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علمية دولية مُحكمة ربع سنوية - تصدر بالشراكة مع كلية المنهل للعلوم - السودان

# في هذا العدد:

■ **مساهمة الهيكل التنظيمي في تحقيق التميز المؤسسي**
(دراسة ميدانية على الشركة السودانية لتوزيع الكهرباء محلية شندي 2022 - 2023م)
د. آلاء عبدالحافظ حموده موسى
د. محمد محجوب سليمان فضيل

■ **أثر اليقظة الاستراتيجية في تحقيق الميزة التنافسية المستدامة**
(دراسة على قطاع المصارف بولاية الخرطوم)
أ. د. علي عبد الله الحاكم
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# مجلة القُلزم العلمية

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# موجهات النشر

## تعريف المجلة:

مجلة (القُلزم) للدراسات العلمية مجلة علمية محُكمة تصدر عن مركز بحوث ودراسات دول حوض البحر الأحمر - السودان، بالشراكة مع أكاديمية المنهل للعلوم - السودان. تهتم المجلة بالبحوث والدراسات العلمية والمواضيع ذات الصلة بدول حوض البحر الأحمر.

## موجهات المجلة:

1. يجب أن يتسم البحث بالجودة والأصالة، وألا يكون قد سبق نشره قبل ذلك.
2. على الباحث أن يقدم بحثه من نسختين. وأن يكون بخط (Traditional Arabic) بحجم 14 على أن تكون الجداول مرقمة وفي نهاية البحث وقبل المراجع على أن يشار إلى رقم الجدول بين قوسين دائريين ().
3. يجب ترقيم جميع الصفحات تسلسلياً وبالأرقام العربية بما في ذلك الجداول والأشكال التي تلحق بالبحث.
4. المصادر والمراجع الحديثة يستخدم أسم المؤلف، اسم الكتاب، رقم الطبعة، مكان الطبع، تاريخ الطبع، رقم الصفحة.
5. المصادر الأجنبية يستخدم اسم العائلة (Hill, R).
6. يجب ألا يزيد البحث عن 30 صفحة، وبالإمكان كتابته باللغة العربية أو الإنجليزية.
7. يجب أن يكون هناك مستخلص لكل بحث باللغتين العربية والإنجليزية على ألا يزيد على 200 كلمة بالنسبة للغة الإنجليزية. أما بالنسبة للغة العربية فيجب أن يكون المستخلص وافياً للبحث بما في ذلك طريقة البحث والنتائج والاستنتاجات، مما يساعد القارئ العربي على استيعاب موضوع البحث وبما لا يزيد عن 300 كلمة.
8. لا تلزم هيئة تحرير المجلة بإعادة الأوراق التي لم يتم قبولها للنشر.
9. على الباحث إرفاق عنوانه كاملاً مع الورقة المقدمة (الاسم رباعي، مكان العمل، الهاتف، البريد الإلكتروني).

نأمل قراءة شروط النشر قبل الشروع في إعداد الورقة العلمية.

بسم الله الرحمن الرحيم

# كلمة التحرير

**الحمد لله رب العالمين، والصلاة والسلام على سيدنا محمد وعلى آله وصحبه أجمعين**

وبعد:

**القارئ الكريم ،،،**

السلام عليك ورحمة الله وبركاته.. نطل على حضراتكم من نافذة جديدة من نوافذ النشر العلمي وهي مجلة القلزم العلمية، ونحن في غاية السعادة والمجلة تصل عددها الثامن والثلاثون بفضل الله تعالى ومنته.

**القارئ الكريم:**

هذه المجلة تصدر بالشراكة مع أكاديمية المنهل للعلوم وهي إحدى الأكاديميات السودانية الفنية التي وضعت بصمات مميزة في مسيرة البحث العلمي، وهذا العدد هو الثامن والثلاثون في إطار هذه الشراكة العلمية التي تأتي في إطار استراتيجية مركز بحوث ودراسات دول حوض البحر الأحمر في تفعيل الحراك العلمي والبحث داخل السودان وخارجه..

**القارئ الكريم:**

هذا العدد يشتمل على عدد من البحوث والدراسات المهمة ذات البعد النظري والتطبيقي ولضمان نجاح واستمرارية هذه المجلة بإذن الله تعالى نأمل أن يرفدنا الباحثون بمزيد من اسهاماتهم العلمية المميزة مع خالص الشكر والتقدير للجميع..

**أسرة التحرير**

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# Determination of Lead Level Concentration in El-Gash River water At the Beginning of the Flood, Kassala State, Sudan

A.nugod Algaily Mohamed

Dr.osman Mohamed Saad

Dr.abdelgadir Mohamed Ahmed

## Abstract:

The exposure to high doses of lead may cause kidney, liver damage and may lead to death, relative to the a cumulative danger of lead and its effect on human and animal body. The current study was designed to determine the concentration of lead level in water of El- Gash River, Kassala State, Sudan, using the experimental scientific method. For this purpose, 15 samples of water were collected at the beginning of the flood of El- Gash River from the selected areas (Wadsharifi, Awetala, Hay Algisr and Kurmuta), during 2019, the water samples were digested using Nitric and Hydrochloric acids as the requirement for the Inductively Coupled Plasma and Optical Emission Spectrometer (ICP-OES) techniques. The analyzed results with SPSS test and since P value P 0.013) is less than 0.05, the Significant difference between the concentration of lead in Awetala and the concentration of lead in Hayalgasor water was found to be P 0.02) . The collected water sample from Kormota and Hay Algisr have significant differences of P 0.025). The analysis results of El-Gash River water show that, lead Concentration level in all selected

areas were found to be within the permissible limit of the World Health Organization (0.01 ppm) for lead level concentration in water, except Wadsharifi area, the mean Values of lead Concentration level were found to be (0.044 ppm) which is consider as higher than the permissible limit of lead in water.

**Keywords:** Lead, Pollutants, Heavy metals , Contaminated water, Optical emission spectrometer.

# تحديد مستوى تركيز الرصاص في مياه نهر القاش عند بداية الفيضان، ولاية كسلا، السودان

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## مستخلص:

إن التعرض لجرعات عالية من الرصاص قد يؤدي إلى تلف الكلى والكبد وقد يؤدي إلى الوفاة، وذلك نسبة لخطورة الرصاص التراكمية وتأثيره على جسم الإنسان والحيوان. صممت الدراسة الحالية لتحديد تركيز مستوى الرصاص في مياه نهر القاش بولاية كسلا، السودان، وذلك باستخدام المنهج العلمي التجريبي، ولتحقيق هذا الغرض تم جمع 15 عينة مياه عند بداية فيضان نهر القاش من المناطق المختارة (ودشريفي، أويتلا ، حي الجسر و الكرمته) خلال العام 2019. تم هضم عينات المياه باستخدام أحماض النيتريك والهيدروكلوريك، حسب متطلبات تقنيات ICP-OES. تم تحليل النتائج باستخدام برنامج التحليل الاحصائي SPSS حيث وجد أن قيمة P(0.013)) أقل من 0.05. توجد اختلافات معنوية في عينة المياه المجمعة من الكَرمَته وحي الجسر (0.025) . أظهرت نتائج تحليل مياه نهر القاش أن مستوى تركيز الرصاص في جميع المناطق المختارة لتركيز مستوى الرصاص في المياه، كان ضمن الحد المسموح به من منظمة الصحة العالمية (0.01) جزء في المليون، باستثناء منطقة ودشريفي، حيث كان متوسط تركيز الرصاص (0.044) جزء في المليون وهو أعلى من الحد المسموح به للرصاص في الماء.

**الكلمات المفتاحية :** الرصاص، الملوثات، المعادن الثقيلة، المياه الملوثة، مطياف الانبعاث البصري.

# Introduction:

Water is of fundamental importance for life on earth (Sharma and Bhattacharya, 2016). The importance of water for sustenance of life cannot be overemphasized, whether it is in use of running water in our homes, rearing cattle and growing crops in our farms, or the increased uses in industry, remain immeasurable. Human activities including industrialization and agricultural practices contributed immensely in no small measure to the degradation and pollution of the environment which adversely has an effect on the water bodies (rivers and ocean) that is a necessity for life. Water is considered polluted if some substances or condition is present to such a degree that the water cannot be used for a specific purpose (Owa, 2014). Environmental pollution is a major challenge in the recent era of modern society. Among different environmental contaminants, heavy metals are well known and are of greater concern due to their toxicity for living organisms and marine life. Heavy metals are a unique class of naturally occurring elements that persist in the environment for a long time and are not biodegradable (Muhammad et al, 2022). Heavy metals are the natural part of the Earth's crust. The sources of heavy metals into the environment could be natural or anthropogenic activities. The naturally occurring heavy metals are already present in nature and become a part of the environment by weathering metal-bearing rocks and volcanic eruptions. In contrast, the anthropogenic sources of heavy metals include various industrial, mining, and agricultural practices (Dixit et al, 2015). The toxic effects of heavy metals are long lasting, reason being the non degradation properties of heavy metals. Heavy metals have toxic effects even at low concentration, which may prove lethal to any living being. Their concentration in biota can be increased through bioaccumulations (Mahipal et al, 2016). Elements having densities more than 5.0 g/cm3 and atomic masses higher than 20 are considered heavy metals. Toxic heavy metals which pose hazardous effects are copper (Cu), chromium (Cr), zinc (Zn), cadmium (Cd),

arsenic (As), nickel (Ni), cobalt (Co), mercury (Mg), lead (Pb) and so on (Muhammad et al, 2022). The topmost toxic heavy metals are Hg, Pb, As, Cr, and Cd, which severely impact ecosystem health. Heavy metals also cause a disturbance in the microbial balance of soil and affect the fertility of the soil ( Barbieri, 2016). Water pollutants mainly consist of heavy metals, fertilizer and trash, thousands of toxic organic compounds (WHO, 1999). Lead is one of the most toxic elements, has an accumulative effect and is an environmental Priority pollutant (Chena et al, 2005). Lead pollution in water systems has seriously influenced the quality of life especially in developing country. Nevertheless, it is used as a raw material in the manufacturing industry such as automotive batteries, ceramic and ink (Comitre et al, 2005), the World Health Organization (WHO) has established the maximum allowable limit of 10 µg / L for lead in water, It is, therefore, important to monitor the lead level in the environmental samples (WHO, 1996). Lead is accumulated in tissues this can lead to joint diseases such as rheumatoid arthritis, and diseases of the kidneys, circulatory system, and nervous system. (ToxFaQs, 1993). The main object of this paper is to determine Lead Concentration level in El-Gash River water in eastern Sudan using Inductively Coupled Plasma Optical Emission Spectrometry techniques.

## 2. Materials and Methods:

## 2.1 Collection of Water samples:

15 samples of river water were collected from Four different areas (Wadsharifi, Awetala, Hay Algisr and Kurmuta) were selected using GPS technique in the course at the beginning of the flood season of El- Gash River in Kassala State eastern Sudan in 2019. The samples were coded as: [Wadsharifi (1Aw, 5 samples), Awetala (1Aa ,4 samples, Hay Algasor (1Ah ,3 samples) and Kormota (1Ak, 3 samples)], and were kept in one liter plastic bottles separately the interior of the plastic bottles being previously rinsed three

times, the samples were acidified with Nitric acid to preserve the water from contamination.

## 2.2. Methods:

### 2.2.1 The Principle of Inductively Coupled Plasma Optical Emission Spectrometry(ICP-OES) Method:

The (ICP-OES) have a linear relation several times the power of ten between the intensities measured and the concentration of an element. This means that quantification by means of external calibration with a linear regression line is possible. The calibration should be adjusted to the working range. Even for the lowest concentration values, sufficient measuring sensitivity and reproducibility must be assured, an aliquot of a well-mixed, homogeneous aqueous or solid sample is accurately weighed or measured for sample processing,. For total recoverable analysis of a solid or an aqueous sample containing un dissolved material, analyses are first solubilized by gentle refluxing with Nitric and Hydrochloric acids, after cooling, the sample is made up to volume, is mixed and centrifuged or allowed to settle overnight prior to analysis. For the determination of dissolved analyses in a filtered aqueous sample aliquot (Perkin- Elmer,2004).

### 2.2.2 Preparation of Reagents:

Hydrochloric acid (1:1) was prepared by adding 500 ml of Concentrated HCl to 400 ml reagent Distilled water, the mixture was diluted with to One Liter., Hydrochloric acid (1:4) was prepared by adding 200 ml of concentrated HCl to 400 ml reagent water, the mixture was diluted to One Liter. Nitric acid (1:1) was prepared by adding 500 ml of Concentrated $HNO_3$ to 400 ml reagent Distilled water, the mixture was diluted to One Liter.

## 2.2.3. Preparation Standard Solutions:

Standard solution containing (0.5, 1, and 5) ppm, and 100µg/liter of Pb were prepared (mention the Pb salt here as chemical formula only and where you are found mention the lab name) (acidified to maintain pH at (1-2), the Calibration curves determine the relationship between the intensity of light emitted at a specific wavelength and the concentration of the element in the solution.

## 2.2.4 Preparation of water samples:

2 ml of (1:1) nitric acid and 1mL of (1:1) hydrochloric acid were added to the beaker containing 1 ml of sample, the solution was evaporated by Placing the beaker on hot plate, the hot plate should be located in a fume hood and previously adjusted to provide evaporation at a temperature of approximately but no higher than 85°C (Perkin- Elmer,2004).

## 4. Results and Discussion:

From table: 1 the water samples of El-Gash River were analyzed using Inductively Coupled Plasma Optical and Emission Spectrometry Techniques for determination of lead at the corresponding wave length ( 220.533 nm).

**Table 1: The Quantities of lead in water samples in Ppm at the beginning of the flood of River**

| Sample number | Sample code | (Lead conc. in (ppm |
|---|---|---|
| 1 | 1Aw | 0.04 |
| 2 | 1Aw | 0.03 |
| 3 | 1Aw | 0.02 |
| 4 | 1Aw | 0.04 |
| 5 | 1Aw | 0.09 |
| 6 | 1Aa | 0.02 |
| 7 | 1Aa | 0.03 |
| 8 | 1Aa | 0.01 |
| 9 | 1Aa | 0.09 |
| 10 | 1Ah | 0.03 |
| 11 | 1Ah | 0.09 |
| 12 | 1Ah | 0.15 |
| 13 | 1Ak | 0.04 |
| 14 | 1Ak | 0.03 |
| 15 | 1Ak | 0.03 |

**Table 2 : Statistic Comparison of lead in Water samples at the beginning of the flood of Gash River Descriptive Statistics**

| Group | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Wadsharifi | 5 | .02 | .09 | .0440 | .02702 |
| Awetala | 4 | .01 | .09 | .0375 | .03594 |
| Hay Algisr | 3 | .09 | .30 | .1800 | .10817 |
| Kurmuta | 3 | .03 | .04 | .0333 | .00577 |
| Valid N (listwise) | 3 | | | | |

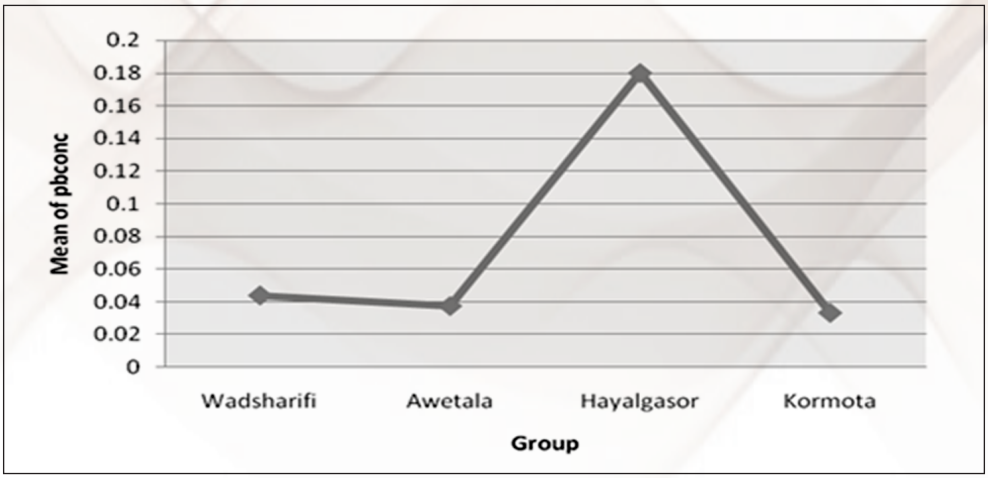


**Figure 1: Means of lead concentration in water at the beginning of the flood of the Gash River in the studied groups.**

**Table 3: Multiple Comparisons of lead concentration in Water samples at the beginning of the flood of the Gash River. Tukey HSD.**

| (I) block | (J) block | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| Wadsharifi | Awetala | 0.00650 | 0.03518 | 0.998 | -.0994- | 0.1124 |
| | Hay Algisr | -.13600-* | 0.03830 | 0.020 | -.2513- | -.0207- |
| | Kurmuta | .01067 | 0.03830 | 0.992 | -.1046- | 0.1259 |
| Awetala | Wadsharifi | -.00650- | 0.03518 | 0.998 | -.1124- | 0.0994 |
| | Hay Algisr | -.14250-* | 0.04006 | 0.020 | -.2631- | -.0219- |
| | Kurmuta | 0.00417 | 0.04006 | 1.000 | -.1164- | 0.1247 |
| Hay Algisr | Wadsharifi | 0.13600* | 0.03830 | 0.020 | 0.0207 | 0.2513 |
| | Awetala | 0.14250* | 0.04006 | 0.020 | 0.0219 | 0.2631 |
| | Kurmuta | 0.14667* | 0.04283 | 0.025 | 0.0178 | 0.2756 |
| Kormota | Wadsharifi | -.01067- | 0.03830 | 0.992 | -.1259- | 0.1046 |
| | Awetala | -.00417- | 0.04006 | 1.000 | -.1247- | 0.1164 |
| | Hay Algisr | -.14667-* | 0.04283 | 0.025 | -.2756- | -.0178- |

*. The mean difference is significant at the 0.05 level.

Table: (1): show the summarized data of Lead levels Concentration in water samples at the beginning of the flood of El- Gash River using (ICP-OES) techniques. The concentration of lead was ranged between (0.01-0.09 ppm) for the studies water samples, the highest concentration of lead was found in Wadsharifi water samples (0.09 ppm ) and the lowest concentration of lead was found to be in Awetala water samples (0.01 ppm) .The mean concentration of lead in water was found to be (0.073 ppm) which is higher than the amount allowed by the WHO (0.01 ppm). for lead concentration. Table 3: shows a multiple comparison of lead concentration in water samples, the mean difference was significant at the 0.05 level. Wadsharifi water samples were selected to make a comparison between the concentration of lead in water at the beginning of the flood of El-Gash River, Wadsharifi water samples have mean value (0.044 ppm) in both lowest and highest concentration of lead (0.02 and 0.09) ppm respectively, this is may be due to the nature of the mountainous region and decomposition of rocks traces reached to the river during the river crossing through it. The lowest and highest concentration of Lead in Awetala water Samples were found to be (0.01 and 0.09 ) ppm respectively with mean concentration of Lead in samples (0.037 ppm).

Hay Algisr water samples have an average value (0.180 ppm) , the lowest and highest concentration of Lead were found to be (0.09 and 0.30 ) ppm respectively , the Lead concentration in water in this region is the highest compared to the other regions and this may be due to the presence of a landfill located on the course of the river or due to the contamination by agricultural fertilizers and fuel stations that may have been swept into the riverbed due to rain water and air pollution with car exhaust due to the presence of the bridge in this site. In Kurmuta water samples the lowest and highest of Lead concentration in water were found to be (0.03 and 0.04) ppm respectively, and the mean value was (0.033 ppm) which is conceder as the lowest value concentration of Lead with respect to other sample and this is

because, Kormota area is far from the agricultural and contaminated areas. Lead concentration in water allowed by the (WHO, 1999) was (0.01 ppm) (Mebrahtu and Zerabruk, 2011) and these sample were exceeded the limit allowed by WHO.

The analyzed results with SPSS test and Since P value (0.013) is less than 0.05, we reject the null hypothesis and we accept the alternative, that means there was significant difference in the concentration of Lead in water between the collected samples for Wadsharifi and Hay Algisr sample (sig 0.02). The significant difference between the concentration of Lead in Awetala and the concentration of Lead in Hay Algisr water was found to be (sig 0.02). The collected water sample from Kormota and Hay Algisr have significant differences of (sig 0.025 ). The concentration of Lead in Hay Algisr water sample showed significant differences of ( sig 0.02) concerning to the all collected samples from other areas.

## 5. Conclusion:

In this research of work , the water of Gash river was analysis to indicate the concentration of lead in the water, using the (ICP-OES) techniques, the Inductively Coupled Plasma and Optical Emission Spectrometry method is fairly selective, precise, and more sensitive for its free from interferences and good advantage of this method and it can be used for routine analysis of both water and soil. based on the above analysis results we can conclude that, Lead concentration level in the selected areas are within the limits of WHO, except Wadsharifi area in which the concentration of Lead is higher than the limit of Lead in water by WHO.

## 6. Recommendations:

The following may be recommended from this research and should be taken to the researchers in this area:

1. Lead levels concentration in the El-Gash River water should be continuously monitored to check on during the river flooding period because Lead element is very poisonous even in their smallest quantities.

2. Lead levels concentration in El-Gash River water was found to be above the Lead concentration level recommended limit by the WHO (0.01ppm), in the area of Wadsharifi on, this may require great efforts must be done from local governments and researchers for the monitoring the concentration of Lead in El-Gash rive in this area.

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