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# Concentrations of lead in the dust of some fuel stations in Salah al-Din Governorate

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## ABSTRACT

This study was carried out in the city of Tikrit and its environs, where environmental pollution with lead was studied in some governmental fuel stations in Salah al-Din Governorate, where cars often gather for refueling, resulting in vehicle exhausts varying proportions of the pollutants emitted from them, including the element lead.
The study was divided to include five sites, four gas stations and a fifth group for control, which are: the old Tikrit gas station, Fateh al-Futuh fuel station (al-Qadisiyah station), al-Dour gas station and the martyr Umayya Jibara station (al-Alam station), and the fifth site (the control site) In the Naamah area outside the preservation center on the roads leading to the Kirkuk governorate, which is approximately 40 km away from the research project stations.
The text of the research is to take samples from the dust scattered on the floor of these stations and the control group for a period of six months with a sample per month, from November 2019 to April 2020.
The results the study were determined by measuring the concentrations of lead present in the dust belonging to these stations by means of a Flame Atomic Spectrometer.
The results showed that there were significant differences between the stations and the control group, so the results recorded the highest concentration of lead in dust for the average of the stations during the six months (0.1543 ±0.01112 mg/L) in the Al-Dour governmental fuel station, and the lowest concentration (0.0831 ± 0.0708 mg / L) in the Fath Al Futuh station.
(Al-Qadisiyah station), while the concentration of the control group was (0.0387 ±0.0316 mg/L). The reason for the high results of these measurements on the control group may be attributed to the high traffic movement of cars, the lack of vegetation and the frequency of dust storms that the study area is exposed to from time to time, in addition to other industrial activities in the area under study.

## Introduction

Pollution with heavy elements represents a serious problem because these compounds tend to accumulate and found within living ecosystems.
The tremendous technological development has accompanied the excessive use of these elements, as they have reached a high level of danger, leaving a great effort on the environment, and man is considered one of the victims of environmental stress [1].

The problem of air pollution is one of the main problems that our civilized world suffers at the present time because it challenges man and his capabilities and sometimes exceeds his energies [2].
Soil is the natural receptor for heavy elements, and it can be a means of transforming heavy elements to ecosystem, when surface or ground water is filtered in areas contaminated with heavy elements, then it is transferred to plant tissues and reaches the human being [3], The behavior of heavy elements in the soil

is affected by the chemical and physical properties, as well as the pH, as it leads to the precipitation of heavy elements [4].

The percentage of lead increases in areas where there are a lot of vehicles that work with gasoline fuel, or where there is a lot of paint, or where there are duplicating or printing devices, and this is due to the use of lead compounds in the fuel or printing inks, and this indicates that the majority of lead pollution comes Primarily from wheel fuel, and then from dyes and inks, which lead into the composition of these materials [5].

Lead is considered a heavy toxic element that has the ability to bioaccumulate in addition to its negative effects on living organisms even in its very low concentrations, as it is a carcinogenesis and mutagenesis [6].

Lead enters the body through food, inhalation and the skin, and a number of poisoning cases appear, which are of two types: Acute and Chronic, according to the period of exposure to it [7].

Lead is toxic to many immune cells as it causes modulations of humoral and cellular immunity.

This element has been recorded as being immunosuppressive, even at low concentrations, in addition to causing dysfunction of the kidneys as it works to cause a defect in the renal tubes represented by impeding their ability to re-absorb glucose, amino acids and phosphates, and lead poisoning leads to hypertension and infertility in men and women [8], Exposure to this element comes from several sources.

The main sources of lead are emissions from vehicle exhausts, use of pesticides, use of ammunition, paint chips, plant fertilizers and other industrial products. If lead enters the environment, it is highly correlated to particles such as soil, sediments, and sludge from sewage [9].

One of the studies carried out by a group of researchers to study the concentration of lead in the soil of different areas of Baghdad, including industrial and residential areas.

The results indicated that lead concentrations in the soil of urban areas in Baghdad were exceptionally high reaching 267 mg/g whereas the average concentrations of samples collected from industrial areas were 36 mg / g [10].

**Objective of the study:**

The aim of the current study is to know the concentration of the lead element in the dust scattered on the floor of the stations under study and the extent of its environmental impact on them, and this is done by investigating the lead element in the dust for those stations over a period of six months and comparing the results with dust from outside the study area as a control group where it is far from the studied stations, about 40 km away, to identify the difference between them.

## Materials and working methods

**Description of the study area and the selected sites:**

Tikrit city is located on the right bank of the Tigris River, 180 kilometers north of Baghdad, and it tilts with a steep edge on Tigris, with a height ranging between 45-50 meters, and an almost undulating area of 110 meters above sea level, penetrated by valleys and reefs. The slope of the earth is from west to east and extending inside the western plateau for varying distances, and the study area extends approximately (40) km for five sites, four of which are gasoline fueling stations, as these sites were chosen as the center for the collection of pollutants that come out from the exhaust of cars which refuel from these stations frequently and continuously, as they are government stations that operate continuously and on a daily basis, and the fifth is a control site that is about 40 km away from these sites in order to be less affected by the causes of pollution. These sites are:

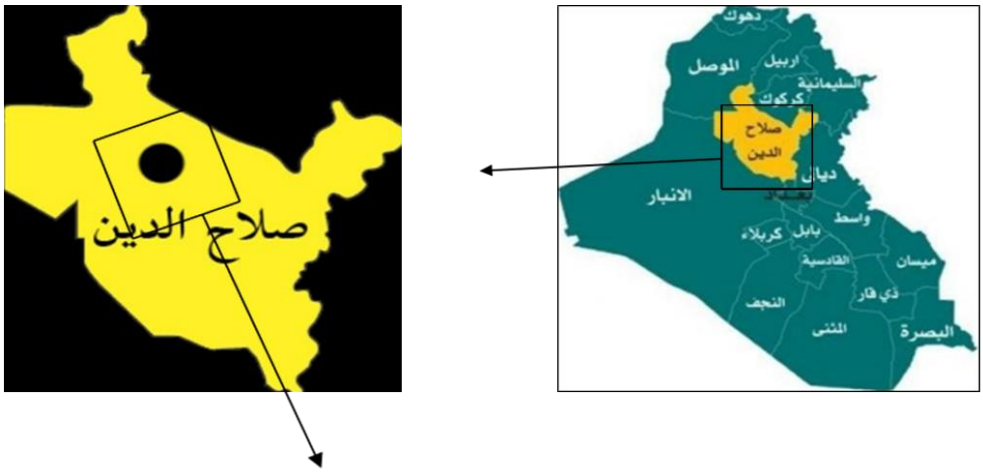
1- The first site (Al-Dour Governmental Fuel Station) in Al-Dur district.

2- The second site (The governmental Gas Station of the Martyr Umayya Jabara,) in the district of Alam.

3- The third site (The Old Governmental Tikrit Fuel Station) in Tikrit district.

4- The fourth site (Fateh Al-Futuh Gas Station / Al-Qadisiyah) in Tikrit District.

5- The fifth site (control site) in the Naamah area, as shown on Map. (1) below:





**Map. 1 Station locations and control, based on Google Earth**

**Table 1: Laboratory devices and equipment used**

| No. | Device Name | The manufacturer |
|---|---|---|
| 1 | Incubator | U.S.A |
| 2 | Balance Sensitive | Germany |
| 3 | Hot plate | U.K |
| 4 | Water Distillator | England |
| 5 | Atomic absorption spectrometer | Singapore |
| 6 | 2mm. Sieve | China |
| 7 | A special brush to collect dust | China |
| 8 | Filter Paper circles Φ9.0cm | India |

**Table 2: chemicals used**

| No. | Material | Manufacturer |
|---|---|---|
| 1 | $HCLO_4$ | India |
| 2 | $H_2SO_4$ | India |
| 3 | DI-$H_2O$ | Iraq |

## Experience Design

Dust sample collection: Dust samples were collected from each site using a soft brush from the floor of the stations and from the control site, then they were placed in sterile plastic boxes and were collected at a rate of one repeat per month, for a period of six months, after which the samples were transferred to the research laboratory at Tikrit University / College of Education for Women / Department of Biology to conduct sample digestion.

## Method of Samples Digestion

The digestion of samples was carried out according to the method [11].

This method is used to digest dust samples by placing them in the incubator from 48-72 hours at a temperature of 65-70 °C and after the weight is fixed, the sample is sifted with a 2 mm sieve and then is weighed 0.2 g of the sample by a sensitive electronic balance and placed in a 100 ml glass beaker and then

add 2 ml of concentrated sulfuric acid after applying sulfuric acid.

Leave the sample for 24 hours until the it becomes blackened and after 24 hours add 2 ml of concentrated perchloric acid with 2 ml of concentrated sulfuric acid to each sample, then put the samples on a hot plate and wait for it until the color of the sample shortens and becomes transparent, then let it cool down and then filter it with a special filter paper for this purpose.

Add distilled water to the sample until the volume gets 100 ml, then put it in sterile, sealed containers for the purpose of transferring it to Atomic absorption spectrometer in the Central Laboratory Department / Presidency of Tikrit University for the purpose of examining the concentration of lead in dust samples.

**Statistical Analysis:**

The results were analyzed statistically using the ANOVA test by applying the statistical program Spss.

The arithmetic averages were compared to the Duncan polynomial test with a probability level of P 0.05 and P 0.01.

## Results and discussion

**1. Quantitative Results*:***

From the results obtained, it was found that the amount of lead contamination varies according to the different locations of the stations located in the five sites (four filling stations) in addition to the control site in a place far from the stations about 40 km, within six months and for the period of time limited between November 2019 to April 2020. These sites were chosen because of the large number of cars in these stations, that mainly affect the presence of lead.

**1-1 Concentrations of lead in the dust covering the floor of the stations during the study period*:***

The results of measuring the stations under study recorded the highest concentration in December of the old Tikrit station (0.1205 mg / L), and its lowest concentration was in April (0.109141 mg / L).

The martyr Umayya Jibara station had the highest concentration (0.1315 mg / L) in December, and the lowest concentration (0.1172 mg / L) in November, and the results also recorded the highest concentration of Al-Dur fuel station in February (0.1639803 mg / L). The lowest concentration was in November (0.1332 mg / L).

As for the Qadisiyah station, its highest concentration was recorded in December (0.1975 mg / L) and the lowest concentration was in March (0.0381008 mg / L).

The results of the current research matched Rashid and Mansour's study [5] and did not agree with Rasul [12]. The reason for the high results of these measurements may be attributed to the high traffic movement of cars, the lack of vegetation cover and the frequency of dust storms that the study area is exposed to from time to time, in addition to other industrial activities in the area under study [13].

The results of the current study showed that there was a significant increase in measurements for all stations under study compared to the control sample, which had the highest concentration in December (0.08762 mg / L) and lowest in January (0.01831 mg / L), as shown In Figure (1) and Appendix (1) .

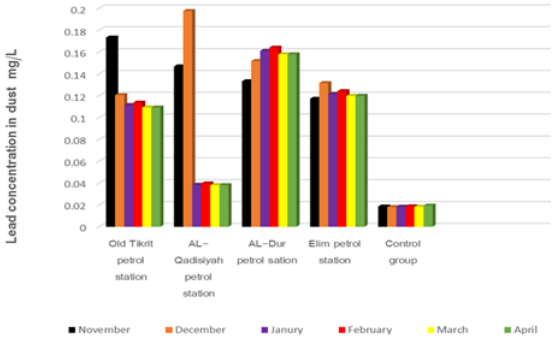



**Fig. 1: The concentration of lead in the dust covering the floor of the stations during the study period.**

**2-1Average concentrations of lead in the dust covering the floor of the stations during the study period:**

Figure (2) and Appendix (1) show the average concentrations of lead in the dust for the four study sites and the fifth site (control site) during the six months of the study, of which we find that the highest concentration of this element was (0.1543) mg / L with a standard error of (0.01112 ±) mg / L in Al-Dur fuel station, which differed statistically from the rest of the other observations, while three observations with the control group gave the lowest concentration of this element, which was at al-Qadisiyah station (0.0831) mg / L with a standard error of (0.0708 ±) mg / L, and it was closer to the result of a Control group in which the average concentration of lead was (0.0387) mg / L with a standard error of (0.0316 ±) mg / L.

The reason for the higher result of the Al-Dur station than its counterparts may be attributed to the small geographical area of this region, its congestion with population, the large traffic movement of cars, the lack of vegetation cover and the frequency of dust storms that it is exposed to from time to time in addition to other industrial activities in the study area [13].

As for the reason for the decrease in the Qadisiyah station, it may be attributed to the curfew in the Qadisiyah area during the study period due to the Corona pandemic (COVID 19), which severely restricted traffic movement, as the area is located in the governorate center, as well as the station's closure for long periods, and this may be one of the reasons for the low results of the examination.

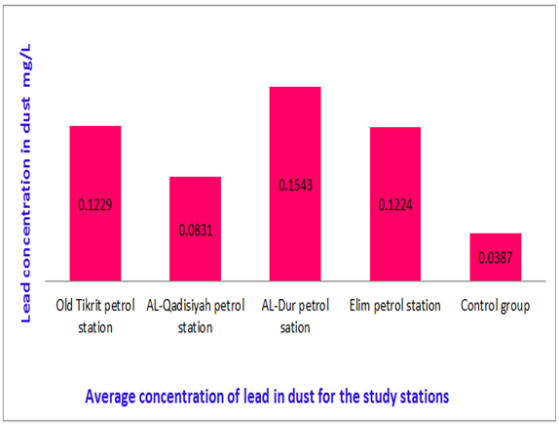



**Fig. 2: represents the average concentration of lead in the dust covering the floor of the stations during the study period.**

**Appendix 1: The concentration of lead in the dust covering the floor of the studied stations for the year 2019/2020, in mg / L unit.**

| **Average stations** | April 2020 | March 2020 | February 2020 | January 2020 | December 2019 | November 2019 | **Months** / **Stations** |
|---|---|---|---|---|---|---|---|
| 0.1229 ± 0.0250 b | 0.109141 | 0.109152 | 0.11370 | 0.1115 | 0.1205 | 0.1731 | The old governmental Tikrit gas station |
| 0.0831 ± 0.0708 c | 0.0381177 | 0.0381008 | 0.039647 | 0.0385 | 0.1975 | 0.1468 | Fateh Al-Futuh Gas Station (Al-Qadisiyah) |
| 0.1543 ± 0.01112 a | 0.15791383 | 0.157913027 | 0.1639803 | 0.1611 | 0.1517 | 0.1332 | Al-Dour Governmental Gas Station |
| 0.1224 ± 0.00503 b | 0.11989409 | 0.11979317 | 0.124138 | 0.1216 | 0.1315 | 0.1172 | Governmental Martyr Umayyah Gas Station (Al-Alam) |
| 0.0387 ± 0.0316 d | 0.01937214 | 0.018358705 | 0.0186762 | 0.01831 | 0.08762 | 0.0701 | Control |
| | 0.0889 ± 0.0582 b | 0.0887 ± 0.0585 b | 0.0920 ± 0.0608 ab | 0.0902 ± 0.0598 ab | 0.1378 ± 0.0407 A | 0.1281 ± 0.0384 A | Months average |

***Similar letters mean there are no significant differences between them.**

## Conclusion

The study of pollution rates at fuel filling stations and the control group has a great role in knowing the proportions of pollutants and their impact on the environment.

Through the results we obtained from the study, the most important conclusions can be summarized as follows:

1. The quantitative ratios of lead concentrations in dust are higher in the stations than at the control group.

2.The results showed that pollution rates were variable and had significant differences with the studied months.

## Recommendations

1. Conducting periodic checks for the soil, which must be within the global and Iraqi determinants, and conducting the checks continuously and within specific dates to take the necessary measures to prevent the accumulation of pollutants in the soil.

2. Planting some plants that are characterized by their ability to effectively collect heavy elements instead of using chemicals that harm the soil.
This is part of biological treatment.

3. Conducting more comprehensive and in-depth future studies to study the causes of increased concentrations of heavy elements and their danger to the environment.

4. Conducting biological studies on plants cultivated in these areas to determine their sensitivity and adaptation to heavy and toxic elements.

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# تراكيز الرصاص في غبار بعض محطات وقود محافظة صلاح الدين


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## الملخص

أنجزت هذه الدراسة في مدينة تكريت وضواحيها حيث تم دراسة التلوث البيئي بعنصر الرصاص في بعض محطات تعبئة الوقود الحكومية من محافظة صلاح الدين التي يكثر عندها تجمع السيارات للتزود بالوقود فينتج عن عوادم السيارات نسب متباينة من الملوثات الخارجة منها التي من ضمنها عنصر الرصاص.

تقسمت الدراسة لتشمل خمسة مواقع، اربع محطات للوقود ومجموعة خامسة للسيطرة وهي كل من: محطة وقود تكريت القديمة، محطة وقود فتح الفتوح (محطة القادسية)، محطة وقود الدور ومحطة وقود الشهيدة امية جبارة (محطة العلم)، وكان الموقع الخامس (موقع السيطرة) في منطقة الناعمة خارج مركز المحافظة على الطرق المؤدي إلى محافظة كركوك والذي يبعد تقريباً 40 كم عن محطات مشروع البحث.

نص البحث على اخذ عينات من الغبار المتناثر على أرضية هذه المحطات ومجموعة السيطرة ولمدة ستة اشهر بواقع عينة في كل شهر، اعتباراً من شهر تشرين الثاني 2019 ولغاية شهر نيسان 2020. تحددت نتائج الدراسة بقياس تراكيز الرصاص المتواجدة في الغبار التابع لهذه المحطات بواسطة جهاز المطياف الذري اللهبي Atomic absorption spectrometer .

أظهرت النتائج وجود فروق معنوية بين المحطات ومجموعة السيطرة، فسجلت النتائج اعلى تركيز للرصاص في الغبار لمتوسط المحطات خلال الستة اشهر (0.1543 ± 0.01112 ملغم/لتر) في محطة وقود الدور الحكومية، واقل تركيز (0.0831 ± 0.0708 ملغم/لتر) في محطة فتح الفتوح (محطة القادسية)، في حين كان تركيز مجموعة السيطرة (0.0387 ± 0.0316 ملغم/لتر)، وقد يعزى سبب ارتفاع نتائج هذه القياسات عن مجموعة السيطرة لكثرة الحركة المرورية للسيارات وقلة الغطاء النباتي وتكرار العواصف الترابية التي تتعرض لها منطقة الدراسة بين فترة وأخرى إضافة إلى النشاطات الصناعية الأخرى الموجودة في المنطقة قيد الدراسة.