Pollution measurement and standards

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Introduction

In last 10 to 20 years in urban area the deterioration in air quality and an increase in health and environmental impacts .In some it is found that most of the premature deaths ,as well as respiratory and cardiovascular diseases are related to air pollution .World Health Organization estimate in 2012 11.6 % deaths due to air pollution outdoor and indoor every year nearly 6.5 million of deaths due air pollution . Air pollution exposure can be considered a function of the concentration of pollutants in a microenvironment and the time spent by individuals in that microenvironment. most of the air pollution is due to the transportation vehicle . The 1970 Clean Air Act specifies that the health justifications for all NAAQS will be re-evaluated by the U.S. Environmental Protection Agency (U.S. EPA) every five years, and that the standards will be modified to reflect new scientific knowledge.

Methodology

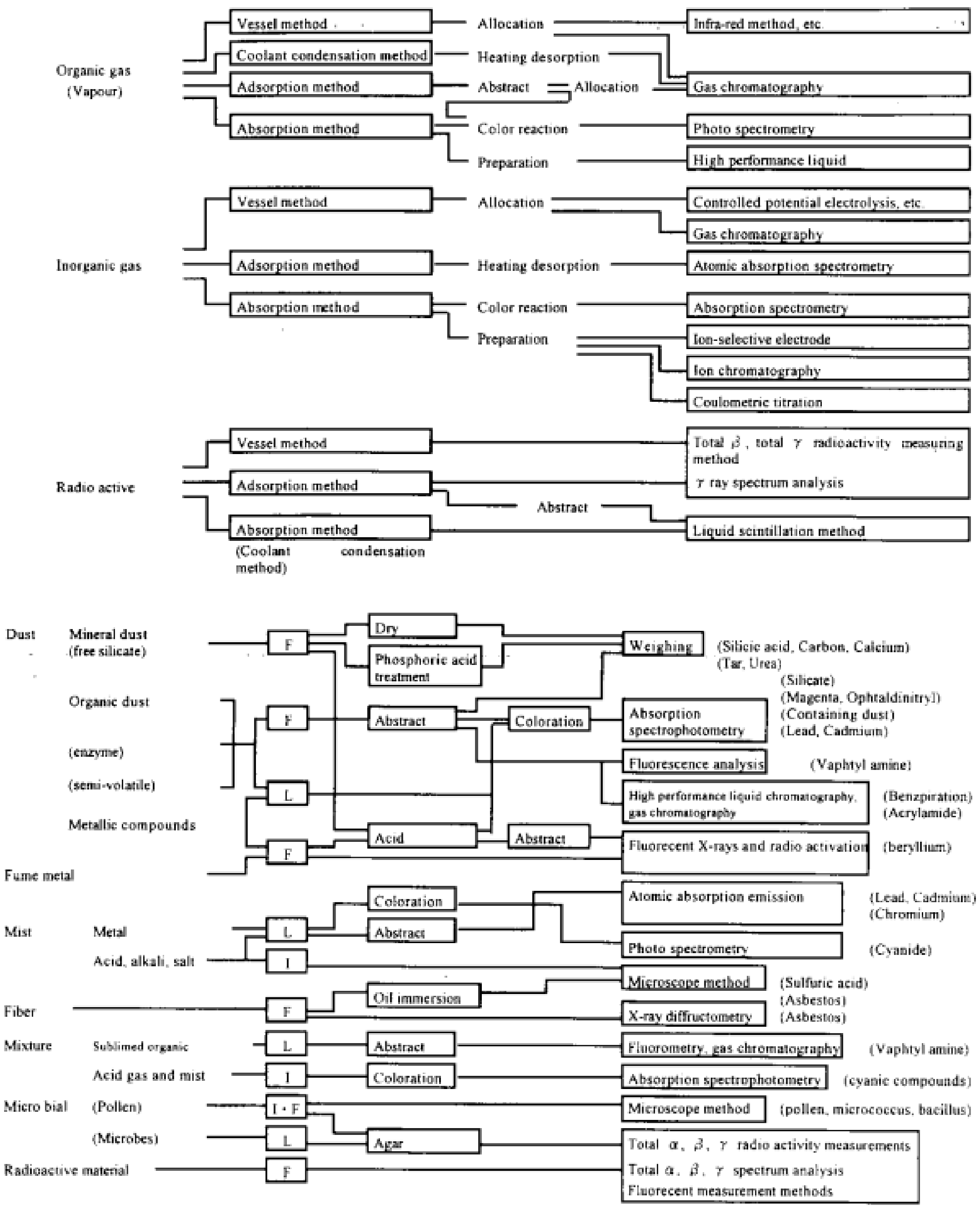
1) Basic of air pollution measurements

Air pollution is define measuring concentration of air pollution and determine the targets substances for measurement

Objective

a) Understand pollution level and concentration when sources and pollutants are knows .
b) To examine the causes of pollution when neither the sources nor the pollutants knows
c) Understand the level of pollution and types of pollution emitted
d) Specify the sources and to determine the level of its contribution
e) To thoroughly understand the broad range pollution level and its fluctuations

Measuring pattern of various kinds of pollution using manual methods



F: Filter collection, L: Liquid (impinger) collection, I: Impactor method;
Terms in brackets ( ) are examples of target substance

Fig.9.1.1 Measuring pattern of various kinds of pollutants using manual methods [3)]

- # Manual analysis method

This method is use for all pollutants in above fig state in which it is introduced to the analysis equipment always either gas and liquid .

C = M/V

Where C = Concentration ,M : Target substance amount (Detection amount X Collection quantity / Injection quantity), V : sample air volume (Aeration flow rate X Time)

For measure lower concentration with the same equipment it is necessary to increase the sample air volume with in a range that does not affect accuracy.

We can analysis air pollution by using to method 1) spectrometry 2) Chromatography

1) Spectrometry

The responses of sample and the standard solution are obtained using a spectrophotometer. The calibration curve is usually prepared for the determination The response are plot on y axis and on x axis more of the standard solution using linear relationship , the amount of the target substance in the targets substance in the samples determined from the sample solution responses , parallel with which , the blank values are determined from the unused absorption solution and the extraction from filter paper ,the difference between the amount of the target substance .

Causes of error of the process

a) Operating error
b) Equipment error
c) Interference from coexisting substance

- # Continuous analysis method

In this method continues data is taken by government or any one for analysis

Measurement method of monitoring the ambient air comprises the domestic law and standard of each country and also international standard

Continuous analysis

shows data concerning the continuous analysis atmospheric ana that are used as standards

Table 9.2.1 (1) Standard continuous analyzers

Measurement targets		
SO_2 Sulfur dioxide	Principle specifications	Ultraviolet fluorescent method, standard measuring range 0 to 0.05/ 0.1/0.2 /0.5/ 1.0ppm.
	Points to note	Sufficient precautions are required for the following: When the indicated values have incurred direct influence from aromatic hydrocarbons such as toluene and xylene, when a scrubber is needed to remove hydrocarbons, sites where motor vehicle exhaust gas levels are high, when the amount of scrubbing has reached high levels for hydrocarbons generated on building sites, etc., and when replacement frequency has risen.
NOx Oxides of nitrogen	Principle specifications	Chemiluminescence method, standard measuring range 0 to 0.1/ 0.2/ 0.5/ 1.0ppm.
	Points to note	With the switch method, the NO_2 can be scattered if the NO concentration is high, or fluctuates severely. Check dehumidifying measures, because the indicated values are interfered with moisture. High concentrations of NH_4 in the air cause dirtying within the reacting cell due to O_3 from the gas reactions, for which a scrubber is effective in removing the hydrocarbons. Further, there are also occasions when organic nitrogen compounds are measured as NO by the converter.
O_3	Principle specifications	Ultraviolet absorption method, standard measuring range 0 to 0.1/ 0.2/ 0.5/ 1.0ppm.

Objective and types of ambient air measurements

There are different types of measuring stations depending on the atmospheric measurement objective as show in table

Table 9.2.2 Measuring station objectives and types

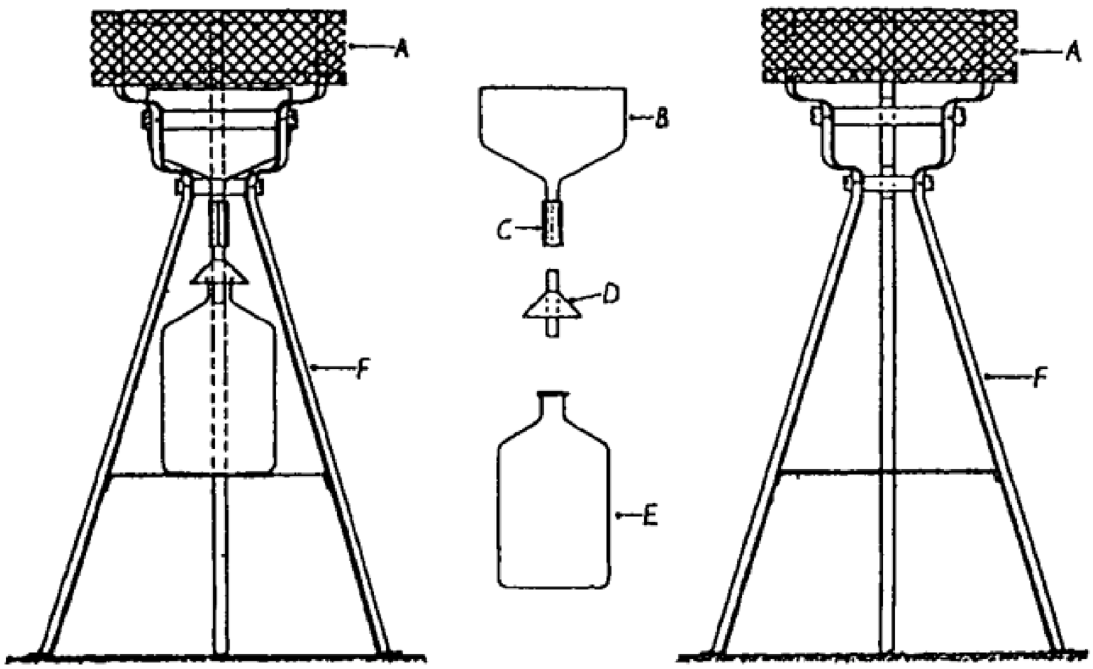
General ambient air measuring stations	These are standard atmospheric measuring stations that generally monitor the state of air pollution in cities, residential areas, and industrial zones. They use standard analyzers.
Automobile exhaust gas measuring stations	These are the measuring stations that, continuously monitor the pollution state in the area around junctions and at roadsides where the air pollution is particularly severe due to automobile exhaust gas. They use analyzers that possess highly concentrated measuring ranges. It is important to ensure that dirt and particles do not interfere with the analyzers.
Ambient air measuring stations	These stations were established with the objective of obtaining basic samples from monitoring a wide range of ambient environment (background) conditions in unpolluted areas such as mountains, fields, and beaches, and because they measure low concentrations, the analyzers need to be highly sensitive with few fluctuations from zero. Further, there are occasions when analyzers are also installed to measure H_2S, O_3, CO_2, and acid rain as well.

- # Dust fall measurement methods

All the sir pollution , dust fall id the name given to smoke , soot , impure particales that settle along with the rain , due to own weight

Sampling method

The dust fall totals are compiled as shown in Fig.9.4.1. The wire mesh A protects the trap funnel B somewhat, preventing birds from cutting off the connection. If a glass collecting bottle is being used during the winter, because there is a risk of it being damaged by frost, the bottle is best wrapped in a suitable insulating material, or else in place of glass, a polyethylene bottle should be used



A. Wire mesh (to keep out the birds)
B Glass collecting bowl
C. Rubber tubing
D. Inverted funnel
E. Collecting bottle
F. Stand

Fig.9.4.1 Deposit gauge assembly

Results and discussion

The average concentration measured every 2 weeks for each gaseous pollutant is shown in Table S2. The average concentrations calculated from the four 2-week periods were used to provide pollutants' spatial distribution maps. The minimum, maximum and average concentrations of gaseous pollutants at each site are presented in Table 4. The differences in the spatial distribution of the sites are examined in the following discussion.

Table 3. Statistical parameters calculated for each interpolation method.

Parameters	MAE		RMSE		R^2	
	IDW	Kriging	IDW	Kriging	IDW	Kriging
NO_2	0.010	3.419	0.031	4.064	0.999	0.738
NH_3	0.029	13.016	0.062	19.945	0.999	0.016
SO_2	0.003	0.437	0.006	0.621	0.999	0.916
HNO_3	0.000	0.093	0.000	0.127	0.999	0.916
O_3	0.007	0.609	0.009	0.815	0.999	0.965

Table 2. Parameters of empirical semivariogram for each pollutant.

	NO_2	SO_2	HNO_3	O_3
Nugget Co $(ppb)^2$	30.90	1.93	0.07	6.93
Partial sill Cs $(ppb)^2$	24.46	5.66	0.16	31.68
Major range (km)	29.44	40.41	30.39	46.51

Table 4. Gaseous pollutants' concentrations and standard deviation (SD) at 21 sampling sites in Abidjan during the dry season (15 December 2015–16 February 2016).

Sampling site		Concentration in ppb														
ID code	Site name	NO_2			NH_3			SO_2			HNO_3			O_3		
		Min	Max	Mean ± SD	Min	Max	Mean ± SD	Min	Max	Mean ± SD	Min	Max	Mean ± SD	Min	Max	Mean ± SD
A1	220 Lgts Liberté	13.9	30.8	20.8 ± 5.0	23.3	43.3	31.1 ± 6.1	0.9	5.4	2.6 ± 1.4	0.9	1.3	1.1 ± 0.1	10.1	12.6	11.3 ± 1.0
A2	Gesco	10.4	13.1	11.6 ± 1.0	25.1	31.6	27.6 ± 2.3	4.9	8.2	6.8 ± 1.3	0.6	0.7	0.6 ± 0.1	10.4	13.3	12.4 ± 1.0
A3	N'Dotré	10.9	15.7	12.2 ± 1.8	20.2	28.2	23.5 ± 2.4	5.4	8.8	7.2 ± 1.2	0.3	0.5	0.4 ± 0.1	7.2	10.3	8.9 ± 0.9
A4	Corridor Anyama	7.0	8.7	7.7 ± 0.6	26.2	38.5	32.2 ± 3.8	3.8	6.0	4.7 ± 0.8	0.2	0.3	0.2 ± 0.0	4.0	5.6	5.1 ± 0.6
A5	Pharmacy Cadre Blvd	19.7	33.6	23.9 ± 4.9	19.0	26.7	23.0 ± 2.2	2.0	4.4	3.1 ± 1.1	0.6	1.9	1.1 ± 0.4	6.9	8.2	7.8 ± 0.4
A6	Airport FHB	5.3	8.0	6.9 ± 0.9	16.4	22.5	18.8 ± 1.9	0.2	0.7	0.4 ± 0.2	0.6	1.0	0.9 ± 0.1	14.0	22.4	18.8 ± 3.0
A7	Town hall Attécoubé	13.9	23.4	17.5 ± 2.9	28.2	58.8	37.0 ± 10.9	0.9	2.5	1.5 ± 0.5	0.6	1.8	1.2 ± 0.5	8.7	15.9	12.4 ± 2.0
A8	Town hall Abobo	18.0	24.6	20.4 ± 2.1	24.7	37.0	30.6 ± 3.6	0.7	2.6	1.4 ± 0.6	0.7	1.6	1.1 ± 0.3	7.4	13.3	10.5 ± 1.9
A9	Yopougon industrial area	15.7	26.7	19.9 ± 3.4	16.7	26.5	21.6 ± 2.8	0.5	2.5	1.8 ± 0.7	0.9	1.7	1.3 ± 0.2	10.9	14.8	12.2 ± 1.3
A10	Zone 3	16.2	19.7	17.7 ± 1.0	15.5	24.5	20.9 ± 2.9	0.9	2.3	1.6 ± 0.4	0.6	0.9	0.8 ± 0.1	7.0	11.6	8.8 ± 1.5
A11	Tri Postal Vridi	22.7	27.6	25.0 ± 1.7	16.9	21.8	19.6 ± 1.6	1.2	2.9	1.9 ± 0.5	0.5	1.0	0.7 ± 0.2	5.8	11.9	9.6 ± 1.9
A12	University FHB	8.4	17.3	12.5 ± 2.4	18.4	33.5	23.9 ± 5.0	0.5	0.8	0.7 ± 0.1	0.6	1.5	1.0 ± 0.4	13.4	15.1	14.1 ± 0.4
A13	Angré	15.8	22.8	18.5 ± 2.2	24.4	29.6	26.9 ± 2.4	1.5	1.9	1.7 ± 0.1	0.8	1.8	1.2 ± 0.3	9.1	16.1	12.9 ± 1.9
A14	Place Inch'allah	15.8	21.5	17.6 ± 1.9	57.6	80.5	67.7 ± 8.3	0.6	1.6	1.1 ± 0.3	0.4	0.8	0.6 ± 0.1	5.3	12.4	7.6 ± 2.4
A15	Akouédo	9.9	13.6	12.0 ± 1.4	36.9	43.3	39.1 ± 2.1	0.4	2.5	1.2 ± 0.7	0.9	1.8	1.3 ± 0.2	15.2	19.6	17.6 ± 1.9
A16	Niangon Bracodi	17.6	18.9	18.3 ± 0.6	83.9	109.4	102,1 ± 9.1	0.8	1.4	1.1 ± 0.2	1.0	1.6	1.2 ± 0.2	7.7	12.8	10.2 ± 1.4
A17	Scientific pole CNRI-UFHB	9.4	21.0	13.6 ± 3.7	16.0	31.5	22.5 ± 6.1	0.7	1.7	1.0 ± 0.3	1.0	2.0	1.4 ± 0.3	11.2	20.4	16.8 ± 3.0
A18	Songon health centre	2.5	2.9	2.7 ± 0.1	7.5	12.4	9.1 ± 1.7	1.4	2.1	1.9 ± 0.2	0.4	0.9	0.7 ± 0.2	10.1	13.7	12.1 ± 1.3
A19	Niangon Adjamé	4.9	5.7	5.4 ± 0.3	41.7	47.2	44.0 ± 2.2	2.3	4.9	3.4 ± 1.0	0.2	0.2	0.2 ± 0.0	5.4	7.8	6.8 ± 0.7
A20	Gonzagueville	6.0	7.7	6.9 ± 0.5	11.0	18.8	14.3 ± 2.6	0.3	0.5	0.4 ± 0.1	0.1	1.5	0.8 ± 0.4	15.9	21.4	19.1 ± 1.7
A21	Ecological research centre	5.1	7.4	6.0 ± 0.7	9.9	17.5	13.6 ± 2.9	0.3	0.6	0.4 ± 0.1	0.4	0.8	0.6 ± 0.2	10.9	15.3	13.6 ± 1.4

CONCLUSION

This review has been broad in examining the different needs for particle monitoring and the methods that have been found to meet those needs. Particle measurement methods have advanced substantially over the past two decades, and much of this advancement has been spurred by the need to de velop better methods to measure compliance with air quality standards. It should be clear from the preceding presentation that much more than a simple, periodic mass measure ment is demanded of compliance monitors. The samples that these monitors acquire are often pushed beyond their original intent to derive information about contributing sources and effects on human health. The TSP and PM, standards were based on the practicality of available contemporary monitoring technology as much as they were based on existing knowledge about health effects. This review concludes that these additional needs must be considered as part of set ting a performance standard for future compliance monitoring. In this way, future revisions to air quality standards will be more closely related to the public health that they are intended to protect.