rail system with electricity is especially interesting due to its low emissions, high speed and safety. The aim of this work was to study the concentrations of nanoparticles (N) and black carbon (BC) in two ground-level railway platforms and inside trains in the Metropolitan Area of Porto Alegre (MAPA), through the monitoring of its variability and characterization of its chemical composition. The campaigns distributed in a period of thirteen months between 2018 and 2019 occurred twice a month with two-hour daily measurements inside trains and seven hours on Rodoviária, station in urban area of Porto Alegre, and Fatima, station in industrial area of Canoas. For the monitoring of N10- 420 nm and BC2.5 μm , SMPS Nanoscan 3910 TSI® and aetalmeter AE51 MicroAeth® were used, respectively. Meteorological variables and other pollutants from the study area (PM10, SO₂, CO, NO₂, NO, O₃) were studied in order to relate them to N and BC. Passive samplers and T60 aetalmeter filters were used for particle sampling. For analysis of chemical composition, field emission scanning electron (FE-SEM) and high resolution transmission (HR-TEM) microscopies, energy dispersion (EDS) and Raman spectroscopies were performed. The results showed that the vast majority of the recorded nanoparticles have an aerodynamic diameter of less than 100 nm, and their concentrations, as well as those of BC, are higher in the station in industrial area when compared to urban and trains. The influence of meteorological variables, especially temperature with higher concentrations in cold periods, was observed. On the platforms, correlations with other pollutants were obtained, mainly with NO and NO₂. In the chemical analyses, high levels of metal compounds like Ba, Zn and Ti were found both on the platforms and inside trains, in amorphous and crystalline phases. Through the methods employed, the wear processes arising from the operation of trains and the contribution of vehicle and industrial emissions around the stations were considered the main sources of nanoparticles and black carbon in the MAPA's rail environment.

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Biography

Bianca Lima has a bachelor's degree in Chemistry (2017) and a master's degree in Remote Sensing with emphasis on Atmospheric Sciences (2020). Currently works with research on atmospheric pollutants, especially nanoparticles, black carbon and volatile organic compounds indoor and outdoor in different conditions, and their effects on human health and environment.