



The temporal and spatial variation and health effects of the elements (iron, copper, cobalt, zinc, barium and silicon) in some regular and irregular garages of Hilla city

1380

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Abstract

The garages are one of the important places in the city, which people may frequent frequently, and because the studies on them are few, we tried to shed light on the polluting elements that cause a threat to the lives of people in that area. Samples were taken from the air by an air extraction device, then samples were taken to the laboratory for analysis by x-ray fluorescence (XRF). The results showed a temporal and spatial variation, as these elements recorded mostly high concentrations in the summer compared to the rest of the other seasons. This results may due to several reasons, including the burning of fuel used for cars, high temperatures and drought, in addition to wind speed. All of these factors contributed to the concentration of pollutants in the study area.

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Introduction

The garages are important places because they are a link between the governorates on the one hand, and also within the governorate on the other hand. They are also very overcrowded places with cars and people, whether they are working in them or passing through. From these two starting points, and due to the lack of studies on this aspect, we headed to study some of the factors affecting human health in terms of their temporal and spatial variations. And distribute them in garages and parking lots. Toxic elements pose a danger to urban dwellers due to their prevalence, consistency and exposure to the environment, where they may reach the human body through inhalation, ingestion and/or direct dermal contact (Rahman et al. 2021). Oral ingestion is the most harmful route for humans to be exposed to dust particles, as it occurs inadvertently with food and drink, respecting children's manual practices (Li et al. 2017). Short-term exposure to metals can cause breathing problems and skin irritation, while long-term exposure to metals can lead to skin, lung, and kidney damage (Jayarathne et al. 2018). In this way, testing of dust which suspended in air and contain elements are of particular concern because people breathe in the residue they pass through every day or live in urban areas with very congested highways, and street dust is a medium through which toxic elements can find their way into topsoil and groundwater, affecting on people, creatures and even vegetation (Razanica et al. 2014).

Capital street dust collects various contributions of heavy metals from a variety of diverse and stationary sources, for example, vehicle dumps, power plants, mechanical plants, and waste incineration (Rahman et al. 2019). Various recent mineral cycles are notable sources of acceptance for Cd, Ni, Zn, and Cu, as in the urban terrestrial environment (Men et al. 2018). Automobiles are the most important contributors of Pb, Cr, Cu, Zn, Ni, Cd and Fe in urban street dust (Delibašić et al. 2020).



Copper and zinc were also contained in high concentrations in street dust from both mechanical areas and vehicular traffic (Shi et al. 2010). The city of Hilla is considered one of the important centers in the province of Babylon, where it is considered the center of the province on one side and on the other hand, it is considered a link between the provinces, so the garages of the city of Hilla pass by many people daily throughout the day, month and year, and this may affect the passersby in those areas from In terms of exposure to toxic elements that are present in the air of garages and parking lots in which fuel-powered cars abound. From this point of view, the study aimed to examine air samples to search for concentrations of some elements that may be toxic to people, whether workers or passers-by in those places.

Material and methods

The study included 11 regular garages and 11 non-formal garages, and the research extended from July 2020 to July 2021. Air dust samples were taken by using a device for collecting dust samples from the air, called vacuum, which contain filter papers that filtered air sample. during all four seasons of the year each season was represented by two readings, one morning and the other evening. After that, the filter papers which contain dust samples that contain the metals under study were kept in petry dishes, and then those samples were sent to laboratories to measure the concentrations of those elements by X-Ray Flouresnse (XRF) device, this method is considered non-destructive analysis.

Results

Iron

This element show elevated in its concentration during summer as compared with other seasons as show in table No. 1 and 2.

Table (1) show concentration of iron in regular garage.

regular	Summer		Autumn		Winter		Spring	
	Morning	Evening	Morning	Evening	Morning	Evening	Morning	Evening
alhaluh almuahad	31	33	27	27.7	16	18.6	29	30
baghdad alqadim	21	25.4	17	20.6	9.8	10	19.8	23
alsawb alsaghir	22	24.4	18.8	20	8.5	9.6	20	22
murab aldaakhil	21	22.2	18	18.9	8.2	9.2	19.6	20
Tahmaziah Square	21.4	23.7	18	19.2	9	9.8	18.5	21
Saad Bridge Square	21.8	27.6	17.1	19.8	9.8	10.2	18.4	22
Bailey Bridge Square	19.8	21.8	17.3	17	8.8	9.6	18.9	20
Naziza Square	18.5	21	14	16.5	6.8	9.4	16	19
aalshuqaq Square	14.8	18	16	18	8	9	16.6	18
Turkish Hospital Square	28	30	24.8	26.7	18	22	27	29
pink square	12	14	9.8	10	6	6.8	11.2	12.2

Table (2) show concentration of iron in irregular garage.

irregular garage.	Summer		Autumn		Winter		Spring	
	Morning	Evening	Morning	Evening	Morning	Evening	Morning	Evening
Marjan Hospital	10.3	11	9	9.2	5.3	6.2	9.6	10
alealwiat sharifah	7	8.4	5.6	6.8	3.2	3.3	6.6	7.6
altahmazia	7.3	8.1	6.2	6.6	2.8	3.2	6.6	7.3



almuhandisin	7	7.4	6.3	6	2.7	3	6.5	6.6
aleaskariu	7.1	7.9	6	6.4	3	3.2	6.1	7
University of Babylon	7.2	9.2	5.7	6.6	3.2	3.4	6.1	7.3
nadir	6.6	7.2	5.7	5.6	2.9	3.2	6.3	6.6
taqatue althawra	6.1	7	4.6	5.5	2.2	3.1	5.3	6.3
althawra	4.9	6	5.3	6	2.6	3	6	5.5
nadir bridge	9.3	10	8.2	8.9	6	7.3	9	9.6
Republican Hospital	4	4.6	3.2	3.3	2	2.2	3.7	4

Copper

This element show elevated in its concentration during summer as compared with other seasons as show in table No. 3 and 4.

Table (3) show concentration of copper in regular garage.

regular garage	Summer		Autumn		Winter		Spring	
	Morning	Evening	Morning	Evening	Morning	Evening	Morning	Evening
almuahad	0.33	3.8	2.8	3	1.66	1.7	0.31	0.36
baghdad alqadim	0.21	2.6	1.66	2.2	0.9	0.96	1.88	0.24
alsawb alsaghir	0.21	2.62	1.88	0.198	0.98	1.0	1.98	0.21
murab aldaakhil	0.2	2.1	1.67	0.188	0.76	0.98	1.8	0.19
Tahmaziah Square	0.24	2.88	1.44	0.198	0.8	0.93	2.1	0.268
Saad Bridge Square	0.198	2.1	1.5	0.17	0.88	0.98	1.78	0.19
Bailey Bridge Square	0.218	2.4	1.68	0.177	0.82	0.9	0.19	0.2
Naziza Square	0.21	2.4	1.98	0.2	1.6	1.84	2.12	0.221
aalshuqaq Square	0.2	2.18	1.4	0.16	0.8	0.98	1.7	0.19
Turkish Hospital Square	0.3	3.3	2.8	0.29	0.2	2.4	2.95	0.3
pink square	0.12	1.6	0.88	1.2	0.67	0.8	0.1	0.14

Table (4) show concentration of copper in irregular garage.

irregular garage	Summer		Autumn		Winter		Spring	
	Morning	Evening	Morning	Evening	Morning	Evening	Morning	Evening
Marjan Hospital	0.0011	0.0126	0.0093	0.001	0.055	0.056	0.103	0.12
alealwiat sharifah	0.007	0.0086	0.0055	0.073	0.003	0.0032	0.062	0.08
altahmazia	0.0007	0.0087	0.0062	0.066	0.0032	0.033	0.066	0.07
almuhandisin	0.0066	0.0007	0.0055	0.062	0.0025	0.0032	0.006	0.063
aleaskariu	0.008	0.0096	0.0048	0.066	0.0026	0.0031	0.007	0.089
University of Babylon	0.0066	0.007	0.0005	0.056	0.0029	0.0032	0.059	0.063
nadir	0.0072	0.008	0.0056	0.0059	0.027	0.003	0.063	0.066
taqatue althawra	0.0007	0.008	0.0066	0.0066	0.0053	0.0061	0.007	0.073
althawra	0.0066	0.0072	0.0046	0.0053	0.026	0.0032	0.056	0.063
nadir bridge	0.001	0.0011	0.0009	0.0001	0.0006	0.0008	0.009	0.01



Republican Hospital	0.04	0.053	0.029	0.04	0.022	0.026	0.033	0.046
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Cobalt

This element show elevated in its concentration during summer as compared with other seasons as show in table No. 5 and 6.

1383

Table (5) show concentration of cobalt in regular garage.

regular garage	Summer		Autumn		Winter		Spring	
	Morning	Evening	Morning	Evening	Morning	Evening	Morning	Evening
alhaluh almuahad	0.098	0.123	0.03	0.048	0.016	0.022	0.063	0.081
baghdad alqadim	0.082	0.09	0.031	0.042	0.014	0.02	0.058	0.07
alsawb alsaghir	0.042	0.06	0.01	0.012	0.005	0.009	0.021	0.031
murab aldaakhil	0.066	0.088	0.02	0.028	0.01	0.014	0.04	0.049
Tahmaziah Square	0.054	0.072	0.016	0.026	0.008	0.012	0.032	0.043
Saad Bridge Square	0.038	0.066	0.012	0.018	0.009	0.01	0.02	0.027
Bailey Bridge Square	0.048	0.068	0.01	0.012	0.007	0.009	0.018	0.031
Naziza Square	0.032	0.054	0.009	0.011	0.005	0.007	0.019	0.028
aalshuqaq Square	0.05	0.063	0.018	0.021	0.009	0.012	0.032	0.04
Turkish Hospital Square	0.081	0.092	0.03	0.045	0.013	0.021	0.061	0.072
pink square	0.051	0.066	0.018	0.02	0.01	0.016	0.032	0.04

Table (6) show concentration of cobalt in irregular garage.

Irregular garage	Summer		Autumn		Winter		Spring	
	Morning	Evening	Morning	Evening	Morning	Evening	Morning	Evening
Marjan Hospital	0.039	0.049	0.012	0.019	0.006	0.008	0.025	0.032
alealwiat sharifah	0.032	0.036	0.012	0.016	0.005	0.008	0.023	0.028
altahmazia	0.016	0.024	0.004	0.004	0.002	0.003	0.008	0.012
almuhandisin	0.026	0.035	0.008	0.011	0.004	0.005	0.016	0.019
aleaskariu	0.021	0.028	0.006	0.01	0.003	0.004	0.012	0.017
University of Babylon	0.015	0.026	0.004	0.007	0.003	0.004	0.008	0.01
nadir	0.019	0.027	0.004	0.004	0.002	0.003	0.007	0.012
taqatue althawra	0.012	0.021	0.003	0.004	0.002	0.002	0.007	0.011
althawra	0.02	0.025	0.007	0.008	0.003	0.004	0.012	0.016
nadir bridge	0.032	0.036	0.001	0.001	0.005	0.008	0.024	0.028
Republican Hospital	0.02	0.026	0.007	0.008	0.004	0.006	0.012	0.016

Zinc



This element show elevated in its concentration during summer as compared with other seasons as show in table No. 7and8.

Table (7) show concentration of Zinc in regular garage.

regular garage	Summer		Autumn		Winter		Spring	
	Morning	Evening	Morning	Evening	Morning	Evening	Morning	Evening
alhaluh almuahad	4.8	5.02	3.02	3.62	2.88	2.98	3.88	4.88 ¹³⁸⁴
baghdad alqadim	4.66	4.8	3	3.02	2.64	2.96	3.22	4.62
alsawb alsaghir	1.92	2.1	1.4	1.48	1.22	1.34	1.8	1.98
murab aldaakhil	3.81	4	2.68	3	2.6	2.66	3.4	3.86
Tahmaziah Square	2.6	2.88	1.86	1.98	1.66	1.8	2.21	2.4
Saad Bridge Square	2.7	2.9	1.66	1.82	1.44	1.54	2.1	2.66
Bailey Bridge Square	2.71	2.94	1.8	2	1.54	1.67	1.98	2.57
Naziza Square	2.44	2.68	1.72	1.98	1.44	1.68	2	2.22
aalshuqaq Square	2.06	2.4	1.2	1.28	0.85	0.98	1.9	2
Turkish Hospital Square	3.44	3.8	2.8	2.98	2.48	2.66	3.02	3.66
pink square	1.88	2	1.2	1.46	0.94	1.12	1.68	1.78

Table (8) show concentration of Zinc in irregular garage.

irregular garage	Summer		Autumn		Winter		Spring	
	Morning	Evening	Morning	Evening	Morning	Evening	Morning	Evening
Marjan Hospital	1.6	1.67	1	1.2	0.96	0.99	1.29	1.62
alealwiat sharifah	1.55	1.6	1	1	0.88	0.98	1.07	1.54
altahmazia	0.64	0.7	0.46	0.49	0.4	0.44	0.6	0.66
almuhandisin	1.27	1.33	0.89	1	0.86	0.88	1.13	1.28
aleaskariu	0.86	0.96	0.62	0.66	0.55	0.6	0.73	0.8
University of Babylon	0.9	0.96	0.55	0.6	0.48	0.51	0.7	0.88
nadir	0.9	0.98	0.6	0.66	0.51	0.55	0.66	0.85
taqatue althawra	0.81	0.89	0.57	0.66	0.48	0.56	0.66	0.74
althawra	0.68	0.8	0.4	0.42	0.28	0.32	0.63	0.66
nadir bridge	1.14	1.26	0.93	0.99	0.82	0.88	1	1.22
Republican Hospital	0.62	0.66	0.4	0.48	0.31	0.37	0.56	0.59

Discussion

The elements under study are very important, especially if they are in high concentrations that exceed the permissible limits, as they have negative effects on human health. And because studies are almost non-existent on this subject in the aforementioned selected areas, we decided to study the spatial and temporal distribution of these elements in those regular and irregular garages on the one hand, but on the other hand, their variation from one site to another

The corrosive nature of Iron seems to further increase the absorption. Target organs are the liver, cardiovascular system, and kidneys. infant Iron exposure may result in low birth rate, anemia, neurological impairment, and growth retardation (CHSR, 2009)



The excess amount of Zinc can cause system dysfunctions that result in impairment of growth and reproduction (Nolan, 2003). The clinical signs of zinc toxicities have been reported as vomiting, diarrhea, bloody urine, liver failure, kidney failure and anemia (Kabata-Pendias and Mukherjee,2007) Copper toxicity is contributor to health problems such as anorexia, depression, anxiety, liver and kidney damage, headaches, and allergies (CHSR, 2009).

The cobalt increase rats will cause disturbances in some important organism(CHSR, 2009).

Iraqi Environment Organization also indicated that the emissions of iron into the atmosphere from its sources should not exceed 100 mg/m³. While copper is 5 mg/m³, while the other elements did not indicate it.

Regardless of whether the elements were above the limits or less than the permissible limits, or its toxic effects on humans, the results showed showed a temporal and spatial variation for all elements from one site to another and from one season to another, but all the elements showed high concentrations during the evening observations (after twelve noon) in the summer compared to the evening observations for the same season. The same was true for the rest of the seasons. Evening observations were higher than the morning observations. The time of taking the pilgrimage may return, which is after twelve noon (the peak time for movement), which causes an increase in the movement of the soil and a re-suspension of the dust that carries the elements, in addition to the amount of solar radiation higher in the evening, which causes a rise in temperatures.

All of these reasons may be the main reason for the increase in the concentration of elements During the evening observation compared to the morning

As for the seasonal difference in the concentrations of the elements, where we note that the highest concentrations were in the summer than the rest of the elements, the reasons may be due to high temperatures, drought and wind. These factors lead to an increase in the attachment of dust particles carrying elements in the atmosphere during the time of sampling

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