STUDY TO BUILD METHOD FOR ANALYZING SOME COMPONENT OF AIRBORN WHICH CAUSE RESPIRATORY DISEASE

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ABSTRACT: Aerosol sampler is located at the top of the three floors building of INST. The amount of PM particle and components such as black carbon; chemical elements; violated organic compounds and microorganisms are analyzed by appropriate methods. Using the method of regression and analysis of variance ANOVA to find out correlation between there pollution components and patients treated at the Department of Respiratory in Hanoi E-Hospital. It shown that microorganisms, benzene, toluene, element sulfur and element silica have effects on monthly number of patients treated respiratory diseases at the E-Hospital.

I. INTRODUCTION

Main cities in Vietnam are been serious environmental pollution by economic developing and population growth that active change in the climate and human health such as Ha Noi, Ho Chi Minh, Da Nang... So that the environmental pollution and special air pollution are problems which environmental scientist are studying. The air pollution level depend geographical features, climate, urbanization, industry, economic, energy and traffic.

Currently, Vietnam still have not regularly informed about air pollution. The studies about polluted air shown only give notice of the concentration airborne, inorganic components and it s source.

To find out the effects in polluted airborn related to the number of patients with respiratory disease which related patient treated respiratory disease. We carry out research working: this is "Study to build method of analyzing some component of airborn to cause respiratory disease."

II. METHODS

The aerosol sampler-Gent StackedFilter Unit (GENT-SFU located on the top of house roof of three floors building of INST with longitude $105^{o}47.56'$, latitude $21^{o}2.46'$). The $PM_{2.5-10}$ particles and $PM_{2.5}$ particles are collected by filters with flow rate 17-18 L/minute. Weight method is used to determined concentration PM particles on filters. The difference weight of filter after and before collection is amount PM particles.

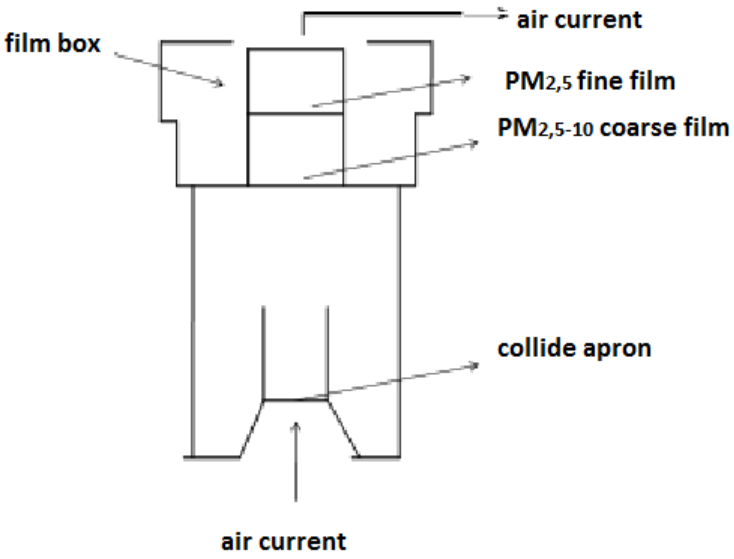


Figure 1: The air dust sample collection diagram in GENT-SFU.

The Black carbon substance is determined by light intensity measurement method. The results are calculated by:

$$BC = 12.88 \frac{1000 * \log\left(\frac{100}{I}\right) + 2.39398}{\frac{45.7985}{V}}$$

Where I is refraction of light intensity in filter and V is air volume goes through filter.

The chemical elements and ions in samples are determined by XRF (X-ray fluorescence) in X-ray fluorescence spectrometer X-VietSpace. model XRF5006 - HQ02.

Working regulation:

+ sample size mode HV = 30 kV, I = 200 μA, no filter
+ Spectrum record time: 1200 sec
+ working environment: primary vacuum
+ Data analysis: automatic

Ions of PM particles are determined by Dionex-600 Ion chromatography with Peaknet 6.0 software.

The volatile organic compounds-BTEX group that is benzene, toluene, ethylbenzen, m-xylene and p-xylene are collected by active methods. FL-1001 pump is used to adsorb air into adsorption tube with flow rate 50 ml/minute and colleting time on each adsorption tube is 25 minutes. We collect two tubes for each sampling with the time collection is separated 10 minutes. The adsorption tubes which are maintained in safety box for VOCs analysis are covered tightly by specialized Teflon cap. The samples are disorption and analysis in GC/MS-QP 2010 (Gas chromatography-Mass spectrometry).

The impingement method is suitable technical condition for collecting bioaerosol. Air flow is impinged in to liquid medium. The air flow impinged into 250 ml glass flask containing 100 ml liquid nutrient medium. The glass flask is connected with the pump by teflon tube □ = 5 mm. After that, solution sample is enriched and analysis the microorganism. Total microorganisms are detected by counting colonies forming unit (CFU) on medium agar disk. Cell morphology and Gram bacteria are determined by Gram stain method and PCR method (polymerase chain reaction). The maintain goal of methods is detection microorganism species which are isolated.

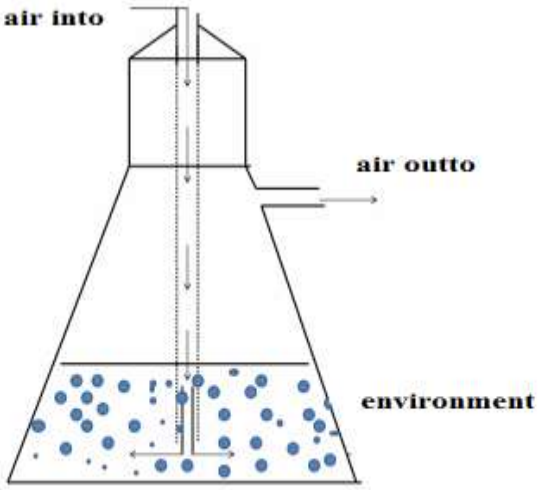
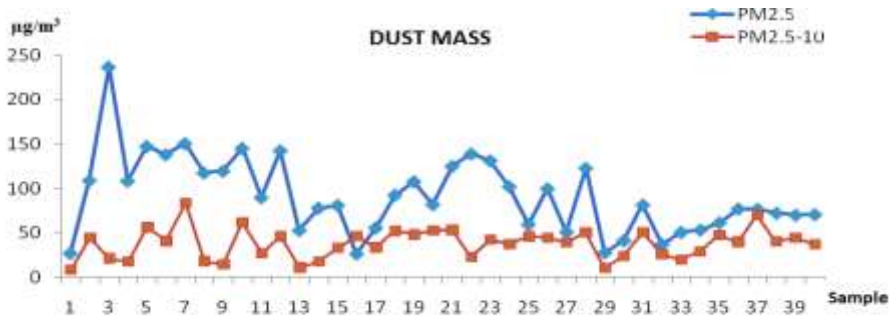


Figure 2: The bioaerosol sampling diagram.

III. Results and discussion



Figurer 3: $PM_{2.5}$ and $PM_{2.5-10}$ particle concentrations collecting in Institute for Nuclear Science and Technology.

The amount PM particle of aerodynamic size 2.5µm $PM_{2.5}$ called fine particle and particulates of aerodynamic size 2.5-10µm $PM_{2.5-10}$ called coarse particle collecting in INST from April 2011 to Mar 2012 are presented in figure 3.

The results is shown that the chemical elements such as Al, Si, S, K, Ca, Ti, Mn, Fe, Cu, Zn and Zr are detected in all sampling, but concentration of elements on coarse particulars is difficult on fine filter. If concentration of chemical elements arranged in line from high to low is S > S i> Ca >K > Al of $PM_{2.5}$ that concentration of chemical elements of $PM_{2.5-10}$ will be Si > Al > S > Ca > K (see figure 4 and figure 5).

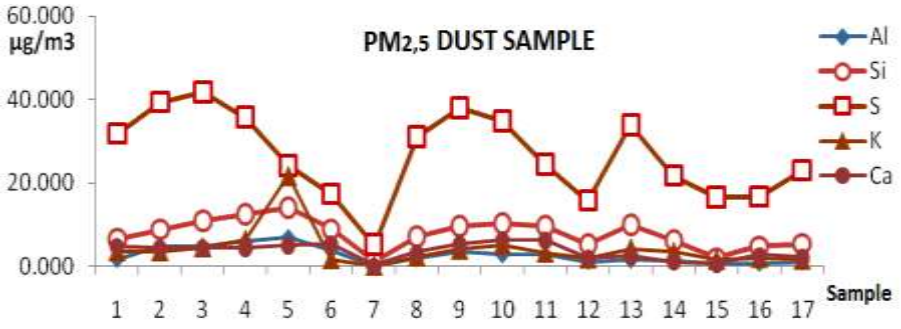


Figure 4: The concentration of elements of $PM_{2.5}$ particles.

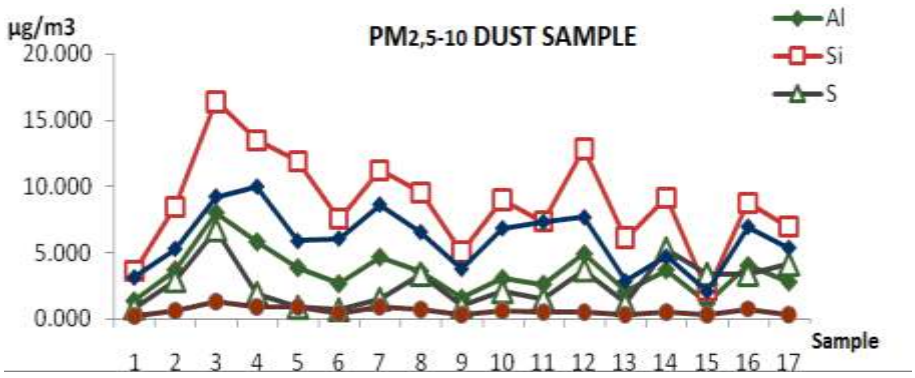


Figure 5: The concentration of elements of $PM_{2.5-10}$ particle.

Anion such as F-, Cl-, Br-, NO3-, PO43-, SO42- and cation such as Na+, NH4+, K+, Mg2+, Ca2+ are detected in all samples. The results of ion chromatography analyze shown that concentration of anion are arranged in line from height to low SO42- > Cl- > NO3- > F- > NO2- > PO43- of PM2.5 and SO42- > Cl- > NO3- > PO43- > NO2- > F- of PM2.5-10 concentration of cation are arranged in line from height to low : NH4+ > Ca2+ > K+ > Na+ > Mg2+ of PM2.5 and Ca2+ > NH4+ > Na+ > Mg2+ > K+ PM2.5-10. All major ions of PM2.5 were detected.

Benzene, toluene, o.m.p-xylene (orto-. meta and para-xylene) are volated organic compounds BTEX group are detected in all collected sampls. The highest concentration of BTEX found in 12/2011 is 7.615µg/m^3 and the lowest concentration in 5/2011is 28.83 µg/m3 (Table 1)

Table 1: VOC data, rainfall data, humidity data and temperature data.

Month/year	Temp ^oC	Humidity %	Rainfall mm	Benzen µg/m^3	Toluen µg/m^3	Ethyl Benzen µg/m^3	m.p Xylen µg/m^3	o. Xylen µg/m^3
5/2011	25.25	84.75	149	8.44	32.82	10.09	9.66	6.89
6/2011	27.75	89.00	396	15.71	37.74	13.56	16.75	9.88
7/2011	28.40	84.20	295	15.51	12.19	5.02	4.30	1.13
8/2011	28.00	84.00	313	18.72	28.63	5.05	11.00	4.02
9/2011	26.67	87.00	247	21.67	42.06	14.78	23.09	12.43
10/2011	24.00	91.75	178	23.77	49.84	33.53	68.03	28.63
11/2011	20.50	88.50	32	25.43	43.19	33.53	60.09	23.54
12/2011	17.20	65.00	52	27.62	77.51	26.75	44.83	16.67
1/2012	14.00	82.00	20	28.83	78.22	10.62	23.67	9.47
2/2012	15.50	86.25	19	23.23	44.69	7.00	17.82	5.53
3/2012	18.80	95.40	17	19.89	43.34	8.39	13.27	8.12
4/2012	24.75	88.25	123	17.71	38.79	4.95	10.08	3.91

The results shown that the highest number of microorganism on day is 37 x 10^4 ± 1.7 x 10^4 CFU/m^3. The highest average results is 88.57 CFU/m^3 in March 2011 and the lowest highest average results is 10.70 CFU/m^3 in October 2011. Genus *Pseudomonas*, S*taphylococcus* and *Aspergillus's* were determined in collected samples. Negative gram bacteria samples ranged from 2% to 15%.

By using ANOVA and regression mathematical method, the results are found components such as benzene (X1), toluene (X2) and average rainfall (X3) affect the number of bacteria (Y) each month:

$$\mathbf{Y = 16971.92+X1 \times 538.44 + X2 \times (-387.08) + X3 \times (-25.32)}$$

Where the significance F=0.04 and F< 0.05.

Interrelate between the patients who treated at Department of Respiratory disease in Hospital E. Hanoi and the number of average bacteria on each month is described with equation:

$$\mathbf{Patient = 110.94 + 0.0028 \times [bacteria]}$$

Interrelate between the patients bacterial, silica element concentration and S element concentration in $PM_{2.5}$ fine particle is described with equation:

$$\mathbf{Patient = 69.49 + 0.006x [bacteria] + 2.123 \times [Si\_Fi] + 0.012 \times [S\_Fi]}$$

Where the significance F = 0.00064 and F< 0.05

So we confirm that total number of bacteria, benzene, toluene, silica element concentration and S element concentration in air affect number of patients who treated at Department of Respiratory disease in Hospital E Hanoi.

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