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Monitoring of trace elements in dust fallout in shaibah, Basrah city, Iraq

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Abstract

Thisstudyexaminedtheimpactofclimaticfactorsonthedistributionandprevalenceofsome traceelementsinsamplesofdustfalloutfromareasneartheoilrefineryinShaibahareainthe provinceofBasrah/ Iraq.Thefallendustcollectedbyspecialcontainers monthly betweenJune2011andNovember2012.Thetrice metals(Ni,Cd,Pb,andCr) and its weight wereestimatedinthesesamples. The results showedthatnosignificantdifferencesinDWconcentration amongthe 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. thehighestamountofdustfallinginautumnwasreached at (20.51 g/m^2),followedbyWinterat ($15.85g/m^2$), Springat ($14.93g/m^2$)andSummer at ($11.15g/m^2$). ThePbconcentrationshavethehighestmean($14.70mg/m^3$)in the winter, whereasCr ($7.91mg/m^3$)in the summer. There isnosignificantdifferenceinconcentrationofCd,Niand Pb among seasons; however, Cr has significant differences among seasons.

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

Introduction

The industryisoneofthelargestsourcesofairpollutantsespeciallyiftheydependonfossil fuels,oilandnaturalgasasthemainsourceofenergy. Theatmosphere composition waschanged whenlargeramounts ofgases were burning,particlesthatareworkingthroughtheaccumulationintheair. They leadtoanimbalanceinitsecosystem so airbecomes thesourceofmany risksanddisadvantagesthatthreatenallaspectsoflivingandnon-livinglife [1, 2]. Dust is an important source of trace metal pollution in the urban environment [3].Airqualitytests inIraqsince2008haverevealed dangerouslyhighlevelsoffineparticulatematter, 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].Thesetinyparticlesmadeupofmany elements,includingheavymetals. For example, Pb,Cr, Cu,andZnhaveraised greaterconcernthanlargeparticulatematterbecausethesetinyparticlescantraveldeeplyintothe lungscausing muchmoredamage [1, 5, 6]. Accordingto Hashim[7] theaverageofdustdepositinIraqisapproximatelyfourtimesand a halfgreaterthantheallowablelimits.As regard to dustdepositsquantity, Hashim[7] foundthattheresultsshowedincreasesindustdepositsquantities inthe Babylongovernorate,whereannual averageofdustdepositsduring the year2008was(32.9g/m2/month); whereastheWorldHealth Organization(WHO)recommendedthatdustdepositsshouldnotexceed(9g/m2/month). AL-Hassen[1] pointedoutthatthehighe s t amountofdustfallinginthecityisincreasingcomparedwiththe countryside andfoundthattheamountofdustfallinginthecityofBasrah,upto(21.5g/m2) during(2009).Thehealthimpactofthedustfallingdoesnotdependonthequantity,butthe quality, as well as some studies, haverevealed that thefallingdust particles contain concentrations ofheavyelements [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 (Alkzizastores), and St9 (MazarAnasIbn Malik) as shown in the map (Fig. 1).

Sampling

SampleswerecollectedbetweenJune2011andNovember2012, byusingmetalcontainer15cm the diameterand30cmheightcoveredby polyethylenebagswhichreplacingeverymonthtocollecteddustsamplesbytakingtheoldoneandtransferredtot helabinMarineScienceCentre.Inthelab,the sampleswashwithdistilledwatertocollectalldustintheglassbeaker(fromthepolyethylene bags)andthendriedin anovenat(105–110)° Ctodriveoutmoisture.Thebeakerweightbefore (W1)and after (W2)drytoevaluationweightdifference(ΔW).Theconcentrationofdustfallcalculatedas showingin equation2

$\Delta W\ g = W2 - W1$ (1)

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

A: areaof container m^2

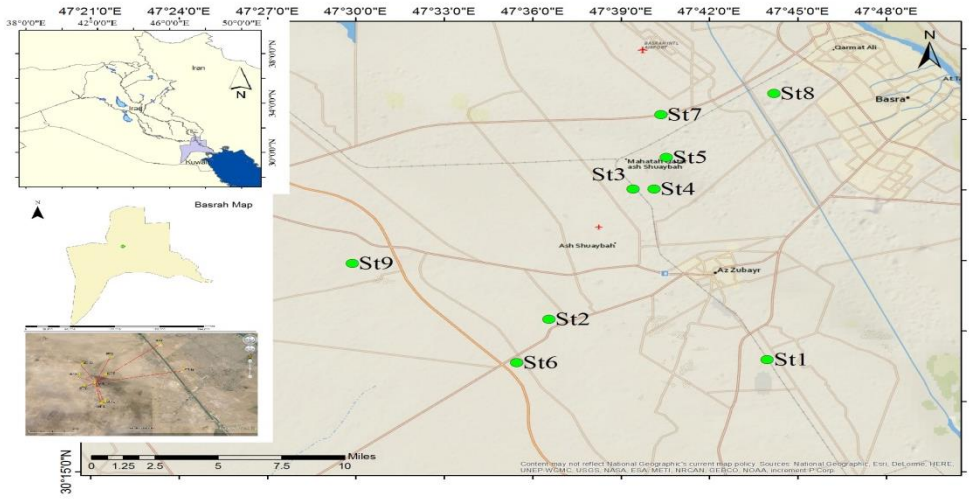

Fig.1. Map of Southern Iraq showingsamplingsiteswithin Basrah governorate

Thedigestionprocedureofthedustsampleswasdoneaccordingto [10] inwhich6 mlof1:1acidmixtureofnitricandperchloricacidswereaddedto thetotalweightofeachdustsamplein Teflonbeakerforthedigestionneardryness.Thesampletransferredto50mlvolumetricflaskand completedthevolumetothemarkwithdistilledwater.Thedigestedsampleswerethenanalyzedfortrace elements,Cd,Cr,Ni,andPb,byusingflameAtomicAbsorptionSpectrophotometermodelPhoenix-986. Resultswereanalyzedstatisticallyusingtheprogram SPSSmodel8byadoptingtheprocedureofrelative leastsignificantdifference(LSD) atthe probabilitylevelP ≥0.05.

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

C: concentration of element;*vi:* volume of sample is equal (50 ml).
vt: The total volume of the container (m 3).

Results and discussion

Theresults(inTable.1and Fig.2)showedthatnosignificantdifferencesinDWconcentrationamongthe stationsandthehighestmeaninST7 (31.72g/m^2). 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/m^3) and the highest was observed at St2 (5.99 mg/m^3) the value ranged from 0.23 to 22.99 mg/m^3.

Table1.ConcentrationandstanderdeviationofDWg/m^2, Cr,Cd,NiandPbmg/m^3onstations

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

The Pb concentrations have the highest mean (16.05 mg/m^3) in St1 and its range from 0.40 1o 95.21 mg/m^3. 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 lowest 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].

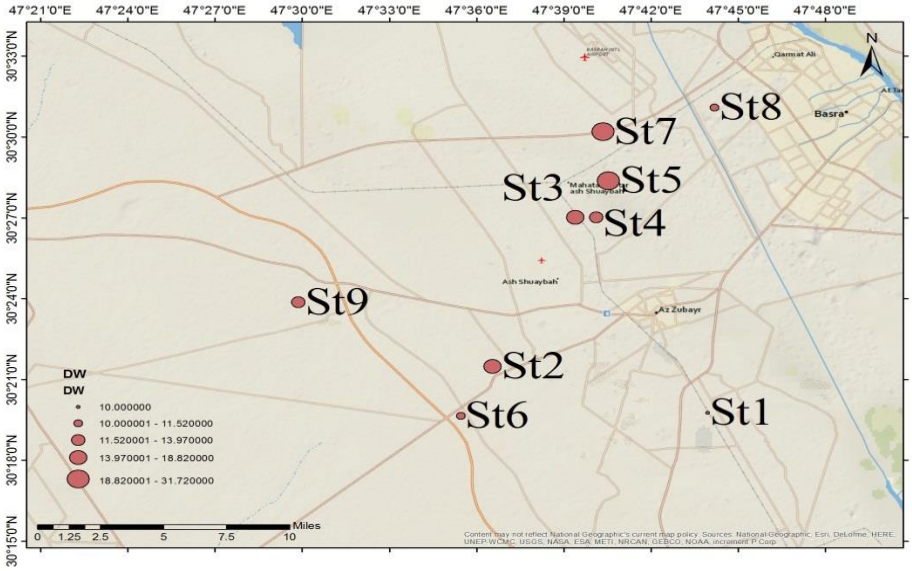

Fig. 2. The DW mean distribution of dust falling.

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. 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).

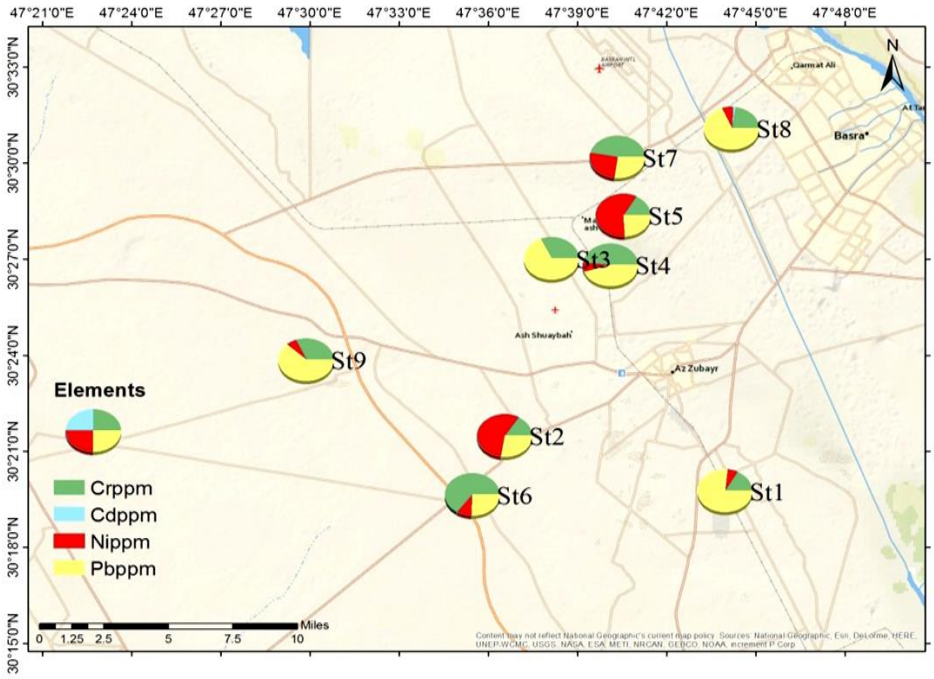

Fig. 3. Themean distribution of Cr,Cd, NiandPbconc.indust falling inShaibah area inBasrahgovernorate.

Asit canbeseenin thetable(2), thehighestamountofdustfallinginautumnwasreachedto (20.51 g/m^2),followedbyWinter(15.85g/m^2), Spring(14.93g/m^2)andSummer(11.15g/m^2).There'sno significanteffectofseasonondustfallingconce.Thisresultdoesn'tagreewithKssam[6]how foundthe highest valuein summer dueto theincreased frequencyof dust storms. All these values seem lower thanthat 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), thePbconcentrationshavethehighestmean(14.70mg/m^3)inwinter, whereasCr (7.91mg/m^3)insummer. There isnosignificantdifferenceinconcentrationofCd,Niand Pb between season but Cr has significant differences among seasons.

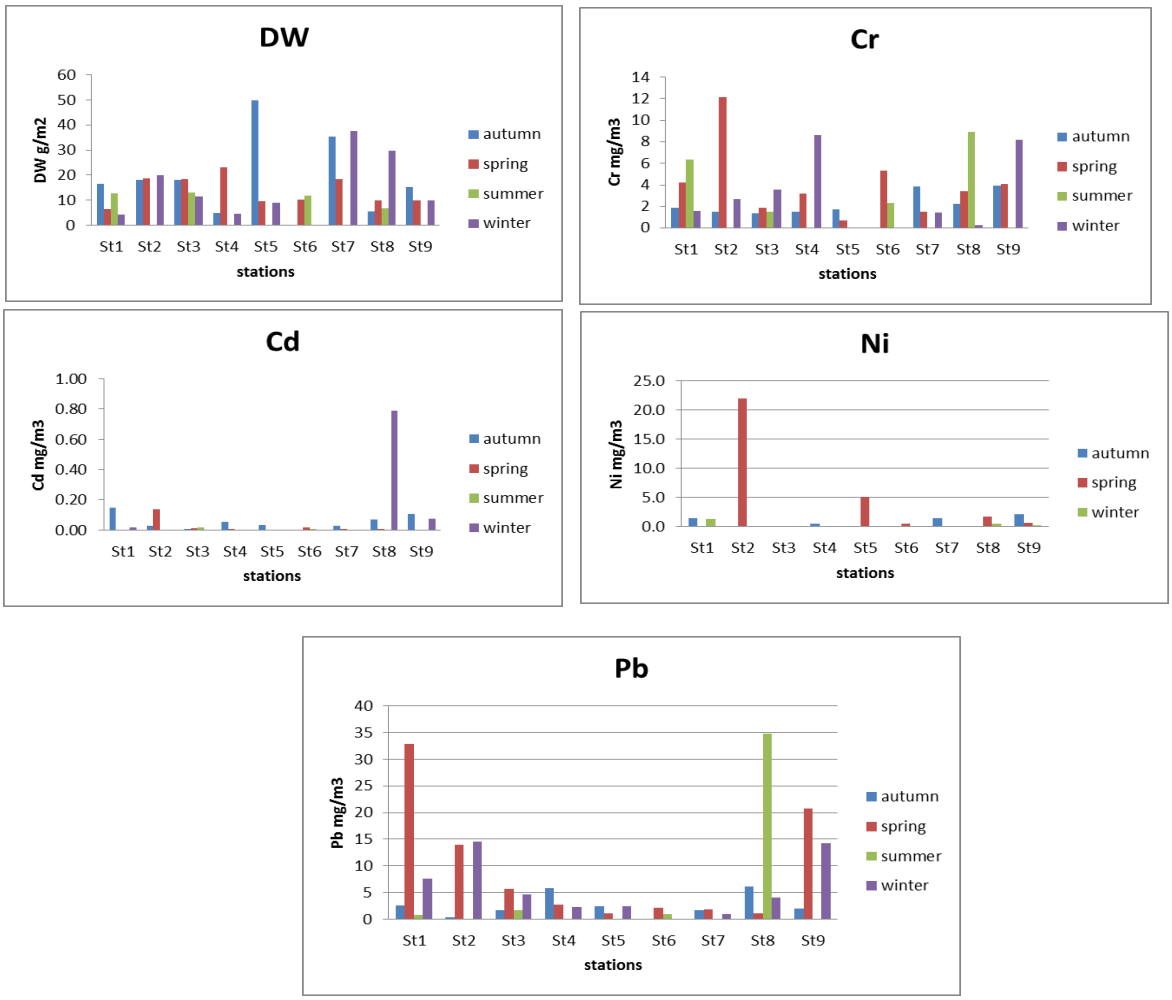

Fig.(4) The interference effect of season and stations for DW, Cr, Cd , Ni and Pbconce. in Shaibah area in Basrah governorate.

There is a largedifference between The minimum and maximum means of parameters Perhaps that is the reason for the high standard deviation values for each parameter.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 certain production operations such. 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]. 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].

Conclusion :

This study has revealed that the atmospheric dust in Basrah city ispolluted 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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