Ministry of Higher Education
and Scientific Research

Journal of Kufa for Chemical Science

A refereed

Research Journal Chemical Science
Vol.2 No.7 Year 2021
ISSN 2077-2351

Address:
Iraq-Najaf-University of Kufa
Box(190)

www.Edu_girl.Kuiraq.com

E-mail:Edu_grils@kuiraq.com

A study of the level of pollution by lead in the air of Anbar Governorate

Mahmood Amin Mejbil **Bashar Abdulazeez Mahmood**
Department of Chemistry, Faculty of Education for Pure Science, University of Anbar, Anbar, Iraq,
(esp.bashar.abdulaziz@uoanbar.edu.iq).

Abstract:

As a result of the industrial expansion and the increase in the population in Anbar Governorate, the sources of air pollution in it have multiplied, the most important of which are industries, various crafts, means of transportation, and residential, agricultural and commercial activities. The current study included estimating the element of lead through seventy selected stations throughout the governorate, including stations in agricultural areas that were considered standard in the study in order to make a comparison. The study indicated that the concentration of lead element in all areas of the study is relatively high, as well as that some study stations showed clear contamination with this element, as its concentration increased in the permissible limits in some countries and national determinants and the World Health Organization, and these stations were represented by some industrial, commercial, traffic, and stations Gasoline filling. The results of this study were compared with previous studies in Iraq as well as international studies**.** Some stations showed clear pollution with this element, as its concentration increased to the permissible limits in some countries, national determinants and the World Health Organization, and these stations were represented by some residential, commercial, traffic, and industrial areas and petrol filling stations, and the reason was the added lead to fuel.

Introduction:

Lead is an important component of air pollution, confiscation, and mining and smelting operations Smoothing, making batteries, dyes, combustion of fuels and pesticides, and combustion of gasoline [(1)]**.** Lead poisoning has a clear relationship to lead, which is present in paints or additives to benzene in the form of tetraethyl or methyl lead. Most of the lead emissions settle near by The source of emission, but there are the minutes whose diameters are small and move to great distances and work to pollute the areas in which they are located [(2),] where the amount of lead in hair [(3)]. and air [(4)]. as well as the amount of lead in the air of traffic areas in London, where it has been observed that traffic areas cause Clear air pollution with lead [(5),] and the amount of lead was found to be relatively high in the air in industrial areas [(6)]**.** and in a study in the city of Riyadh in Saudi Arabia, lead in the air was estimated and it was found that there is significant pollution with this The element lead to headaches and general weakness, as well as an increase in the secretion of uric acid and its accumulation in the joints and kidneys, And it reduces the formation of hemoglobin pigment in the body as well as replaces calcium in bone tissue, and causes mental retardation in children, while its accumulation in fetuses leads to fetal distortion and abortion of pregnant women [(7)]. For all these reasons, the importance of this field research is to assess the element of lead in the air of Anbar Governorate and to indicate areas of contamination with this element.

Air is that part of the atmosphere closest to the surface of the earth, which when it is dry and unpolluted, consists of several gases, not more than 0.032% in the fresh air, and these gases are 99.99% of the air volume [(8)]**.** When the air is inhaled it enters the alveoli to transfer it Oxygen, when the air is polluted with smoke and combustion gases sent by factory chimneys and the exhausts of transportation means, it is lacking oxygen and is harmful due to the toxins they contain , When the air is polluted with smoke and combustion gases sent by factory chimneys and the exhaust of transportation means, it is lacking in oxygen and is harmful because of the toxins they contain , In the long term, the person is exposed to lung diseases (chronic lung infections, respiratory failure, poisoning, cancer) and seriously affects the heart

and blood [9]. Air is considered a pollutant if the natural balance of its natural gas components is disturbed, whether the imbalance is for one of these components or more [10].

Air pollutants are small particles of various origin and chemical composition. And particles are solid or liquid particles that split precisely. They can be composed of inert or very chemical substances with a size of (0.0002 - 50 microns), Particulate matter is deposited in different regions of the respiratory system according to the retention of particles larger than 10 microns by the cilia of the nose. If the particle is between 2 to 10 microns, it can enter the upper respiratory tract that consists of the nasal cavity And nasopharynx, larynx and trachea. Particles smaller than 2 microns are deposited in the bronchi, and only a few reach the transcriptional ducts (part of the lower respiratory tract). And particles with a size of less than (0.25 -1) micron, enter the alveoli in the lungs, which reduces the size of the alveoli there because it damages the lungs by reducing the exchange of oxygen from the air to the blood. Some hospitals have reported increased admissions for a range of respiratory diagnoses and events due to exposure to particulate air pollution, Particulate matter has been found to be responsible for increased heart rate and respiratory problems and admissions in 168 acute hospital care in Ontario, (Canada). And for heart and lung cases in Los Angeles, And acute cases, and also diagnosed cases of entry into cases of the heart, respiratory system, and cases of cerebral and peripheral vascular diseases. Among the various pollutants, particulate matter is responsible for the most shortening of life. The effects of PM2 on health occur at exposure levels and are being tested by most urban and rural residents in both developed and developing countries. Chronic exposure to particles leads to a risk of developing cardiovascular and respiratory diseases, and can also cause lung cancer. In some developing countries, [11].

An individual may be exposed to lead by inhalation, and the effect of inhaled lead depends on the size of the inhaled particle. Small particles with a diameter smaller than 2.5 micrometers travel to the blood through the alveoli, and their absorption into the bloodstream is 100%. As for particles with a diameter ranging between(25 - 10)Micro meter , they are deposited in the trachea and the nasopharynx and thus can be swallowed up to the digestive system. The absorption rate in adults is estimated at 10% and in children it is 50% [12] .

It is estimated that about (0.33 × 109) kilograms of lead are emitted directly into the atmosphere each year [13] , Spot measurements in five French and four American cities in (1984-1989) indicated that the levels of lead in the air reported ranged from 0.005 µg / m3 to 0.44 µg / m3 [14] .

Study area :

The study was conducted in Anbar governorate and its district along the Euphrates River from Fallujah district in the east to Al-Qaim district in the west with the Syrian border. The study also included some sub-districts such as Kabisa, Al-Muhammadi, Al-Baghdadi and Al-Khalidiya sub-districts, The study focused mostly on populated areas such as residential, traffic, And industrial and agricultural areas. Figure (1) shows a map of Iraq and Anbar Governorate, located to the west of the capital, Baghdad

Figure (1) Anbar Governorate – Iraq.[15]

Previous studies:

In the year 1999, Al-Shammari conducted a study that included measuring the concentration of suspended particles and some heavy metals as well as some gaseous pollutants in the city of Najaf. The results showed that lead concentration rates in all the studied stations and their number. 20 stations at a height of 1.5 meters are higher than those at a height of 5 meters, and the concentration of some of these stations is higher than the internationally and nationally permissible limits. The study also showed a high concentration of suspended minutes above the determinants of the World Health Organization (WHO)**(16).**

In the year 1999, Rashid Al Mosleh, the reformer studied chemical pollutants resulting from automobile exhaust, industries, power plants, fires, and others, and the most important of these pollutants are carbon oxides, nitrogen, sulfur, hydrocarbons and suspended particles. Human and animal**(17)** .

In the year 2000, Al-Zayni studied each of the heavy metals, TSP, and some gases inside some private and governmental industrial facilities in Baghdad, and the study concluded that there was a violation of the permissible limits of Cd,pb, Co, and SO, while the concentration of Zn was ,Fe, Ab, Cu, Mn within the permissible limits**(18).**

In the year 2008, Al-Saadi studied air pollution from automobile exhaust in the city of Baghdad through 6 selected stations. The daily, monthly, quarterly and annual rates of pollutant concentration were studied The results showed that the increase in the concentration of pollutants in the air of the city of Baghdad, such as (carbon oxides, sulfur, nitrogen, and hydrocarbons) has an effect on the increase in the maximum and minimum temperature and the occurrence of global warming**(19)** .

In the year 2013, the researcher Zainab Abdul Razzaq studied some air pollutants in the city of Najaf related to outdoor and indoor air pollution through 13 sites to study the falling and suspended dust. One of the most prominent results was that the air of the city of Najaf was polluted by falling dust, especially in the summer, and the winter observations were more polluted due to the use of oil and gas heating devices.The study also revealed that the concentration of outdoor air pollutants is greater in summer, on the contrary that pollutants Indoor air is bigger in winter **(20).**

Collecting air samples :

Air samples were collected from the districts of the governorate and some sub-districts, and the collection areas were classified into four types. The areas in which there is an industrial neighborhood or a (industrial) factory were considered , The areas that witness intensive multi-

modal movement were considered (traffic), while the populated residential neighborhoods were considered (residential), And the areas outside the cities where there is agricultural activity or green cover (agricultural), samples were collected on this basis to see if there is an effect of the means of transport or laboratories on lead pollution of the air. Table (1) shows the locations from which air samples were collected for all districts. Governorate .

Table (1) locations from which air samples were taken.

No	code	Sample site	No	code	Sample site
1	**Q1**	Al-Sanjak (agricultural).	**30**	**He 6**	Industrial district, (industrial).
2	**Q2**	Al-Qaim Old Market (Traffic).	**31**	**He7**	Skylat Street, (industrial).
3	**Q3**	Al-Rasheed District (Traffic).	**32**	**H e8**	Al-Qadisiyah District, (residential).
4	**Q4**	Industrial district (industrial).	**33**	**He 9**	Basaer area, (agricultural).
5	**Q5**	Al-Hawi (residential).	**34**	**He10**	Al-Hassania Mosque, (agricultural)
6	**Q6**	Karabla Husaybah (residential).	**35**	**He11**	First Assembly District (residential)
7	**Q7**	Seven Nisan neighborhood (agricultural).	**36**	**R 1**	Sajari (agricultural).
8	**Q8**	Andalus neighborhood (residential).	**37**	**R 2**	Al Warrar (residential).
9	**A1**	Industrial district (industrial).	**38**	**R 3**	Children's Hospital (residential).
10	**A2**	Curse the entrance street (traffic).	**39**	**R 4**	Post Street (residential).
11	**A3**	Al-Nasr neighborhood (residential).	**40**	**R 5**	Republic neighborhood (residential).
12	**A4**	Anah Kindergarten (residential).	**41**	**R 6**	Ramadi Grand Mosque (Traffic)
13	**A5**	Anah the Great Mosque (Traffic).	**42**	**R 7**	Sufi (agricultural).
14	**Rw1**	Bashar markets (Traffic).	**43**	**R 8**	17th Street (Traffic).
15	**Rw2**	The castle (agricultural).	**44**	**R 9**	Ramadi General Hospital (residential)
16	**Rw3**	Rawa Post Office (residential).	**45**	**R 10**	College of Agriculture (residential).
17	**Rw4**	Muhammad Al-Fateh Street (Traffic).	**46**	**R 11**	The seven kilos (traffic).
18	**Ha1**	Modern entrance (traffic).	**47**	**R 12**	The five kilos (traffic)
19	**Ha2**	North Oil Company K3 (industrial)	**48**	**R 13**	35 km Al Zawia Restaurant (Traffic)
20	**Ha3**	Haqlaniyah Petrol Station (Traffic)	**49**	**R 14**	Nationalization (industrial)
21	**Ha4**	Bani Daher (agricultural).	**50**	**R 15**	Acidity (agricultural).
22	**Ha5**	The city center is Al-Mustafa Mosque (residential).	**51**	**Hb1**	Zawia Albu Mari (residential)
23	**Ha6**	Barwana (residential).	**52**	**Hb 2**	Spanish floor (residential)
24	**Ha7**	Bani Daher (agricultural).	**53**	**Hb 3**	Housing houses (traffic).
25	**He 1**	Al-Mohammadi, (Traffic).	**54**	**Hb4**	Industrial district (industrial)
26	**He 2**	Hit Island, Pristine District, (Traffic)	**55**	**Hb5**	Al-Khalidiya, Al-Quds District (Traffic)
27	**He 3**	Running, clock junction, (Traffic).	**56**	**Hb6**	Zawia Albu Mari (agricultural).
28	**He 4**	Abdullah bin Al-Mubarak Mosque (Traffic)	**57**	**F 1**	Andalus District (Traffic)
29	**He 5**	Worker neighborhood, (residential).	**58**	**F 2**	Resala District (residential)

59	**F 3**	Al-Jumhuriya District (residential)	**65**	**F 9**	Al Nasaf (Traffic)
60	**F 4**	Al-Wehda District (residential)	**66**	**F10**	Hay Nazzal (Traffic).
61	**F 5**	Golan District (Traffic)	**67**	**F11**	Female farmers (traffic).
62	**F 6**	Al-Julan District (industrial)	**68**	**F12**	Azarakh (agricultural).
63	**F 7**	Teachers Second District (residential)	**69**	**F13**	Alsjar (agricultural).
64	**F 8**	Industrial district (industrial)	**70**	**F14**	Al-Shehabi (agricultural).

Extraction :

Heavy elements were extracted using the method (hot acid extraction), where the filters containing suspended particles are placed in a 100ml beaker, then 10 ml of a mixture of hydrochloric acid and concentrated nitric acid are added in a ratio of 3:1. In a row, while making sure that the entire filter is covered with acid, then it is placed on a hot plate at a temperature of 80 ° C and the heating process continues for 30 minutes after covering the beaker with an hour bottle, making sure that the extract does not dry, after which it is cooled and 10 ml of distilled water is added to it. The non-ionic substance is left for 30 minutes, after which it is placed in a volumetric bottle of 25 ml and the volume is completed to the point of the mark and the sample is preserved until measurement **(21)**.

Results and discussion:

A clear percentage of pollution was shown in all districts of the governorate, and it was noted that the percentage of pollution is high in districts that are crowded with means of transportation, such as the districts of Ramadi, Fallujah and Hit. Table (2) shows the highest, lowest value and rate of air pollution in the districts of the governorate**.**

Table (2) shows the reading of the (atomic absorption) device and the total air intake volume The volume of liquid containing the sample after digestion and the concentration of the element lead in unit (µg / m3).

No	sample	C µg/mL	V_1 mL	V_T m^3	$(C\times V_1)/V_T$	Station type	Concentration Pb µg /m^3	Global determinants µg /m^3
1	Q1	0.084	25	20.12	0.104	Agricultural	0.104	0.150
2	Q2	0.334	25	18.22	0.439	Traffic	0.439	0.150
3	Q3	0.276	25	19.87	0.347	Traffic	0.347	0.150
4	Q4	0.235	25	21.11	0.278	Industrial	0.278	0.150
5	Q5	0.191	25	20.20	0.236	Residential	0.236	0.150
6	Q6	0.166	25	21.03	0.197	Residential	0.197	0.150
7	Q7	0.096	25	21.12	0.113	Agricultural	0.113	0.150
8	Q8	0.133	25	20.22	0.164	Residential	0.164	0.150
9	A1	0.161	25	19.11	0.210	Industrial	0.210	0.150
10	A 2	0.191	25	20.00	0.238	Traffic	0.238	0.150
11	A3	0.114	25	20.09	0.141	Residential	0.141	0.150
12	A4	0.010	25	20.44	0.012	Residential	0.012	0.150
13	A5	0.150	25	19.14	0.195	Traffic	0.195	0.150
14	Rw1	0.088	25	20.08	0.109	Traffic	0.109	0.150
15	Rw2	0.071	25	18.12	0.023	Agricultural	0.023	0.150
16	Rw3	0.039	25	19.21	0.050	Residential	0.050	0.150
17	Rw4	0.129	25	19.66	0.167	Traffic	0.167	0.150
18	Ha 1	0.153	25	18.33	0.208	Traffic	0.208	0.150
19	Ha 2	0.133	25	18.11	0.183	Industrial	0.183	0.150
20	Ha 3	0.199	25	20.09	0.123	Traffic	0.123	0.150

21	Ha 4	0.036	25	19.20	0.046	Agricultural	0.046	0.150
22	Ha 5	0.089	25	17.23	0.129	Residential	0.129	0.150
23	Ha 6	0.094	25	18.72	0.125	Residential	0.125	0.150
24	Ha 7	0.055	25	19.12	0.071	Agricultural	0.071	0.150
25	He 1	0.317	25	22.33	0.354	Traffic	0.354	0.150
26	He 2	0.342	25	21.53	0.397	Traffic	0.397	0.150
27	He 3	0.399	25	22.67	0.440	Traffic	0.440	0.150
28	He 4	0.332	25	21.34	0.388	Traffic	0.388	0.150
29	He 5	0.198	25	20.13	0.245	Residential	0.245	0.150
30	He 6	0.211	25	20.23	0.260	Industrial	0.260	0.150
31	He7	0.243	25	19.76	0.307	Industrial	0.307	0.150
32	He8	0.177	25	19.87	0.222	Residential	0.222	0.150
33	He 9	0.084	25	21.28	0.098	Agricultural	0.098	0.150
34	He10	0.076	25	20.60	0.092	Agricultural	0.092	0.150
35	He11	0.099	25	19.47	0.127	Residential	0.127	0.150
36	R1	0.085	25	18.76	0.113	Agricultural	0.113	0.150
37	R 2	0.144	25	18.98	0.189	Residential	0.189	0.150
38	R 3	0.211	25	19.88	0.265	Residential	0.265	0.150
39	R 4	0.158	25	20.19	0.195	Residential	0.195	0.150
40	R 5	0.167	25	20.09	0.207	Residential	0.207	0.15
41	R 6	0.328	25	19.77	0.414	Traffic	0.414	0.150
42	R 7	0.099	25	20.48	0.120	Agricultural	0.120	0.150
43	R 8	0.287	25	18.63	0.385	Traffic	0.385	0.150
44	R 9	0.182	25	21.25	0.214	Residential	0.214	0.150
45	R 10	0.163	25	20.09	0.202	Residential	0.202	0.150
46	R 11	0.255	25	17.89	0.356	Traffic	0.356	0.150
47	R 12	0.198	25	18.65	0.265	Traffic	0.265	0.150
48	R 13	0.191	25	19.28	0.247	Traffic	0.247	0.150
49	R 14	0.175	25	20.86	0.209	Industrial	0.209	0.150
50	R 15	0.065	25	20.64	0.078	Agricultural	0.078	0.150
51	Hb1	0.199	25	21.33	0.233	Residential	0.233	0.150
52	Hb 2	0.120	25	20.49	0.146	Residential	0.146	0.150
53	Hb 3	0.258	25	19.67	0.327	Traffic	0.327	0.150
54	Hb4	0.187	25	18.56	0.251	Industrial	0.251	0.150
55	Hb5	0.262	25	18.12	0.361	Traffic	0.361	0.150
56	Hb6	0.032	25	20.49	0.039	Agricultural	0.039	0.150
57	F 1	0.354	25	21.32	0.415	Traffic	0.415	0.150
58	F 2	0.163	25	20.08	0.202	Residential	0.202	0.150
59	F 3	0.188	25	20.81	0.225	Residential	0.225	0.150
60	F 4	0.184	25	19.42	0.236	Residential	0.236	0.150
61	F 5	0.264	25	20.11	0.328	Traffic	0.328	0.150
62	F 6	0.202	25	18.49	0.273	Industrial	0.273	0.150
63	F 7	0.276	25	20.29	0.340	Residential	0.340	0.150
64	F 8	0.223	25	18.71	0.297	Industrial	0.297	0.150
65	F 9	0.322	25	21.06	0.382	Traffic	0.382	0.150
66	F10	0.324	25	22.08	0.366	Traffic	0.366	0.150
67	F11	0.367	25	21.16	0.433	Traffic	0.433	0.150
68	F12	0.192	25	20.75	0.231	Agricultural	0.231	0.150
69	F13	0.112	25	19.70	0.142	Agricultural	0.142	0.150
70	F14	0.097	25	20.88	0.116	Agricultural	0.116	0.150

The results obtained from the atomic absorption device showed that there is a contamination rate in some areas of the study because it exceeded the internationally permitted limit for the concentration of lead in the air, which is (0.15 µg / m3) [22]. These areas are either close to the main streets that witness heavy traffic, near fuel stations, or close to industrial areas, where the highest concentration of lead was observed in industrial areas, fuel stations and main streets. As for the adjacent areas or slightly less than the permissible limit, such as some residential neighborhoods, the reason is due to the lack of transportation in these areas and the presence of some trees (green cover), Which in turn works to some extent to purify the air that transmits pollutants. As for the areas where there is no pollution with lead, according to the results, they are agricultural areas or far from external roads, factories, and electric power generators. Thus, we can say that some of the lead in the air comes from fuel burning processes, especially gasoline engines, because the element of lead is added to gasoline to reduce cracking. It was found through the results in the above table that there is a high level of pollution, especially in crowded traffic areas with transportation and industrial areas**Q2** Karabila**,** Al-Qaim market (0.439 µg / m3), this percentage is about three times the global permissible limit (0.15 µg / m3), and the least polluted area is Area **Q1**, an agricultural area called Sanjak (0.104) µg / m3. In front of the pollution rate for all regions, it reached (0.234 µg / m3), and this in turn is considered pollution. Figure (1) shows the pollution rates for Al-Qaim district.

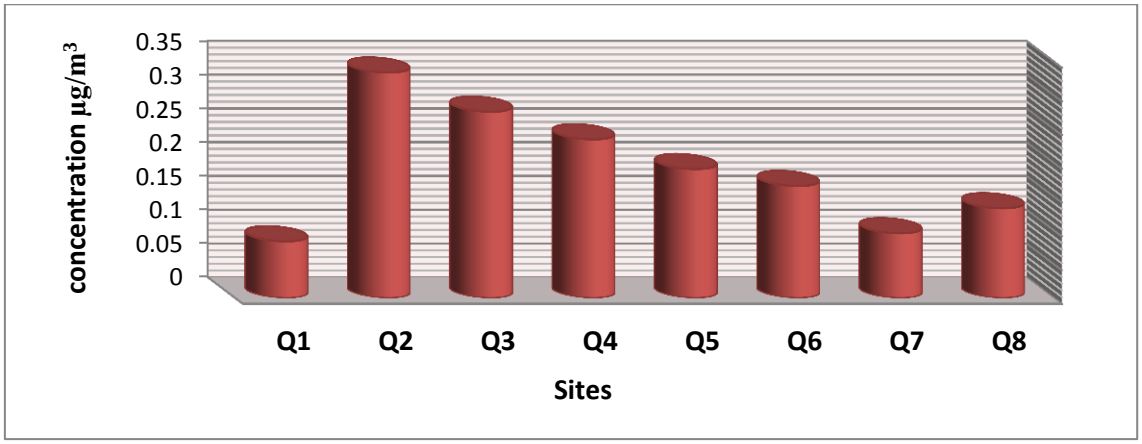

Figure (1) represents the pollution percentage of air samples in Al-Qaim district.

For the Anah and Rawa districts, the highest pollution rate was recorded in the A2 district, the entrance to the entrance street, near the road linking with the Qaim district (0.238 µg / m3), and the lowest pollution rate was recorded in the area A4 near the Anah Kindergarten (0.012 µg / m3). It reached (0.127 µg / m3), which is less than the permissible limit globally, and Figure (2) shows the pollution percentage of the selected areas in the Anah and Rawa districts.

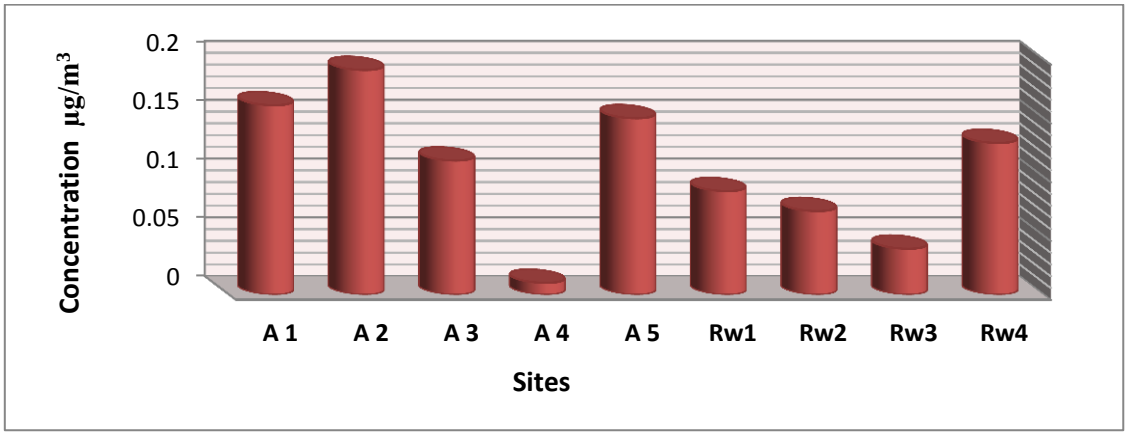

Figure (2) represents the pollution percentage of the Anah and Rawa district air samples

As for Haditha district, the highest value was recorded in the area Ha1, the entrance to Haditha (Haqlaniyah), as it reached (0.208 µg / m3), and the lowest pollution rate was in Ha4, the Bani Daher region (agricultural) (0.046 µg / m3), and the rate for all regions was (0.126 µg / m3). Figure (3) shows the pollution rates for the selected areas in the district.

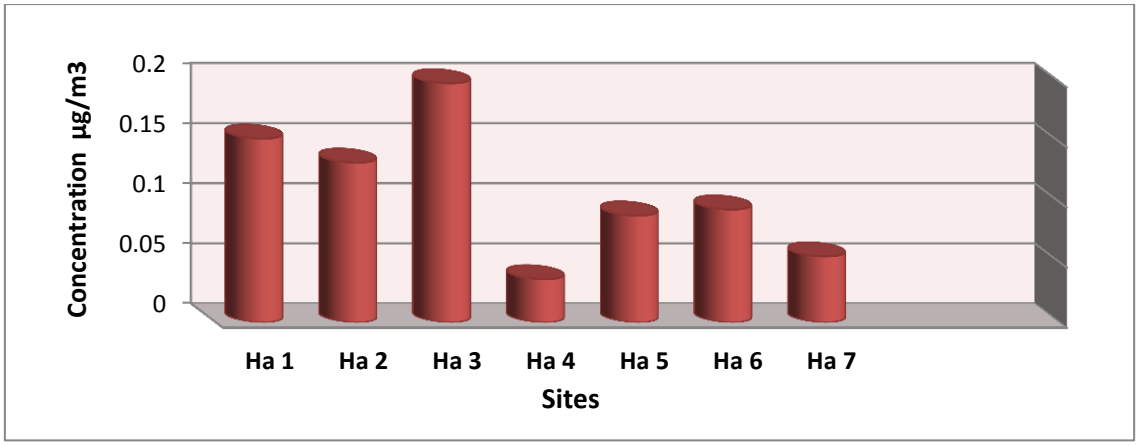

Figure (3) represents the pollution percentage of fresh, district air samples

As for the Heet district, the highest rate was recorded in the region, He3, in the Teachers 'District, it is a busy traffic area (0.440 µg / m3). As for the lowest value recorded in the Heet Jameh Al Hassania area, an agricultural area (0.092 µg / m3) and the rate was (0.266 µg / m3). This is considered pollution because it exceeded the global surveyed limit, and Figure (4) shows the pollution rates for the selected areas of the district.

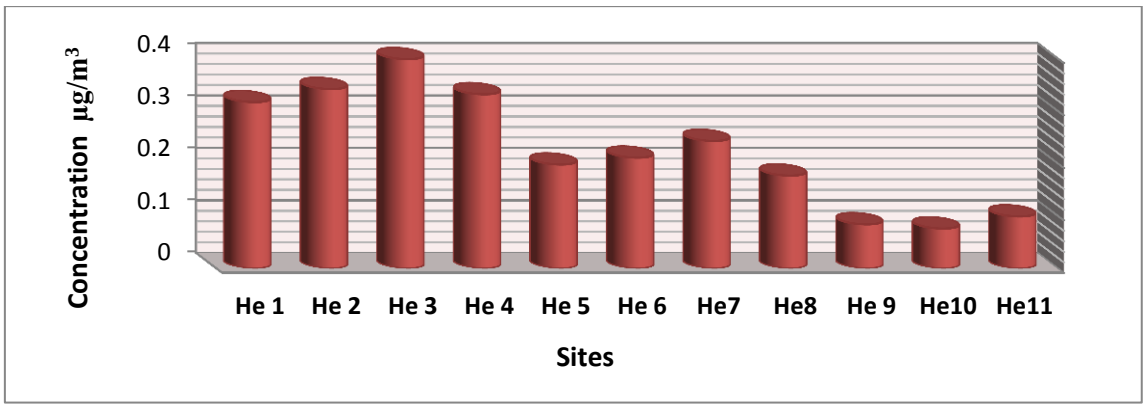

Figure (4) represents the pollution percentage of the Heat district air samples.

Ramadi District, the highest value recorded in the Ramadi Grand Mosque, traffic area R6 (0.414 µg / m3), and the lowest value recorded in the acidic R15 area, an agricultural area (0.078 µg / m3), and the rate for all regions was (0.230 µg / m3). Figure (5) shows Pollution rates for all selected areas in the district.

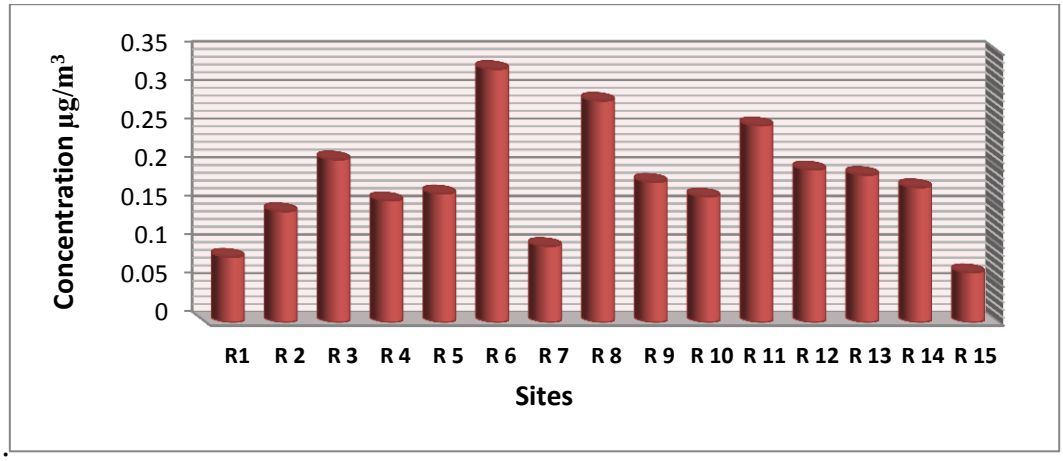

Figure (5) represents the pollution percentage of the Ramadi district air samples.

Habbaniyah district, the highest percentage was in the Hb5 Khalidiya district, the Jerusalem Traffic neighborhood (0.361 µg / m3), and this percentage is about twice the global permissible amount. 0.226 µg / m3) and Figure (6) shows the pollution rates for all selected areas of the district.

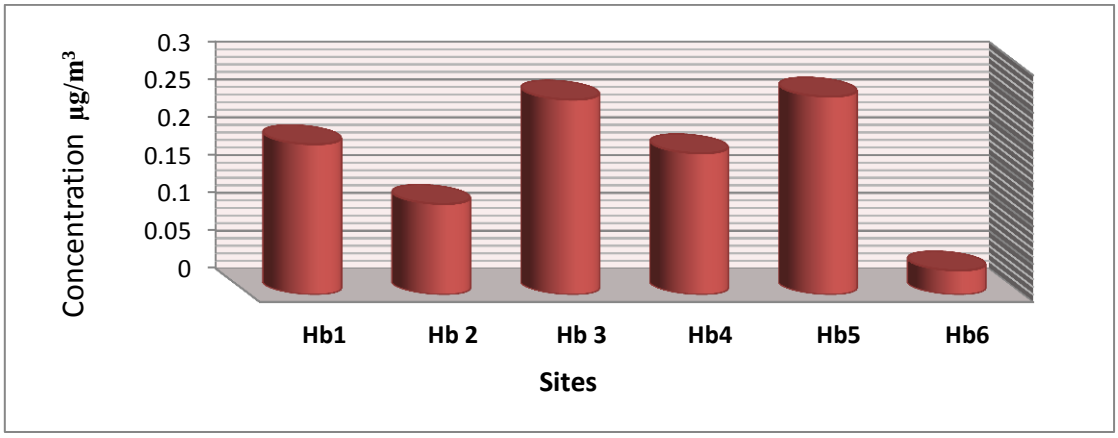

Figure (6) represents the pollution percentage of the Habbaniyah district air samples.

Al-Fallujah district has the highest value in the area F11, the traffic farmers (0.433 µg / m3) and the lowest value in F14 Al-Shehabi, an agricultural area (0.116 µg / m3), and the rate is (0.284 µg / m3). Elimination. Figure (7) shows the pollution rates for all the selected areas in the district.

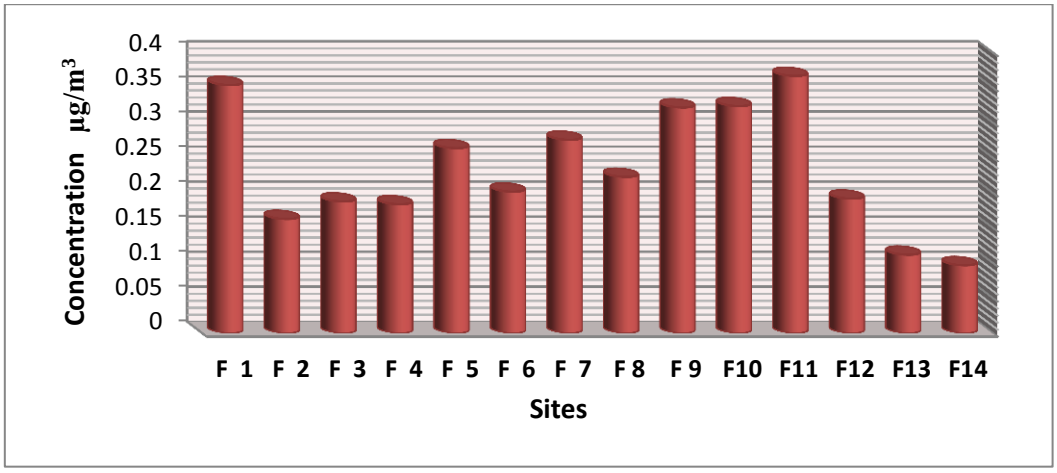

Figure (7) represents the pollution percentage of the Fallujah district air samples.

Discuss results :

As for the results of the examination of air samples, a clear percentage of pollution was evident in all districts of the governorate, and it was noticed that the proportion of pollution is high in districts crowded with transport modes, such as the districts of Ramadi, Fallujah and Heet. For bullets thrown into the air of the districts, and table (3) shows the highest, lowest value, and the rate of air pollution in the districts of the governorate.

Table (3) shows the highest, lowest value and the rate of air pollution in Anbar governorate

No	Elimination	The highest recorded value is µg / m3		The lowest value recorded is µg / m3		the average µg / m3
1	Al-Qaim	**Q2**	**0.439**	**Q4**	**0.104**	**0.234**
2	Anah	**A2**	**0.238**	**A4**	**0.012**	**0.127**
3	Haditha	**Ha**	**0.208**	**Ha1**	**0.046**	**0.126**
4	Heat	**He**	**0.440**	**He10**	**0.092**	**0.266**
5	Ramadi	**R6**	**0.414**	**R15**	**0.078**	**0.230**
6	Habbaniyah	**Hb5**	**0.361**	**Hb6**	**0.039**	**0.226**
7	Fallujah	**F11**	**0.433**	**F14**	**0.116**	**0.284**

By calculating the pollution rate of the air samples of each district, it was found that the air of Fallujah district is the most polluted with lead, and Haditha district is the least of which. Figure (8) shows the rate of air pollution in the seven districts. It appears from the results that the Haditha, Anna and Rawa district is less polluted with regard to the air, and the reason for this is the lack of traffic movement (lack of transportation means) in those cities.

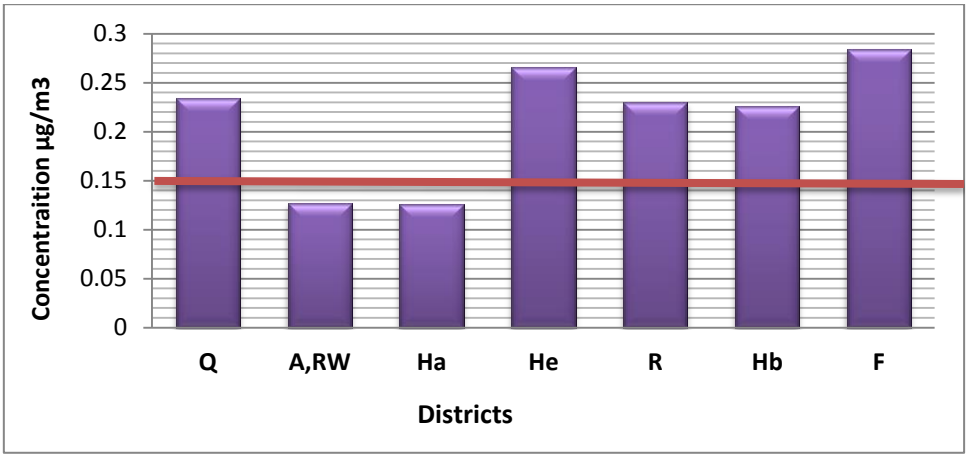

Figure (8) shows the rate of air pollution in the seven districts .

Conclusions :

1-Al-Qa'im District: There are five areas out of a total of eight that have exceeded the permissible level of pollution, which are Q2, Q3, Q4, Q5, and Q6. As for the rest of the areas, there is no pollution.

2-Judicial Anah and Rawa found pollution in three areas: A1, A2, and A5, while the rest of the areas were within the permissible limit .

3-Haditha District: air samples in Ha1 and Ha3 are polluted, while the rest of the areas are within the permissible limit.

4-Heet district: there is pollution in the traffic and industrial areas such as He1, He2, He3, He4, He5, He6, He7,and He8. As for the rest of the areas within the limit, and from these results, most areas in Heet are air polluted.

5-Ramadi District: It was found that all areas are polluted and exceed the permissible limit, except for three areas, R1, R7, and R15, where the percentage of pollution is within the permissible limits.

6-Habbaniyah District: There is a high percentage of pollution in the areas Hb1, Hb3, Hb4 and Hb5. As for the rest of the areas, there is no significant pollution.

7-Fallujah District: All areas where the percentage of pollution was found to exceed the permissible limit globally.

Recommendations :

1- A study should be conducted to use unleaded gasoline and to replace lead added to gasoline with less toxic substances and less danger to the environment.
2- Speed up finding solutions to the electricity problem, the consequences of which are the spread of private electricity generators throughout the governorate and within residential neighborhoods and government departments, which represent one of the causes of lead pollution. As well as agricultural areas, diesel pumps are used for irrigation due to the lack of electricity, and thus it has become a general problem in cities and rural areas.
3- Transferring petrol filling stations outside residential neighborhoods. Emphasis on the use of fuel without lead additives, as well as the relocation of industrial neighborhoods outside the city center.
4- Addressing the situation of old cars in some way by the province. And the dimensions of the car showrooms outside the residential neighborhoods.
5- The streets, sidewalks and store floors must be washed periodically to get rid of the residual lead from the air.

References :

[1]- WHO, "European series No. 23", 1997.
[2]-Mage, D.T. and Zali, O. WHO. 1992.
[3]-Henry, H. and Wiseman. WHO.1997.
[4]-Saltzaman, B.E.,Cholak,J.,Schafer,L.J.,environ.Sci.Techol19 p.328.1985.
[5]-Heidorn, K.C. and Rohac, I.Z., J.APCA,p 311. 1981.
[6]-Trinidad,H.A.,Pfeffer,W.C.Env.Sci. and Tech.p15,84 . 1981.
[7]-Shobokshy, M.S., AL-Tamrah and Hussein, F.M., Atoms Enviro.2413 (1990).
[8]-Muhammad Sabah Mahmoud (Geography of the Mediterranean, Air Pollution) Center for Sea Studies, Cyprus, pp. 11-12. 1999.
[9]-Fazaa Soliman (The Environment and the Dangers of Pollution) Dar Al-Hoda for Printing, Publishing and Distribution, Algeria, D., T., p. 12. 2012.
[10]-Abdel-Gawad, Ahmed Abdel-Wahhab, (Air Pollution) First Edition Series of Environmental Knowledge House Arab Publishing and Distribution House Cairo, p. 21. 1991.
[11]-Neurotoxicol Teratol; 21: OECD regulation ,Paris, France./11,1999.
[12]. OECD regulation, Risk reduction monographs Paris, France. 1993.
[13]- NRIAGU, J.O. & PACYNA, J.M. Quantitative assessment of worldwide contamination of air, water and soils by trace metals. Nature,p. 333: 134–139 ,1988.
[14]. DELUMYEA, R. & KALIVRETENOS, A. Elemental carbon and lead content of fine particles from American and French cities of comparable size and industry, (1985). Atmospheric environment,p 21: 1643–1647 ,1987.
[15]- http://musingsoniraq.blogspot.com,10/iraqs-security-forces-collapse-as.html, 2014.
[16]- Amer Musa Al-Shammari, Air Pollution in Najaf, Department of Chemistry, Soil College for Girls, University of Kufa ,1999 .
[17]- 2- Rashid Al-Musleh, Chemical Pollutants in the Air and Their Effect on Living Organisms in the Environment, Journal of Sustainable Environment Research, Volume Two,1999.
[18]- Salah Mahdi Zaini, Air pollution inside some industrial facilities in the city of Baghdad, Master's thesis, Department of Metallurgical Production Engineering, 2000 .
[19]- Maysoon Taha Mahmoud Al-Saadi, Climatic Effects of Air Pollution in the City of Baghdad with Car Exhaust for 1446 A.D. 2006 Using GIs, a thesis .MA, Department of Geography, Ibn Rushd College of Soils, University of Baghdad, 2004.
[20]- . Zainab Abdul-Razzaq Abdul-Hussein, A geographical analysis of air pollution in the holy city of Najaf, Master's thesis, Department of Geography, College of Arts .University of Kufa, 2013.
[21]- usepa (United States Environmental Protection Agency). Electrokinetic and Phytoremediation In Situ Treatment of Metal-Contaminated Soil: State- of-the-Practice. Draft for Final Review. EPA/542 Environmental Protection Agency,Office of Solid Waste and Emergency Response Technology Innovation Office, Washington. 2000.
[22]- . National Research Council, United States of America . 1980 .