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# VOC composition in air: multi-component sources in a polluted sub-urban area of Florence (Italy).

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Degradation processes of solid waste in landfills, industrial and domestic solvent use, road transportation and bio-fuel combustion are the main sources of non-methane volatile organic compounds (VOCs) in urban areas. These compounds are a remarkable feature in gas emissions released from anthropogenic activities since most of them, especially clorofluorocarbons (CFC) and aromatics, are of great environmental concern in relation to the negative effects they produce on atmospheric chemistry, climate and human health. Despite of these processes regulating behavior and distribution of these species in polluted environments are still poorly known.
In the present study we describe the VOC speciation in air, collected from 20 different sites of a sub-urban zone located 3 km N of Florence (Italy), where a municipal solid waste disposal site (Case Passerini landfill) and important traffic arteries are present. Three air samples from both Florence downtown and a nearby unpolluted site were also included in the dataset for comparison. The main aim is to assess, on the basis of a totally empirical approach, the relationship between VOC compositional features and potential pollutant sources.
VOCs were sampled using tri-phase (Carbopack C, Carbopack B and Carbosieve 11) solid traps (ST) and analyzed by GC-MS equipped by a desorption device. Up to 143 different VOCs, pertaining to 13 functional groups, were detected and quantified. VOC composition in the whole landfill area is practically dominated by aromatics, representing more than 50% of total VOCs, and alkanes. This speciation was highly expected because bacterial-driven decomposition of solid waste typically produces such compounds. Relatively high abundances of terpenes, whose potential sources include fragrant household detergents and air fresheners, characterize the samples collected near the composting plant in the landfill area, where the highest VOC concentrations (> 200 [U+F06D]g/m3) were measured. In this zone, long-chain alkanes (> C6) are relatively enriched, being these species related to the initial phases of organic material degradation. The benzene/toluene (B/T) ratios in the landfill ($\sim$ 0.2) are similar to those measured in the distal part of the studied area, where these compounds are likely mainly deriving from traffic emissions. Conversely, samples collected in the urban sites are characterized by B/T ratios up to 0.6, likely because catalytic stock-pots are not efficient when car engines do not reach temperatures of 300 °C, i.e. during short distance travels. This is also supported by relatively high concentrations of branched alkanes, which are easily destroyed by thermocatalytic processes, in urban air. Degradation processes of alkanes seem to preferentially produce aldehydes instead of ketons and other O-bearing VOCs. S-bearing compounds characterize the composting plant zone, being mainly related to emission from fresh waste material. Summarizing, our results suggest that measurements of VOC composition in air are a useful tool to trace genetic processes and potential VOC sources in areas marked by intense anthropogenic activity. Despite the high performances that can be reached by using the present-day available instrumentations, the European and local government directives do not still provide concentration limits for most of the toxic compounds that can be released in the atmosphere from those areas affected by a high anthropogenic pressure. By coupling the urban air chemistry with epidemiological investigations, actions to reduce air contaminants could be undertaken to enhance the life quality in densely lived areas.