SOME RESULTS OF AIR MONITORING QUALITY IN HANOI AND ASSESSMENT OF AIR MONITORING METHODS USED IN VIETNAM

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ABSTRACT

It is the first time the passive sampler has been prepared and used in Vietnam. The study on concentration and volume of absorption solutions for NO_2 and SO_2 gases, the area of absorption filter, the lengths of diffusion tube and the other parameters have been carried out. In order to estimate the using quality possibility, it is necessary to compare the results of air monitoring quality gain by using Vietnam passive samplers with those by applying Japanese passive samplers and other methods such as active samplers, automatic continuous monitoring equipments for monitoring NO_2 and SO_2 gases concentration in ambient air. In addition, this report will present some results of air concentration of NO_2, SO_2, CO, CO_2 gases and SPM in nine industrial areas in Hanoi from 1997 to 2000.

Keyword: *Passive sampler, ambient air quality of Hanoi city*

Introduction

Institute of Chemistry, National Center for Natural Science and Technology, NCST has carried out a study on the optimal passive samplers of NO_2 and SO_2 gases with very kind help or Prof.Yasuaki Maeda, from Osaka Prefecture University Japan. The components with suitable concentrations and volume of absorptive solutions of NO_2 and SO_2 gases have bee studied. The every detail with style and size of passive samplers has been prepared talking after Japanese passive samplers as the references. (Named as IOC passive samplers) have been used parallel with Japanese ones in Hanoi to make the comparisons of the results. The results achieved by IOC and by Japanese ones in samplers are quite similar except for some small differences due to the automatic continuous equipments.

Hanoi is the capital of Vietnam with population of over 2.2 millions, covering the area 927,4 km^2 (data up to 1998). There are nice industrial areas located in Hanoi with old factories and new cooperated industrial areas as Thuong Dinh (TD), Van Dien (VD), Phap Van (PV), Mai Dong (MD), Chem (CH), Cau Dien (CD), Dong Anh (DA), Sai Dong (SD), and Duc Giang (DG). Starting with its old and outdate technology, Hanoi' factories and enterprises have gradually been improved through the new and high industrial technology. Such air pollutants pollute the ambient air quality of Hanoi as CO, CO_2, NO-NO_2-NO_x, SO_2 and SPM, which are released from industrial areas and traffic. At present, there are only three air automatic continuous monitoring stations for the ambient air quality of Hanoi. They are located on Civil Engineering University in Hai Ba Trung District (South Part of Hanoi, Chemistry in Tay Ho District (North part of Hanoi). The passive samplers, which is one of many useful methods with low-cost technology and simple operating for gases absorption, have been used for ambient air quality survey of nine industrial areas of Hanoi together with others methods such as active samples (flow injection methods) and automatic continuous monitoring equipments. The report show not only some results of air monitoring quality in nine industrial areas of Hanoi conducted by the IOC passive samplers and the Japanese ones for NO_2 and SO_2 gases but also air monitoring survey on CO, CO_2 and SPM by other methods since 1997 to 2000.

Experiment

Apparatuses applied as follows:

1. Air automatic continuous monitoring Apparatuses used as mobiling station, include:

- Nitrogen oxide Analyzer- Model-265P- Kimoto, Japan
- Sulfur Dioxide Analyzer- Model SA-631-Kimoto, Japan
- Carbon monoxide Monitor- Model-540- Kimoto, Japan
- Suspended particulate Metter Monitor SPM-611, Kimoto, Japan
- Standard gas Calibration AFC-65, Kimoto, Japan.

Prof.Yasuaki Maeda from Osaka Prefecture University, Japan Supports all the apparatuses in cooperation to study on air monitoring methods in Vietnam with the preparation of passive samplers for Vietnam.

2. Simple measuring methods based on using absorptive solutions of air pollutants by the Air Handy sampler HS-7, Kimoto, Japan. (Flow Injection Method)

3. Simple measuring method with using passive sampler for the measurement of individual exposure value for air pollutants. The passive sampler is made in Institute of Chemistry (NCST) and in Japan.

4. Temperature, Relative Humidity, atmosphere pressure, wind direction and speed were measured by Kimoto apparatuses.

5. Analytical Instruments are Ion-Chromatography-Alltech-USA and Spectrophotometer UV-VIS, Unicam-British.

Result and discusion

The passive samplers of SO_2 and NO_2 have been studied and prepared in Institute of Chemistry under technical consulting of Prof.Maeda basing on the principle of Martin Ferm (Sweden, 1991). SO_2 and NO_2 are acid gases so they are absorbed by basic solution as reactions below:

$$SO_2 + OH \quad SO_3^{2-} \quad SO_4^{2-}$$
$$NO_2 + OH^- \quad HNO_2^-$$

The absorptive solutions for NO_2 gas are studied and with the mixture of NaOH + NaI + CH_3OH and mixture of Triethanlamin, TEA + acetone to impregnating papers. According to table 1, the optimal condition for preparation of impregnated solution of NaOH-NaI-Methanol is the mixture of 1% NaOH +8% NaI in the methanol.

Table 1. Study on the components, concentrations and exposures time for impregnating solution for absorption of NO_2

No	NaOH (8%NaI)		NaI (1% NaOH)		Exposure time		Mix TEA+acetone		Notice
	g/100ml	*ηg*	*g/100ml*	*ηg*	*(min)*	*ηg*	*ml*	*ηg*	Volume: 50µl
1	0	0	0	172	10080	2926	0	0	T (Ave): 30°C
2	0.4	464	2.0	334	20160	5252,6	5	384.33	RH (Ave): 52%
3	1.0	556	4.0	30	30240	7537	10	430.66	P (Ave) = 719 mHg
4	1.6	567	6.0	438			15	426.66	On the gate of NCST of
5	Japanese	566	Japanese	434				416.66	Hoang Quoc Viet str.

The impregnated solution of mixture of Triethanolamin (TEA) in Acetone also has studied for absorption of NO_2 gas. The optimal concentration of the solution is 10% of TEA and 90% of acetone. The impregnated volume is 50µl too. The more stability of results it is better to use the second solution, it is the mixture of TEA in acetone.

The absorptive solution of SO_2 have been studied by impregnating solution 0-10% Na_2CO_3 in water and 0-6% K_2CO_3 in water. Table 2 shows that the study with the optimal concentrations of impregnating solutions for SO_2 is 5%- 10 % NaOH solution gave the best results.

Table 2: Study on the components, concentrations and exposures time for impregnating solution for absorption of NO_2

No	0	2%	2.5%	4%	5%	6%	7.5%	8%	10%
Na_2CO_3=	0		1365.33		2995		3074.66		3050.66
K_2CO_3	0	1455		3137.33		2992.33		3100.33	

As K_2CO_3 can absorb water more easily, so Na_2CO_3 was used for impregnating paper. The equipment of passive sampler has been prepared by taking after Japanese passive sampler as references. In near future, we will study to prepare our ones for Vietnamese conditions.

With the passive samplers studied and prepared, we used them to collect NO_2 and SO_2 gases of ambient air in nine industrial areas in Hanoi. To compare their results with those by other methods, we used Japanese passive samplers and the automatic continuous monitoring equipments and flow injection methods.

The basic absorption solution in this study is mixture of 10% TEA in acetone and 10% NaOH in water with the volume of absorption solution is 50µl. The analytical method is Ion chromatography to determinate SO_2 gas and Colorimeter for determination of NO_2 gas.

The results of the air monitoring of Vietnam passive samplers, Japanese passive samplers and automatic continuous monitoring equipments are shown in chartl and chart 2 with method 1 is flow injection method, method 2 is passive sample and method 3 is automatic continuous equipment.

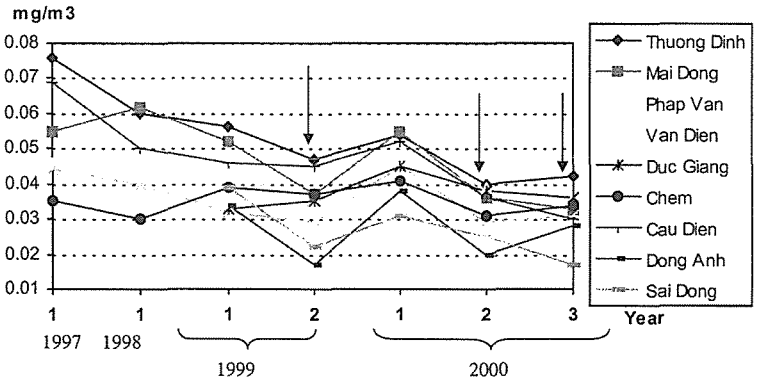

Fig. 1. The Concentration of NO_2 gas in nine industrial areas in Hanoi
1. Flow injection method 2. Passive sampler 3. Continuous monitoring equipment

According to fig. 1 and fig. 2, the results of method 1 and method 3 are very close. The NO_2 passive samplers are exposed only for two days and seven days for SO_2 passive sampler. The automatic continuous monitoring equipment id operated for a week.

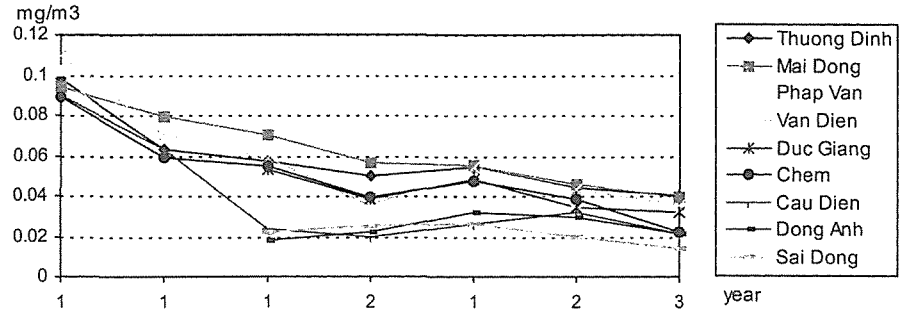

Fig. 2. Chart of Concentration of SO_2 gas in nine industrial areas in Hanoi
1. Active sampling method 2.Passive sampler 3.Continuous monitoring equipment

During that time, we also used our Vietnam passive samplers for monitoring NO_2 and SO_2 gases. The results show that, the passive sampler of IOC is needed to improve the air monitoring quality. It step by step should be made better.

The fig. 3 shows the concentrations of CO, CO_2 and SPM from 1997 to 2000 in nine industrial areas in Hanoi city.

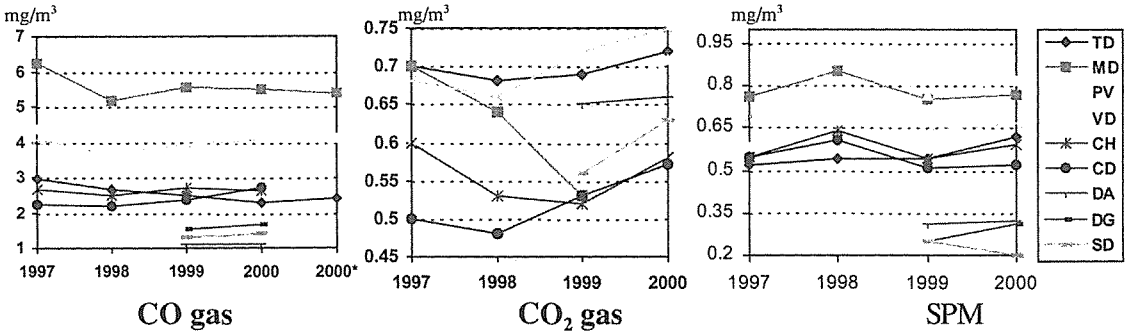

Fig. 3. The concentration of CO_2, CO and SPM in nine industrial areas in Hanoi from 1997 to 2000

The content of CO_2 gas and SPM in most of nine industrial areas were exceeded the Vietnamese standard to 1-3 times. Especially in Mai Dong area, where the content of CO gas was 1 to 1.2 times higher than standard.
The highest pollutant industrial areas are Mai Dong, Phap Van, Thuong Dinh and Van Dien. They are biggest and oldest industrial areas of Hanoi and located near the main traffic road and interfere in residential areas. In our opinion, the high content of CO_2 gas may be caused not only by emission of industrial waste gases, but also by elimination from traffic fuels in Hanoi and domestic fuels, because small enterprises and many families in Hanoi use hazal-neet or briquette coal to fire and to cook. The high content of SPM has been contributed a significant part of many construction sites, traffic density in Vietnam.

Conclusion

1. Air pollution level caused by emission of industrial waste gases in Hanoi Is still not so critical. The content of most of the measured parameters such as CO, SO_2 and NO_2 gases are lower than permit standard.

2. Producing and using successfully passive sampler of Institute of Chemistry (NCST) in measuring of NO_2 and SO_2 gases (appendix 1) will open a new capability of management and monitoring of ambient air quality. Because this method is very simple, cheap and effective

Acknowledgement

On the behalf of Institute of Chemistry, NCST, we would like to express our sincere thanks to Prof.Yasuaki Maeda, Osaka Prefecture University, Who has given the Institute the many equipments of Air Automatic continuous monitoring station for CO, CO_2, SO_2 NO-NO_2-NO_x, SPM and Gas Calibration. We thanks to him for his technical consulting to study on passive samplers and to Dr.Kiyoshi Imamura and Dr.Tsujino Yoshio for very kind help.

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