Monitoring Volatile Organic Compounds in Indoor and Outdoor Air Using Passive Sampling in Milan, Italy

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Volatile organic compounds (VOCs) are significant contributors to urban air pollution, affecting both human health and environmental quality [1]. This study aimed to monitor VOC levels in indoor and outdoor environments at five locations in Milan, Italy, over a two-month period during the summer of 2024, a time characterized by high emissions and intensified photochemical activity. Using Radiello® passive samplers and gas chromatography-mass spectrometry (GC-MS), the VOC concentrations were measured and the emission profiles of household cleaning and personal care products were analysed to assess their impact on indoor air quality. The results showed that the average total VOC concentration (TVOCs) outdoors was 220.8 ± 195.4 µg/m³, while indoor levels were slightly higher at 243.6 ± 134.3 µg/m³, resulting in an indoor-to-outdoor ratio of 1.32 ± 0.719. These concentrations surpass typical background levels in other European cities [2], underscoring the complex nature of VOC emissions in Milan. The most abundant VOC group in both environments were alkanes, although their relative distribution differed. Outdoors, the predominant groups were alkanes > aromatic hydrocarbons > alkenes > terpenes > esters > alcohols & ethers > halogenated compounds > organosiloxanes > aldehydes & ketones. Indoors, alkanes and terpenes were dominant, followed by esters, alcohols & ethers, aromatic hydrocarbons, and other compounds. To further assess the dynamics of VOCs, the (*m* + *p*)-xylene to ethylbenzene (X/E) ratio was employed as an indicator of photochemical aging [3, 4]. Notably, the recommended indoor TVOC threshold of 200 µg/m³, established by Mølhave to minimize discomfort and health risks, was exceeded in three out of four monitored apartments.

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References

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