

ANALYSIS OF AIR PARTICULATES BY RADIOISOTOPIC X-RAY FLUORESCENCE TECHNIQUE

A. Y. YOUSIF

Technical College – Basrah – Comission of Technical Education

SUMMARY

X-ray fluorescence technique is employed to determine lead , zine and iron concentrations in air particulates samples collected from Baghdad Al-Jededa site using high volume air sampler .

The average concentrations of Pb , Zn and Fe are 0.86, 0.105 and 10.88 $\mu\text{g} / \text{m}^3$ respectively. It is found that these elements were emitted from more than one source and their high concentrations reflects the highly polluted of Baghdad ambient air .

INTRODUCTION

It is well known that the growing of population involves an increase in foods and industrial demands , which means an increase in number of pollution sources . To overcome such problem various studies should be carried out to determine concentrations of potentially toxic metals in natural mediums (air , water , soil) , to control the rate of ecosystem pollution and how to solve it .

Suspended particulate in air is recognized as a major pollutant which can have a pronounced effect on the health of the population and the quality of the environment .A vast information dealt with the source and distribution of pollutant have been accumulated , such information were employed for health and national wealth enhancement (5) .

The optimum management of air particulates pollution require detail environmental studies i.e sources , distribution and chemical composition of the solid particulates , The city of Baghdad represents the largest metropolitan area in Iraq with population of more than four millions . It is believed that the ambient air of Baghdad is highly polluted (4) , so the aim of the present study is to detect the level of air pollution via determination of Zn , Pb and Fe concentrations in the air particulates .

MATERIALS AND METHODS

To achieve the aim of this study, a weekly sampling for air particulates was carried out. Baghdad Al-Jededa area (Fig .1) was selected for sampling because it represents an industrial and commercial area . The sampling period extent from 18 June to 6 August 1997 . Total suspended particulate was collected using a calibrated high volume air sampler with constant flow rate of $28 \text{ ft}^3 / \text{h}$. the sampler was placed at level of 6m high from any thoroughfare or car traffic as well as to reduce contamination by soil splashing . The period for collection was 24 hours to avoid air moisture .

For more accurate calibration , a set of standards were prepared using primary standard solutions of Pb , Fe and Zn , An appropriate volume of the solutions were dropped on a filter paper using micropipetting liquid drops ($5 \mu\text{L}$) , to form a network of points with 10 mm distance between centers , then allowed to dry under infrared (IR) lamp . Identical thickness and diameter of the filter papers for both standard and samples were used in order to minimize the possible absorption differences .

The collected samples were analyzed using radio isotopic X – ray technique . The set – up is shown in (Fig.2) . The samples placed at a distance of 1 cm from a ^{109}Cd annular X-ray source of 10 mCi emitting 22.1 keV primary photon . The elemental secondary X-ray were detected by Canberra Si(Li)detector system having resolution of 171 eV for the 5.9 keV of ^{55}Fe $\text{K}\alpha$ X-ray . The measurements have been done with a computerized multi – channel analyzer for 30 K seconds .

To check the accuracy of the obtained results , a certain reference standard material (IAEA Air – 3/1) was chosen . Table (1) shows that the obtained values were statistically acceptable and the applied method was of high analytical precision

Table (1) : Accuracy determination of the method

Element	Concentration ug			Mean value μg	Cited value μg
	M1	M2	M3		
Pb	104.21	103.35	100.11	102.55	105
Fe	206.41	200.73	197.60	201.58	204
Zn	146.13	147.49	151.26	148.29	143

M1 , M2 , M3 , are the consecutive measurements

RESULTS AND DISCUSSION

The obtained data were shown in Table (2) . The main reason behind the selection of Pb , Zn and Fe elements were attributed to the effect on human health, Iron represent one of the abundant elements in the earth crust (56000 ppm) , while Pb and Zn represent trace elements in the earth crust (76ppm and 160 ppm) (2). The highest concentration of Pb causing the kidney damage , brain damage besides stupidity weak memory ,Baker (3) demonstrated that the Pb and Zn concentrations causing disruption in the synthesis of protein .On the other hand the deterioration in Fe and Zn abundance in women blood during pregnancy may be responsible for the abortion (1)

Table (2) : Elemental concentrations in air in Baghdad Al – Jededa site

Sample data	Air volume M ³	Wind direction	Concentration $\mu\text{g} / \text{m}^3$		
			Pb	Fe	Zn
18-6-1997	944	NW	0.72	7.66	0.08
32-6-1997	967.7	NW	0.85	8.38	0.12
28-6-1997	898.4	NW	1.15	10.94	0.15
01-7-1997	1120.1	NW	0.57	12.33	0.13
07-7-1997	91804	NW	0.62	8.56	0.09
11-7-1997	1012.6	SE	0.75	14.10	0.11
18-7-1997	979.8	SE	0.84	9.48	0.06
25-7-1997	982.3	NW	0.72	10.27	0.07
01-8-1997	1141.5	NW	0.90	8.01	0.12
06-8-1997	1083.4	SE	1.07	11.92	0.09

Figures (3,4,5) illustrate the mutual relationships between the studied elements .The absence of any significant relationship between Pb , Zn , and Fe indicates that there are more than one source contribute these elements to the air particulates . The variation in Pb and Fe concentrations during collection period (Table 3) for the same area (Baghdad Al-Jededa) could be attributed to the temperature variation and the effect of wind velocity perturbation .The differences in concentrations of Pb , Zn and Fe between the area of study and that of Chilton – United Kingdom (Table 3) resemble related to the metrological conditions .

The present average Pb concentrations in air is $0.86 \mu\text{g}/\text{m}^3$ which is higher than the lowest permissible value for Pb in air ($0.5 \mu\text{g}/\text{m}^3$) (3) which means that the ambient air of Baghdad is considered to be highly polluted and the major causes of this atmospheric pollution are the industrial activities , traffic and motor vehicles using leaded

gasoline and diesel fuels . So the present study suggest the restriction in using Pb additives in these fuels .

Table(3):Min,max and mean values of Pb,Zn and Fe in Baghdad and Chilton-U.K

Element	Chilton – U.K $\mu\text{g} / \text{m}^3$			Present study , $\mu\text{g} / \text{m}^3$		
	Min	Max	Mean	Min	Max	Mean
Pb	25.1	27.0	26	057	1.15	0.86
Zn	24.1	41.4	33	0.06	0.15	0.125
Fe	123	164	132	7.66	14.10	10.88

REFERENCES

- 1- Al-Hemeary, A.A.(2001)" A Study of trace elements cearuloplasnin and hemoglobin in normal pregnant and spontaneous abortion women on Basrah city unpublished M. Sc. Thesis , Basrah University 98 p (in Arabic)
- 2- Aresini , G., Drapar , M. H. Duffus , J. H., (1993) "The toxicology of Chemicals " Series one , EUR , 14990 E M ., 187 P .
- 3- Baker , S,J . (1999)" Trace and major elements in the atmosphere of rural locations : Summary of data obtained for the period 1996 – 1998" . Report , No AEAT – 4371/201/20174403 . United Kingdom .
- 4- Kanbour , F .I ., Kitto , A , N ., Yassein , S., Al-Taie . F . A . (1985) "Environmental pollution study for air using INAA technique",Environment International 11: 459-464 .
- 5- Khalaf , K., Yousif , A .Y ., Mohson , A . (1997) "Determination of Pb as a major air pollution in Baghdad" . Ibn Al-Haitham Journal For pure and Applied Science 8:38 -45 .

تحليل الدقائق العالقة في الهواء بأستخدام تقنية الاشعة السينية المتفلورة

أركان يعقوب يوسف

الكلية التقنية - البصرة - هيئة التعليم التقني

الخلاصة

أستخدمت تقنية الأشعة السينية المتفلورة لتقدير تراكيز الرصاص والزنك والحديد في نماذج للدقائق العالقة في الهواء جمعت من منطقة بغداد الجديدة بوساطة وحدة نمذجة للهواء . وجد أن معدلات التراكيز للرصاص والزنك والحديد هي $0.105\mu\text{g}/\text{m}^3$ ، $10.88\mu\text{g}/\text{m}^3$ و $0.86\mu\text{g}/\text{m}^3$ على التوالي ، كما وجد أن هذه العناصر تتبع من أكثر من مصدر واحد ويعكس ارتفاع تراكيزها المقدرة مستويات التلوث العالية في أجواء بغداد .

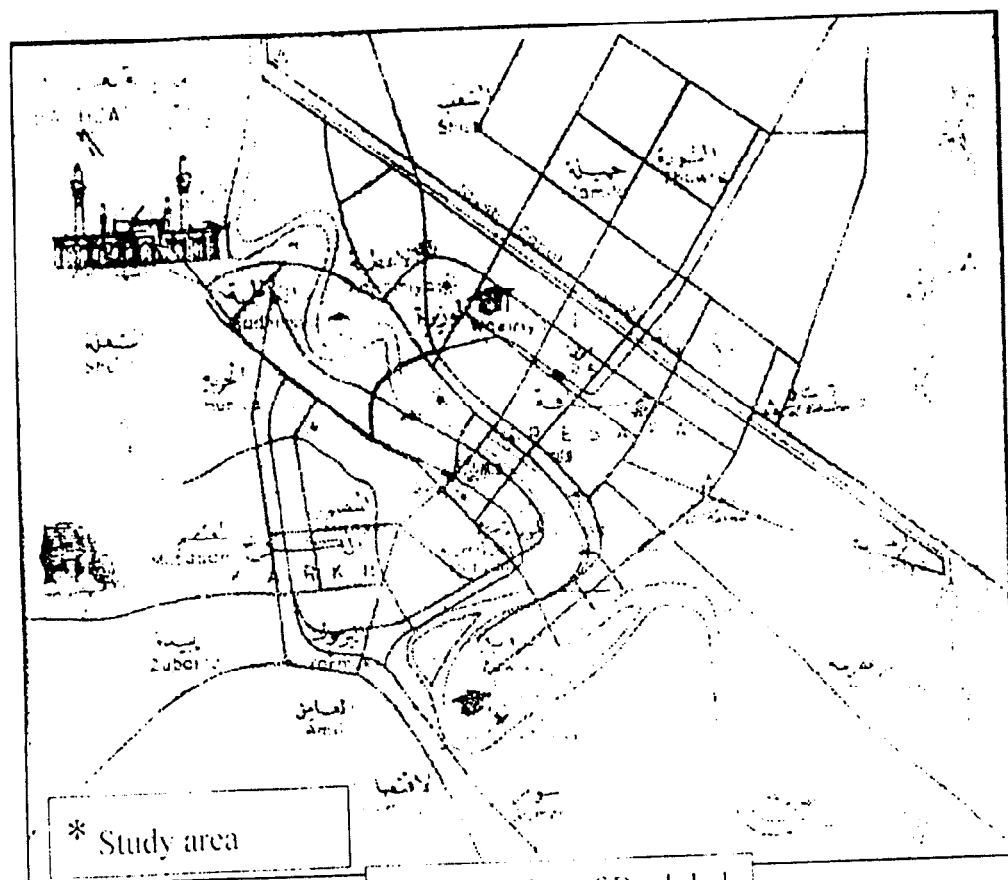


Fig (1) :Map of Baghdad

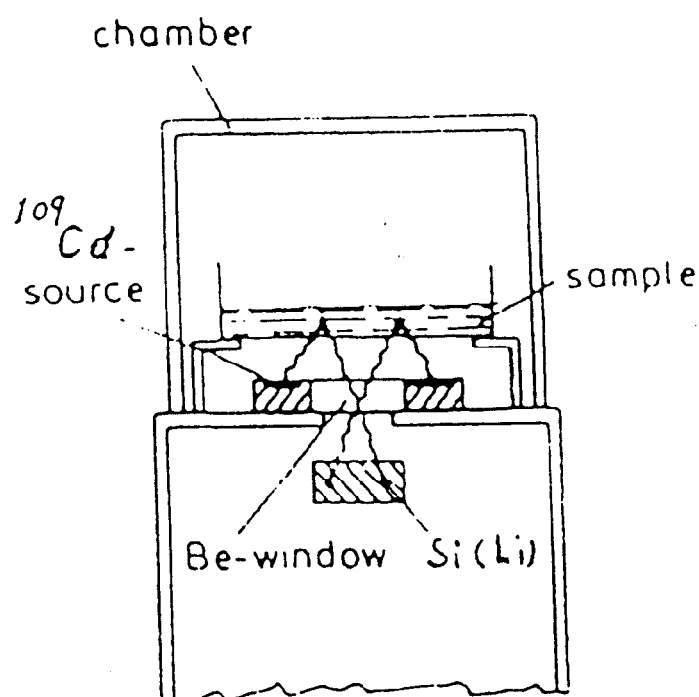


Fig (2): Experimental set up for X-ray fluorescence analysis