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DEVELOPMENT AND VALIDATION OF A METHOD FOR DETERMINING VOCs BY USING MULTI-SORBENT TUBES AND ATD-GC-MS

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The emission of volatile organic compounds (VOCs) from various waste management facilities has become a major concern in recent years. Although their concentrations are generally very low (in the range of ppb ~ ppm), the associated environmental impacts cannot be ignored. Some VOCs have been reported to be toxic/hazardous to human health, while some might contribute to global warming, stratospheric ozone depletion and photochemical ozone formation, etc. Moreover, many VOCs are also known as odorous compounds. Accurate atmospheric concentration data are fundamental for the studies considering VOCs emission, transportation and assessment of the environmental impacts, which highlights the necessity of a precise and reliable analytical method.

In this study, an analytical method based on auto-thermal desorption (ATD) coupled to gas chromatography (GC) and mass spectrometry (MS) was developed and validated for the determination of a wide range of VOCs in gaseous samples. The TO-15 65 Component Mix (65 compounds) and Ozone Precursor (PAMS Mix, 57 compounds) gas phase standards were used for the calibration. Different volumes of each standard gas were taken out using syringes, then injected into Tedlar bags and well mixed with N₂ to reach a total volume of 500 mL; the mixed standard gas was then sampled onto multi-sorbent tubes (Tenax, Carbograph 1TD and Carboxen 1003) by using a SKC pump with a constant sampling flowrate of 50 mL/min. The internal standard calibration method was adopted by using the TO-14A Internal Standard/Tuning Mix as internal standards, which included four compounds: bromochloromethane (IS1), 1, 4-Difluorobenzene (IS2), chlorobenzene-D5 (IS3) and 4-bromofluorobenzene (IS4).

A total of 92 VOCs can be quantified with this method, including 11 oxygenated compounds, 1 sulphur compound, 15 aromatics, 27 alkanes, 7 alkenes and 31 halogenated compounds. Validation of the method is conducted according to Compendium Method TO-17 (US Environment Protection Agency) criteria, which includes the following items: determination of method detection limits; analytical precision; audit accuracy; tube desorption efficiency; tube safe sampling volume and breakthrough test. This work is still in progress; the data will be supplemented in the full paper and will be presented at the conference.

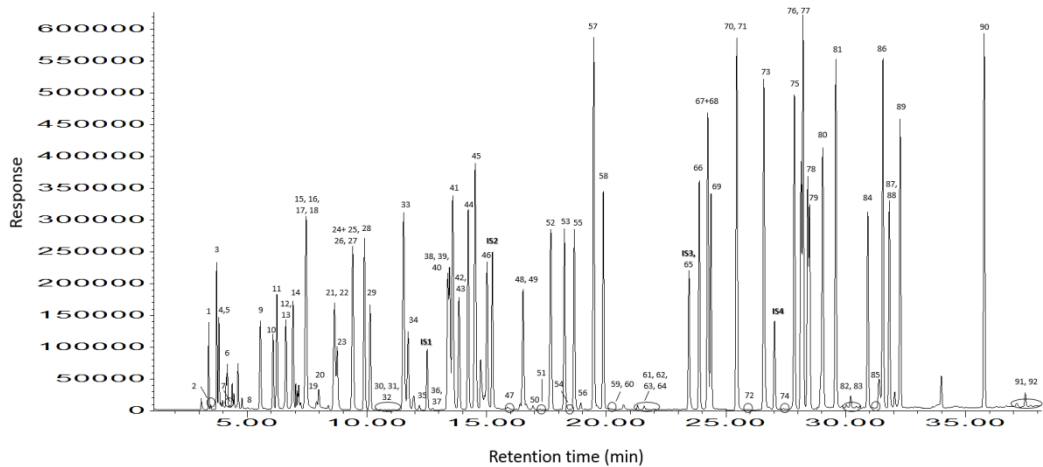


Figure 1. GC chromatogram for the mixed standard gas.