

Development of an automatic sampling equipment for Volatile Organic Compounds (VOCs) using sorbent tubes and its application monitoring of the air quality in Vietnam, Hanoi city

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1. Introduction

In developing countries, while living standard has been improved, air pollution has become to be worse in many regions. Due to urbanization, air pollution in Hanoi city in Vietnam, sampling site in this research, is highly expected to be worse than current situation. In order to evaluate current air condition, consequently to control and reduce air pollution, monitoring of trace gases of pollutants is required. In Vietnam, there are 13 air pollution monitoring stations (Hanoi 2, Dong nai 2, Ho Chi Minh city 9)¹⁾. However, they are in limited locations and the number of stations is not sufficient. Furthermore individual Volatile Organic Compounds (VOCs), important oxidant precursors, were not typically monitored at such stations in Vietnam. Therefore, in order to know more detail of air quality, in situ sampling of VOCs are required at sampling site. In this study, an automatic VOCs sampling instrument using sorbent tubes was developed in order to obtain higher portability and VOCs data with lower cost and fewer manpower, and which was applied to monitoring of VOCs in Hanoi.

2. Instruments

Sample gas is pumped and passed through the sorbent tubes are filled with activated carbon as adsorbent. Then trace gases in sample gas are captured into the tubes. After sampling, sorbent tubes are brought back to a laboratory and set to the desorption instrument. Then, captured trace gases are desorbed by heating and analyzed by gas chromatography. In the air sampling, sampling tubes are automatically changed by switching flow lines using electric solenoid valves. The switching is controlled by an electrical signal from a personal computer with an analog to digital converter. The timing of switching was set by self-coded program written in software: LabVIEW. At first, the basic performance of sampling system, dehydrating method, flow rate and volume, were tested using standard gases in the laboratory, and then detection rates of ethane and compounds with carbon number more than three are within the error of detector ($\pm 10\%$). The variability of the system was also tested with air sampled in forest area at suburban site of Tokyo by comparing with the other conventional sampling system.



Fig. 1 Auto Sampler

3. Result

Concentrations of CO, O₃ and VOC and number density of particle matters were measured in Hanoi city from 9/23/2015 to 9/30/2015. The concentrations of CO and VOCs, especially isopentane, showed similar time trends and are high during rush hour in morning and evening. Additionally, concentrations of isopentane and pentane, mainly released by gasoline combustion showed high. These results indicate that transportation is a main source of pollutants in the city. In Hanoi, motorcycle is 90% in entire of vehicles of the road transport fleet²⁾ Therefore, it can be concluded motorcycles are the predominant cause of air pollution in downtown of Hanoi.

4. Reference

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