Tracking the source: first evaluation of benzothiazoles in airport non-exhaust emissions

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The steady expansion of the aviation sector, a pillar of global connectivity, demands growing attention to its environmental footprint, particularly with regard to air quality.[1] While exhaust gas emissions have been extensively investigated, non-exhaust sources such as tire wear particles (TWPs) remain comparatively underexplored.[2] These particles constitute a major source of microplastics and associated pollutants, releasing chemical additives including benzothiazoles (BTHs), widely employed as tracers of road traffic emissions.[3–6] Yet, their occurrence and abundance in airport-related non-exhaust emissions have never been assessed.

In this study, leveraging the enhanced analytical capabilities of the Centre for Trace Analysis (CeTrA) within the ITINERIS framework and in collaboration with ARPA Lombardia, we provide the first characterization of BTHs in the airborne particulate matter (PM_{10}) at Milano Linate Airport. The investigation employed an advanced analytical platform to resolve the aerosol chemical composition and identify traces and ultra-traces of BTHs alongside other relevant molecular markers.

The results demonstrate that the airport is a significant source of BTHs, particularly elevated in BTH, BTH-NH_2, BTH-MeS, and BTH-SO_3H. The aerosol composition at the airport closely parallels that found in high-traffic urban areas, yet the BTHs signature itself is highly distinctive. A weekly pattern further differentiates this source, and the novel observed correlation between BTH-NH_2 and BTH-SO_3H suggests airport-specific dynamics as the underlying driver of these pollutant profiles.

The chemometric analysis resolved three distinct pollution profiles: one driven by aircraft and ground-support vehicle emissions, a second associated with de-icing operations, and a third linked to medium-range atmospheric transport and secondary chemical processes. Beyond addressing a major knowledge gap in the literature, this study provides critical evidence to advance the understanding of airport-related impacts on air quality and to inform effective mitigation strategies.

Keywords: non-exhaust emissions, benzothiazoles, airport

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