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Title : **Monitoring of trace elements in dust fallout in Shaibah, Basrah city/ Iraq**

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Abstracts

This study examined the impact of climatic factors on the distribution and prevalence of some trace elements in samples of dust fallout from areas near the oil refinery in Shaibah area in the province of Basrah/ Iraq. The fallen dust collected by special containers monthly between June 2011 and November 2012. The trace metals (Ni, Cd, Pb, and Cr) and its weight were estimated in these samples. The results showed that no significant differences in DW concentration among the stations, both Cr and Pb have dominated in all stations but at St2 and St5 the Ni and Pb have the highest percentage. Lead, chromium and cadmium contamination may be coming from other areas as well as pollution locally due to high prevalence at all

locations, while nickel appears locally polluted due to its high rates at only two stations. the highest amount of dust falling in autumn was reached at (20.51 g/m^2), followed by Winter at (15.85 g/m^2), Spring at (14.93 g/m^2) and Summer at (11.15 g/m^2). The Pb concentrations have the highest mean (14.70 mg/m^3) in the winter, whereas Cr (7.91 mg/m^3) in the summer. There is no significant difference in concentration of Cd, Ni and Pb among seasons; however, Cr has significant differences among seasons.

Key words: Basrah, monitoring, fallen dust, trace metal.

Introduction

The industry is one of the largest sources of air pollutants especially if they depend on fossil fuels, oil and natural gas as the main source of energy. The atmosphere composition was changed when larger amounts of gases were burning, particles that are working through the accumulation in the air. They lead to an imbalance in its ecosystem so air becomes the source of many risks and disadvantages that threaten all aspects of living and non-living life [1, 2]. Dust is an important source of trace metal pollution in the urban environment [3].

Air quality tests in Iraq since 2008 have revealed dangerously high levels of fine particulate matter, breathe air polluted with the most worrisome kind of dust particles fine particles, or “particulate matter,” that lodge deep inside the lungs, at levels almost 10 times higher than the desirable levels in U.S. National Ambient Air Quality Standards [4]. These tiny particles made up of many elements, including heavy metals. For example, Pb, Cr, Cu, and Zn have raised greater concern than large particulate matter because these tiny particles can travel deeply into the lungs causing much more damage [1, 5, 6]. According to Hashim [7] the average of dust deposit in Iraq is approximately four times and a half greater than the allowable limits. As regard to dust deposits quantity, Hashim [7] found that the results showed increases in dust deposits quantities in the Babylon governorate, where annual average of dust deposits during the year 2008 was ($32.9 \text{ g/m}^2/\text{month}$); whereas the World Health Organization (WHO) recommended that dust deposits should not exceed ($9 \text{ g/m}^2/\text{month}$). AL-Hassen [1] pointed out that the highest amount of dust falling in the city is increasing compared with the countryside and found that the amount of dust falling in the city of Basrah, up to (21.5 g/m^2) during (2009). The health impact of the dust falling does not depend on the quantity, but the quality, as well as some studies, have revealed that the falling dust particles contain concentrations of heavy elements [5, 8, 9].



Materials and Methods

Study area and sites were selected for the study they from areas nearby the oil refinery in Shaibah area in Basrah governorate, southern Iraq, St1 (electric gas station), St2 (Shuaiba houses), St3 (house staff break), St4 (oil refinery), St5 (FCC Project), St6 (Military control), St7 (Al-Kassed station), St8 (Alkziza stores), and St9 (Mazar Anas Ibn Malik) as shown in the map (Fig. 1).

Sampling

Samples were collected between June 2011 and November 2012, by using metal container 15cm the diameter and 30 cm height covered by polyethylene bags which replacing every month to collected dust samples by taking the old one and transferred to the lab in Marine Science Centre. In the lab, the samples wash with distilled water to collect all dust in the glass beaker (from the polyethylene bags) and then dried in an oven at $(105-110)^{\circ}\text{C}$ to drive out moisture. The beaker weight before (W1) and after (W2) dry to evaluation weight difference (ΔW). The concentration of dust fall calculated as showing in equation 2

$$\Delta W \text{ g} = W2 - W1 \quad (1)$$

$$\text{Conc. Dust fall g/m}^2 = \Delta W / A \quad (2)$$

A: area of container m^2

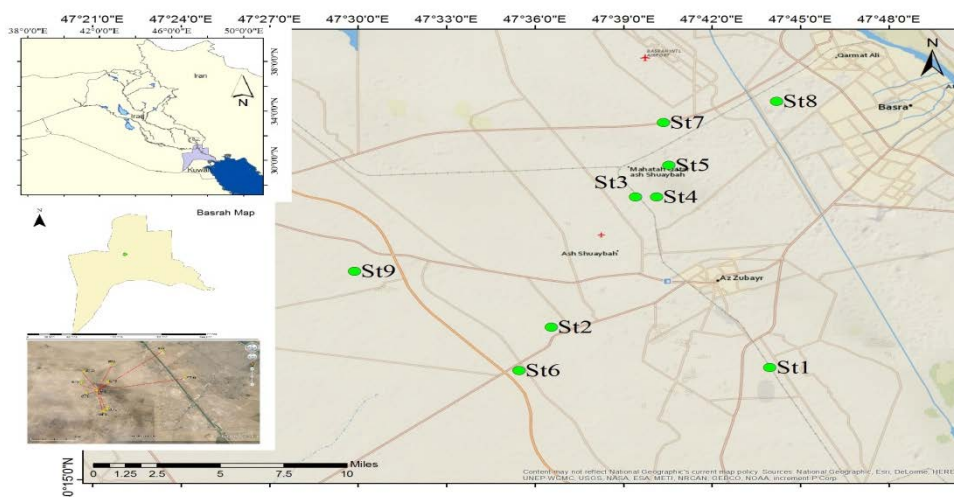


Fig.1. Map of Southern Iraq showing sampling sites within Basrah governorate

The digestion procedure of the dust samples was done according to [10] in which 6 ml of 1:1 acid mixture of nitric and perchloric acids were added to the total weight of each dust sample in Teflon beaker for the digestion near dryness. The sample transferred to 50 ml volumetric flask and completed the volume to the mark with distilled water. The digested samples were then analyzed for trace elements, Cd, Cr, Ni, and Pb, by using flame Atomic Absorption Spectrophotometer model Phoenix-986. Results were analyzed statistically using the program SPSS model 8 by adopting the procedure of relative least significant difference (LSD) at the probability level $P \geq$

0.05.

$$\text{trace metal conc. mg/m}^3 = \frac{c \times v_i}{vt}$$

C: concentration of element; v_i : volume of sample is equal (50 ml).

vt : The total volume of the container (m³).

Results and discussion

The results (in Table.1 and Fig.2) showed that no significant

differences in DW concentration among the stations and the highest mean in St7 (31.72g/m²).

Table1. Concentration and stander deviation of DW g/m², Cr, Cd, Ni and Pb mg/m³ on stations

Stations		DW	Cr Ppm	Cd ppm	Ni ppm	Pb Ppm
St1	Mean	10.00	3.46	0.08	1.42	16.05
	SD	5.51	2.02	0.09	0.03	34.98
	Minimum	4.29	1.53	0.02	1.40	0.85
	Maximum	17.72	6.35	0.15	1.44	95.21
St2	Mean	18.82	5.99	0.08	22.02	10.68
	SD	14.41	9.54	0.08	30.45	12.25
	Minimum	0.41	0.72	0.01	0.49	0.40
	Maximum	37.02	22.99	0.20	43.55	26.31
St3	Mean	16.53	2.00	0.01	0.06	4.16
	SD	6.53	1.07	0.01		5.66
	Minimum	9.94	0.54	0.01	0.06	0.74
	Maximum	26.19	3.53	0.02	0.06	15.33
St4	Mean	13.97	4.14	0.03	0.54	3.87
	SD	16.83	3.11	0.03		3.55
	Minimum	4.50	1.51	0.01	0.54	0.68
	Maximum	47.83	8.65	0.06	0.54	9.65
St5	Mean	29.58	1.40	0.03	5.14	2.06
	SD	42.98	0.91	0.04		0.70
	Minimum	5.58	0.70	0.01	5.14	1.13
	Maximum	93.99	2.43	0.06	5.14	2.77
St6	Mean	10.96	3.82	0.01	0.59	1.53
	SD	1.12	2.14	0.01		0.86
	Minimum	10.17	2.31	0.01	0.59	0.92
	Maximum	11.76	5.33	0.02	0.59	2.14
St7	Mean	31.72	2.66	0.02	1.46	1.53
	SD	23.35	1.77	0.02	0.44	0.63
	Minimum	9.12	1.45	0.01	1.15	0.87
	Maximum	61.93	5.20	0.05	1.77	2.28
St8	Mean	11.52	3.43	0.29	1.10	10.47
	SD	10.28	3.33	0.43	0.84	14.06
	Minimum	4.87	0.23	0.01	0.51	1.11
	Maximum	29.63	8.90	0.79	1.69	34.84
St9	Mean	12.53	5.05	0.10	1.01	9.73
	SD	7.26	3.10	0.08	0.98	9.39
	Minimum	7.05	1.17	0.02	0.30	1.54
	Maximum	23.22	8.20	0.19	2.12	20.79
Total	Mean	16.78	3.56	0.08	3.92	7.51
	SD	17.16	3.87	0.16	10.63	15.92
	Minimum	0.41	0.23	0.01	0.06	0.40
	Maximum	93.99	22.99	0.79	43.55	95.21

Stations can be arranged according to the amount of dust falling as follows:-
 $St7 > St5 > St2 > St3 > St4 > St9 > St8 > St6 > St1$.

Results of the statistical analysis indicated no significant differences, only Cr conc. showed significant differences among stations of this study (Table1), its lowest mean in St5 (1.40 mg/m³) and the highest was observed at St2 (5.99 mg/m³) the value ranged from 0.23 to 22.99 mg/m³. The Pb concentrations have the highest mean (16.05 mg/m³) in St1 and its range from 0.40 to 95.21 mg/m³. Both Cr and Pb have dominated at all stations except at St2 and St5 the Ni and Pb have the highest Percentage (Fig.3). In comparison with the other metals, the Cd concentration

has the fewer levels in all stations (fig 3) and Cd means were less than the range of the concentration in the earth's crust (0.2 mg/g) [11]. The Cd concentrations do not, therefore, give cause for concern [3].

Pb and Cr concentrations were the first- and second-most-abundant metals, respectively, as shown in (fig.3). While Ni evident in St2 and St5. were as shown in Fig. (3) lead contamination may be coming from other areas as well as pollution locally due to high prevalence in all locations as well as chromium and cadmium, while nickel appears locally polluted due to its high rates in only two stations (St2 and St5).

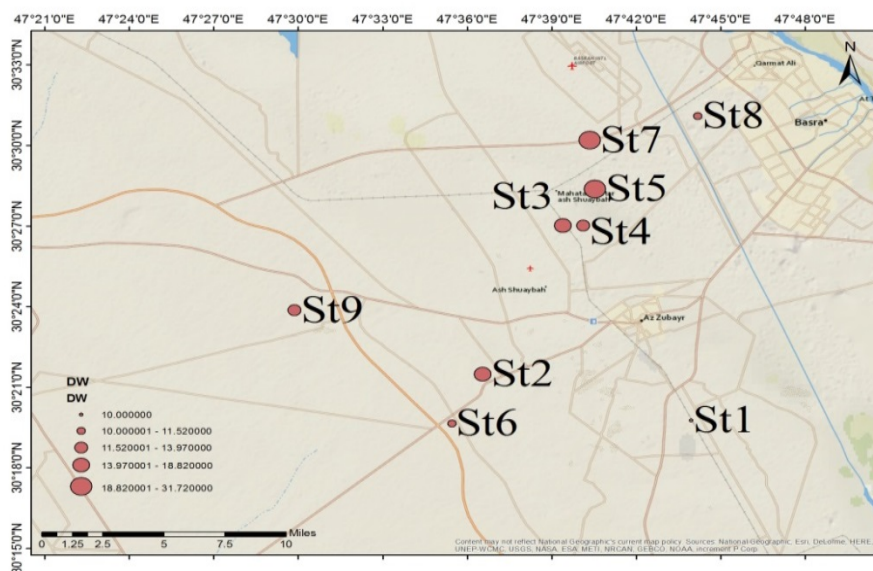


Fig. 2. The DW mean distribution of dust falling.

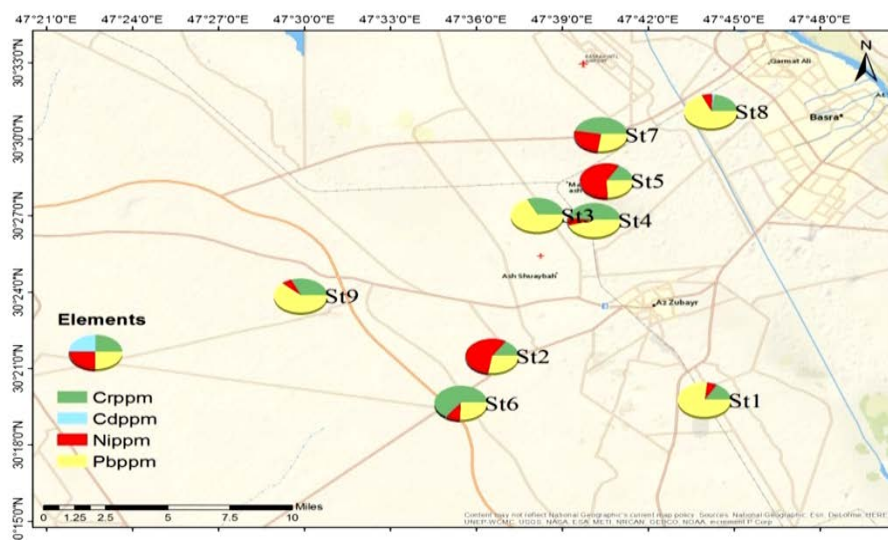


Fig. 3. The mean distribution of Cr, Cd, Ni and Pb conc. in dust falling in Shaibah area in Basrah governorate.

As it can be seen in the table(2), the highest amount of dust falling in autumn was reached to (20.51 g/m^2), followed by Winter (15.85 g/m^2), Spring (14.93 g/m^2) and Summer(11.15 g/m^2). There's no significant effect of season on dust falling conce. This result doesn't agree with Kssam [6] how found the highest value in summer due to the increased frequency of dust storms. All these values seem lower than that recorded rates in this region. This may be due to the fact that the samples were collected in an open area where there are no obstructions that reduce wind speed, allowing dust to fall [6, 7].

As recorded in the table (2), the Pb concentrations have the highest mean (14.70 mg/m^3) in winter, whereas Cr (7.91 mg/m^3) in summer. There is no significant difference in concentration of Cd, Ni and Pb between season but Cr has significant differences among seasons. There is a large difference between The minimum and maximum means of parameters perhaps that is the reason for the high standard deviation values for each parameter.

The result of Fig.4 shows the

interference effect of season and stations for DW, Cr, Cd, Ni and Pb concentration in Shaibah area in Basrah governorate. DW the lowest was 4.70 g/m^2 in St4 in winter and the highest 49.79 g/m^2 in St5 in autumn. The highest means of Cr (12.14 mg/m^3) and Ni (22.02 mg/m^3) which recorded in spring in St2 it is Shuaiba houses station, also the highest means of Cd (0.79 mg/m^3) and Pb (34.84 mg/m^3) recorded in St8 Alkziza stores in winter and summer respectively. The Basrah oil refinery in Shuaiba one of the sources of industrial pollutants to the city of Basrah, where the samples were collected from the area around the refinery (Fig.1), where the wind gas transported and fumes and vapors as a result of such certain production operations. The process of distillation for the purpose of separating derivatives that are different boiling points, such as gasoline gas, kerosene, medium and derivatives, heavy derivatives, and produces a result of these operations gaseous compounds lead to air pollution[12]. This may be one of the main reasons for a high concentration of trace elements in the falling dust particles agreeing with

many of the local area studies, such as [6, 8, 12]. On the other hand, the soil can be from the same area or come from other places across transported by

wind or dust storms essential source of trace elements in dust [13].

Table2. Concentration and stander deviation of DW g/m², Cr, Cd, Ni and Pb mg/m³ on season

Season		DW	Crppm	Cdppm	Nippm	Pbppm
Autumn	Mean	20.51	2.37	0.06	1.22	3.09
	Std. Deviation	24.39	1.69	0.06	0.71	2.96
	Minimum	4.50	0.72	0.01	0.06	0.40
	Maximum	93.99	6.73	0.19	2.12	10.13
Spring	Mean	14.93	4.26	0.05	8.68	11.72
	Std. Deviation	12.29	5.41	0.07	17.18	24.50
	Minimum	0.41	0.54	0.00	0.49	0.68
	Maximum	47.83	22.99	0.20	43.55	95.21
Summer	Mean	11.15	4.77	0.01		9.56
	Std. Deviation	2.93	3.46	0.01		16.85
	Minimum	6.86	1.54	0.01		0.85
	Maximum	13.19	8.90	0.02		34.84
Winter	Mean	15.85	3.76	0.29	0.73	6.34
	Std. Deviation	12.15	3.35	0.43	0.58	5.36
	Minimum	4.29	0.23	0.02	0.30	0.87
	Maximum	37.50	8.65	0.79	1.40	14.56
Total	Mean	16.78	3.56	0.08	3.92	7.51
	Std. Deviation	17.16	3.87	0.16	10.63	15.92
	Minimum	0.41	0.23	0.00	0.06	0.40
	Maximum	93.99	22.99	0.79	43.55	95.21

High concentrations of heavy metals in the soil of Zubair, especially in the North West and West sides of the city, that point of consensus prevailing wind direction in the study area and the

resulting transfer of amounts of heavy elements by the wind to the town of Zubair with dust during dust storms [6].

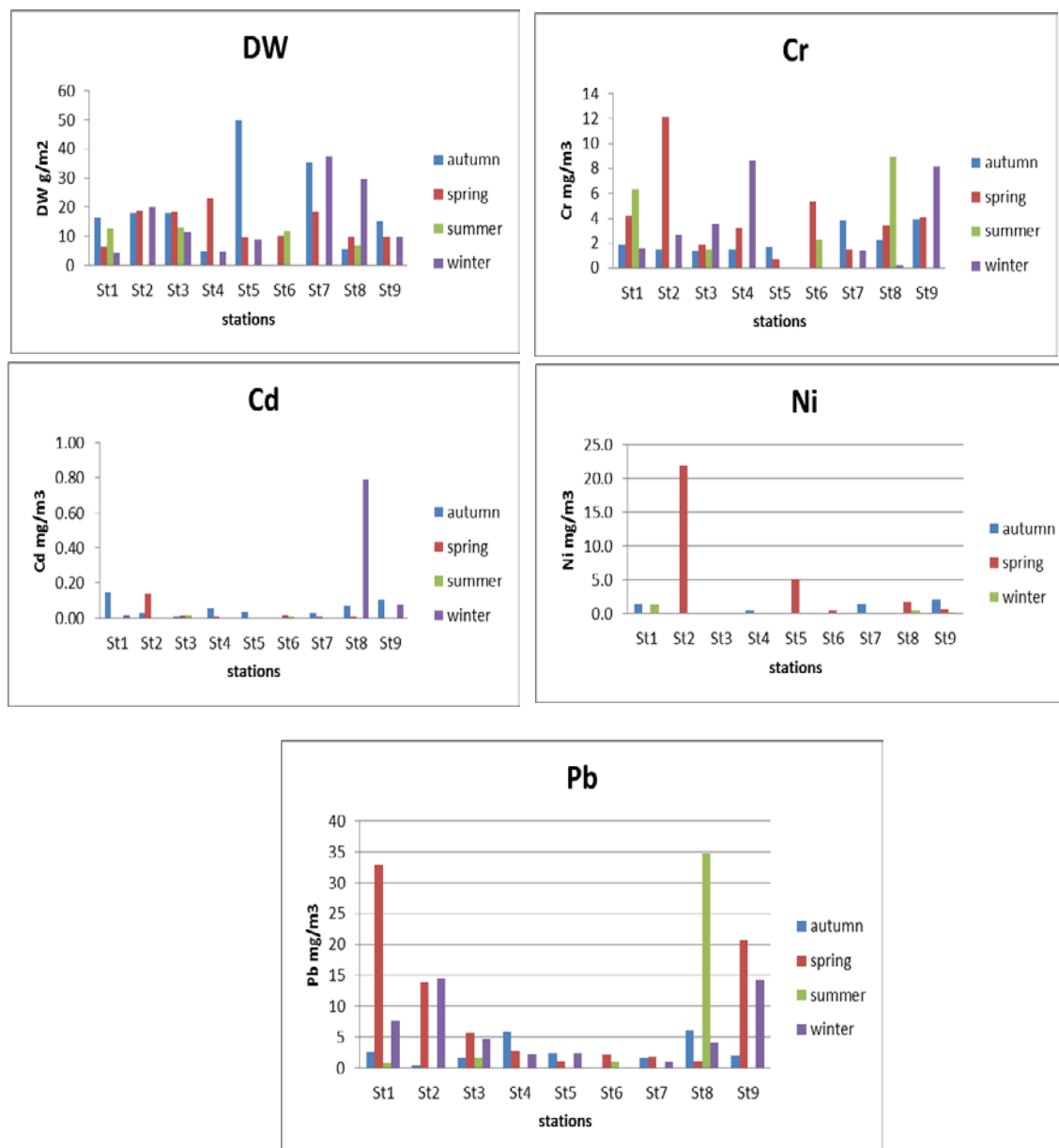


Fig.(4) The interference effect of season and stations for DW, Cr, Cd , Ni and Pb conce. in Shaibah area in Basrah governorate.

Conclusion :

This study has revealed that the atmospheric dust in Basrah city is polluted with trace elements. Although there was no difference in the amount of dust, trace elements differed spatially from one region to another, thus confirming the effect of local factors, Especially the presence of oil

refinery and increased traffic activity. Lead, chromium and cadmium contamination may be coming from other areas as well as pollution locally due to high prevalence at all locations, while nickel appears locally polluted due to its high rates at only two stations.

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