Journal of Applied Science

Biannual Peer Reviewed Journal Issued by Research and Consultation Center , Sabratha University

Issue (12)
April 2024

Journal of Applied Science

Biannual Peer Reviewed Journal Issued by Research and Consultation Center, Sabratha University

Editorial

We start this pioneering work, which do not seek perfection as much as aiming to provide a scientific window that opens a wide area for all the distinctive pens, both in the University of Sabratha or in other universities and research centers. This emerging scientific journal seeks to be a strong link to publish and disseminate the contributions of researchers and specialists in the fields of applied science from the results of their scientific research, to find their way to every interested reader, to share ideas, and to refine the hidden scientific talent, which is rich in educational institutions. No wonder that science is found only to be disseminated, to be heard, to be understood clearly in every time and place, and to extend the benefits of its applications to all, which is the main role of the University and its scholars and specialists. In this regard, the idea of issuing this scientific journal was the publication of the results of scientific research in the fields of applied science from medicine, engineering and basic sciences, and to be another building block of Sabratha University, which is distinguished among its peers from the old universities.

As the first issue of this journal, which is marked by the Journal of Applied Science, the editorial board considered it to be distinguished in content, format, text and appearance, in a manner worthy of all the level of its distinguished authors and readers.

In conclusion, we would like to thank all those who contributed to bring out this effort to the public. Those who lit a candle in the way of science which is paved by humans since the dawn of creation with their ambitions, sacrifices and struggle in order to reach the truth transmitted by God in the universe. Hence, no other means for the humankind to reach any goals except through research, inquiry, reasoning and comparison.

Editorial Committee

Notice

The articles published in this journal reflect the opinions of their authors only. They are solely bearing the legal and moral responsibility for their ideas and opinions. The journal is not held responsible for any of that.

Publications are arranged according to technical considerations, which do not reflect the value of such articles or the level of their authors.

Journal Address:

Center for Research and Consultations, Sabratha University

Website: **https://jas.sabu.edu.ly/index.php/asjsu**

Email**:** **jas@sabu.edu.ly**

Local Registration No. (435/2018)

ISSN 💻 2708-7301

ISSN 🕮 2708-7298

Publication instructions

The journal publishes high quality original researches in the fields of Pure Science, Engineering and Medicine. The papers can be submitted in English or Arabic language through the Journal email (jas@sabu.edu.ly) or CD. The article field should be specified and should not exceed 15 pages in single column.

All submitted research manuscripts must follow the following pattern:

- Title, max. 120 characters.
- Author Name, Affiliation and Email
- Abstract, max. 200 words.
- Keywords, max. 5 words.
- Introduction.
- Methodology.
- Results and Discussion.
- Conclusion.
- Acknowledgments (optional).
- References.

Writing Instructions:

Papers are to be submitted in A4 (200×285 mm) with margins of 25 mm all sides except the left side, which should be 30 mm. Line spacing, should also be 1.15.

Table 1. Font size and style

	Bold	**English**	**Arabic**
Font Style	✓	Times New Roman	Simplified Arabic
Article Title	✓	14 Capital	16
Authors Name	✓	12	14
Affiliation	×	11	13
Titles	✓	12	14
Sub-Title	✓	12	13
Text	×	12	14
Figure Title	✓	11	13
Table Title	✓	11	13
Equations	✓	12	14

Figures:

All figures should be compatible with Microsoft Word with serial numerals. Leave a space between figures or tables and text.

References:

The references should be cited as Harvard method, eg. Smith, R. (2006). References should be listed as follows:

Articles: Author(s) name, Year, Article Title, Journal Name, Volume and Pages.

Books: Author(s) name. Year. “Book title" Location: publishing company, pp.

Conference Proceedings Articles: Author(s) name. Year." Article title". Conference proceedings. pp.

Theses: Author(s) name. Year. "Title". Degree level, School and Location.

Invitation

The Editorial Committee invites all researchers "Lectures, Students, Engineers at Industrial Fields" to submit their research work to be published in the Journal. The main fields targeted by the Journal are:

- Basic Science.
- Medical Science & Technology.
- Engineering.

Refereeing

The Editorial Committee delivers researches to two specialized referees, in case of different opinions of arbitrators the research will be delivered to a third referee.

Editorial Committee

CONTENTS

NITRATES IN MAN-MADE RIVER COMPARED TO GROUNDWATER WELLS IN EL-KUFRA AREA

Zahia M.A. Bobaeda[1*] and Fathi Elathram[2]

[1,2] College of Science, University of Benghazi, Kufra Branch
[*] elzoyezezenia@gmail.com

Abstract

The current research seeks to identify the quantitative analysis rates of the nitrate compound in the artificial river compared to groundwater wells in the Kufra region. The quantitative approach was relied upon in analyzing the study samples that were brought from three different areas of the Great River in Libya, and three other areas of groundwater areas in the Kufra Oasis. After subjecting the samples to quantitative analysis, we arrived at results including: Quantitative analysis of the compound “nitrate” from samples of the “man-made river” in Libya, which came at an average of (70.34) mg/L. As for the quantitative analysis of the compound “nitrate” in samples of “groundwater” in the “Kufra” oasis, it came at an average of (57.34) mg/L. Quantitative analysis of the compound “nitrite” from samples of the “man-made river” in Libya, which came at an average of (1) mg/L. As for the quantitative analysis of the compound “nitrite” in samples of “groundwater” in the “Kufra” oasis, it came at an average of (1) mg/L. Quantitative analysis of the compound “ammonia” from samples of the “man-made river” in Libya, which came at an average of (18.33) mg/L, which is a lower percentage than the average rate allowed in water, and the average percentage is (25) mg/L. While the trace percentage should not exceed (15) mg/liter, according to the World Health Organization. Quantitative analysis of the compound “ammonia” in “groundwater” samples in “Kufra” Oasis showed an average of (37.67) mg/L.

Quantitative analysis of the compound "cyanide" from samples of the "Man-Made River" in Libya, which showed an average of (0.034) mg/L. Quantitative analysis of the compound "cyanide" in "groundwater" samples in the "Kufra" oasis showed an average of (0.67) mg/l. It is also lower than the normal rate set by the World Health Organization.

Keywords: Nitrates; Nitrogen; man-Made river; groundwater; quantitative analysis; Inorganic compounds.

Introduction

Nitrogen compounds in natural waters are important in public health, agriculture, industry, and geochemistry. The numerous sources of nitrogen compounds and the

profound involvement of nitrogen in the vital processes of living organisms make the study of these compounds difficult. The theoretical end product in water and the compound most often identified is NO3−1. The concentration of nitrogen compounds ranges from 0.0 to > 100 parts per million (ppm) in surface waters and from 0.0 to > 1,000 ppm in groundwater. (Schrock, R. R., 2005).

Nitrate as a nitrogen compound is highly soluble in water and is commonly found in groundwater, and levels of 0.1 ppm to 3 or 4 ppm are not uncommon. Nitrates have no detectable taste or odor compared to normal substances in water, so nitrate removal operations must either be foolproof or involve extensive monitoring of the treated water. (SIRAH DUBOIS, 2018).

From this standpoint, the basic research aims to compare the quantitative proportions of the nitrate compound in artificial rivers and groundwater in wells, through a practical experiment on the (artificial river) in Libya, and groundwater in the "Kufra" oasis in Libya, in order to determine the current rates and the extent of their impact on the environment and the health of the population residing in those areas.

The Theoretical Framework of the Study

1- Basic Search Terms

- **Nitrate Compound**

Nitrate is a polyatomic ion, with the chemical formula NO3−, carrying a negative charge, and its molecular mass is 62.0049 g/mol. It is also an organic functional group of RONO2. (Wolfgang Laue, et.al, 2006)

- **Nitrogen**

Nitrogen is a chemical element in the periodic table with the symbol N and atomic number 7. It is colorless, tasteless, and odorless. It is usually inactive and in the form of a gas at standard temperature and pressure. It is also non-metallic and is in the form of a two-atom molecule. It forms many important compounds such as ammonia, nitric acid, and cyanide. It is also used in the manufacture of fertilizers. (Garrett, Reginald H., 1999).

- **Man-Made River**

The Man-Made River Project in Libya is the largest water transfer project in the world known to man so far. Technical, economic and social studies have shown the possibility of transferring these huge quantities of groundwater to areas where there are fertile agricultural lands, high population density and agricultural infrastructure, where about (6.5) One million cubic meters of fresh water per day for agricultural, industrial and drinking water purposes. More than 75% of it has been allocated for agricultural purposes 4) Groundwater:

2- Chemical Composition of Nitrate

Nitrates are salts as well as esters, which consist of nitric acid (HNO3). Salts belong to the chemical formula MINO3 where (MI: cation) is monovalent. The anion NO3− carries a negative charge. As for the nitric acid ester, it has the chemical formula R–O–NO2 (where R: organic molecule). One type of ester is nitroglycerin, which is a highly explosive substance, and its chemical name is "glycerol trinitrate." Any nitrate salt is formed by the union of a metal atom with a nitrate anion, while an ester is the union of an organic molecule with a nitrate anion. (Wolfgang Laue, et.al, 2006)

3- The Approved Global Healthy Levels of Nitrates in Fresh Water

European Union instructions regarding drinking water stipulate that the level of nitrates in one liter of water should not exceed 50 milligrams, a level that the European Union considers "safe" for consumer health. (Shaker, 2014)

4- Health Harms Resulting from an Increase in the Proportion of Nitrates in Fresh Water

Converting nitrates through chemical processes into nitrites causes several problems. The infant's stomach cannot process nitrite when this substance reaches his body, and at the same time it is difficult for him to inhale oxygen, which inevitably leads to cyanosis. Adults are exposed to the harmful effects of nitrates, as the interaction of nitrates with protein in the body leads to the production of nitrosamines. According to the German Cancer Research Center, there are experiments on animals that show a link between nitrosamines and stomach cancer. But so far, no relationship has been shown between nitrosamines and cancer in humans. Groundwater is also exposed to high pollution with nitrates through agriculture, as the excessive use of fertilizers in fields makes the soil unable to benefit from this amount of materials. The more agricultural land there is in a given area, the higher its nitrate levels. "The more polluted the groundwater is, the higher the cost of drinking water for the consumer," says Beatrice Klaus of the World Wide Fund for Nature. (World Wide Fund for Nature, 21-9-2018).

The Practical Aspect of the Study

1- Methodology

The method used in the current study is: quantitative analytical. This method helps in knowing the quantity or percentage of each inorganic nitrogenous compound in the study sample (fresh water), whether in artificial rivers or groundwater.

2- Search Samples

- The first sample: Water from the man-made river in Libya from its three regions (southeast - southwest - northern part).

- The second sample: Groundwater in the Kufra Oasis in Libya from its three regions: The eastern region, the sample was brought from the (Al-Taj) well. The central region, the sample was brought from the well (New Kufra). The western region, the sample was brought from the well (Al-Jawf Al-Gharbi Al-Hara).

3- Procedures

- **Bringing Samples**

Man-made river samples: Three samples were brought from three different areas of the river (the southeastern region - the southwestern region - the northern region). Also, three samples of groundwater from the wells located in “Al-Kufra” Oasis (east of the oasis - the central region of the oasis - west of the oasis).

- **Method and Technique and Tools for Measuring Nitrate Concentration in Water**

A. Method and technique: A high-performance liquid chromatography method called (HPLC) was used. This method is very sensitive and gives accurate results in separating compounds that are non-volatile or easily degradable at temperature.

In this analysis, the standards published by local and foreign organizations in accredited laboratories were followed with the accepted testing standards in the world.

B. The tool used: An excellent digital device, the DR/890 digital device for testing the percentage of nitrates in water. This device is easy to carry and move around, and the method of using it to test nitrates is easy, and it does not take up much space in the laboratory.

- **Steps to Measure Nitrate Concentration in Water**
  - Press PRGM 7 to check the percentage of nitrates in high concentration. PRGM will appear on the screen.
  - Pressing ENTER 51 will show you mg/L NO3-N and the ZERO icon.
  - Fill the sample up to 10 ml, and the pH of the sample must be adjusted before the test.
  - Place the contents of the Nitra Ver 5 test material, which is a powdery substance, in the sample and close it.
  - Press TIMER ENTER. The reaction with the substance will take one minute, during which stir the sample well.
  - After the minute ends, a 5-minute timer will appear. Press ENTER until the 5-minute reaction time begins.
  - Fill another sample with 10 ml in the second test bottle.
  - Place the sample in the device and cover it with the cover of the nitrate testing device.

- When the timing ends and the device whistles, press ZERO to zero the sample, as 0.0 mg/L NO3-N will appear on the device screen, meaning a reading of zero will be given.
- Place the prepared sample to which the nitrate test substance was added in the device and close it.
- Click on READ, where the reading for nitrates in NO3-N mg/l will appear.

- **Conduct Quantitative Analysis of Inorganic Nitrogen Compounds**

A quantitative analysis was conducted of the six samples brought from the study areas, in order to determine the proportions of inorganic compounds derived from nitrogen, by knowing the ratio of milligrams/liter of water. The quantitative analysis focused on compounds (nitrate, nitrite, ammonia, and cyanide). The results of the quantitative analysis were as shown in the following tables:

A. Quantitative Analysis of "Nitrate" Compound Levels in the two Study Areas (The Man-Made River and the Kufra Oasis in Libya)

Table (1): Results of Quantitative Analysis of Levels of the Compound "Nitrate" in the two Study Areas (The Man-Made River and the Kufra Oasis in Libya).

Nitrate concentration (mg/L)	**Samples of man-made river areas**
72	Southeast region
68	Southwest region
71	The northern area
70.34	Average concentration of river samples
Nitrate concentration (mg/L)	**Samples of groundwater areas**
55	East of the oasis
58	The middle part of the oasis
59	West of the oasis
57.34	Average concentration of river samples

Table (1) shows the quantitative analysis of the compound "nitrate" from samples of the "man-made river" in Libya, which came at an average of (70.34) mg/L, which is a slightly higher percentage than the normal percentage decided by the World Health Organization, which is (50) mg/L. This can be explained by the exposure of the sample areas to pollution resulting from the interaction of water with long-distance pipelines, and perhaps the water mixing with some pollutants due to population size or changing environmental conditions at the river level.

As for the quantitative analysis of the compound “nitrate” in “groundwater” samples in the “Kafra” oasis, it came to an average of (57.34) mg/l. This can be explained by the fact that although the water in the oasis is free of chemical pollution originating from the nitrate compound, most of the wells are exposed to environmental and physical pollution, since they are open and located in unorganized random areas, and the majority of the water quantities in the oasis are used directly for irrigation operations in On farms, it is not used directly for drinking, but is transported to water treatment factories to be refined, purified, and treated before the population uses it. This explains the establishment of many water refining and bottling factories in those areas. Chart (1), (2) illustrates this:

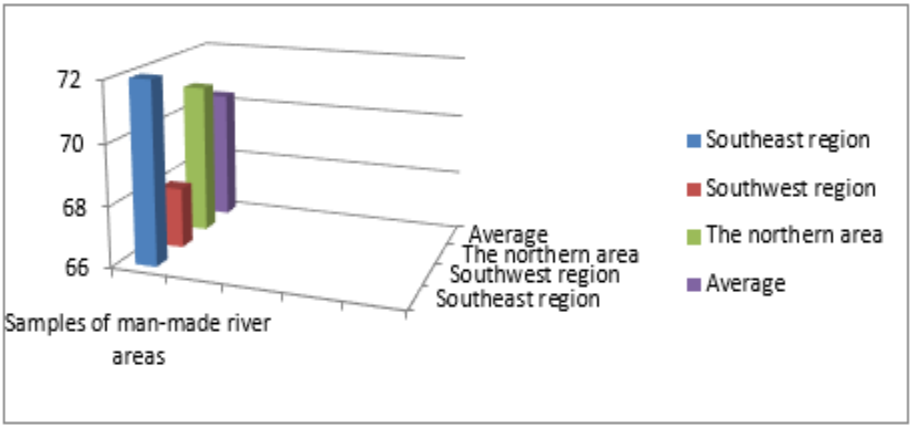

Figure (1): Shows the Quantitative and Average Analysis of Concentrations of "Nitrates" in Samples from the Great River in Libya.

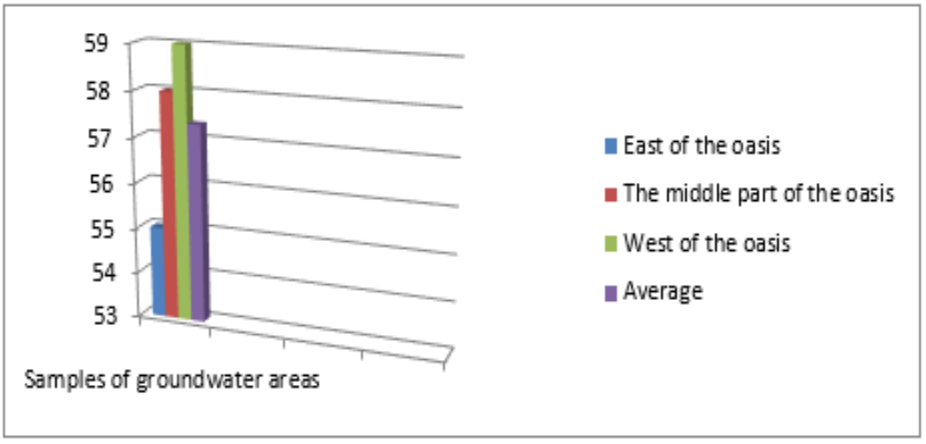

Figure (2): Shows the Quantitative and Average Analysis of Concentrations of "Nitrates" in Samples from Samples of Groundwater Areas in Libya.

B. Quantitative analysis of the levels of the compound "nitrite" in the two study areas (the Man-Made River and "Al-Kufra" Oasis in Libya

Table (2): Results of Quantitative Analysis of Levels of the Compound "Nitrite" in the Two Study Areas (The Man-Made River and the Kufra Oasis in Libya).

Nitrite concentration (mg/L)	Samples of man-made river areas
1	Southeast region
2	Southwest region
0.0	The northern area
1	Average concentration of river samples
Nitrite concentration (mg/L)	**Samples of groundwater areas**
0.0	East of the oasis
1	The middle part of the oasis
2	West of the oasis
1	Average concentration of river samples

Table (2) shows the quantitative analysis of the compound "nitrite" from samples of the "man-made river" in Libya, which came at an average of (1) mg/l, which is a small percentage that does not represent a danger to the environment and the lives of the population, as nitrite levels exceeding (1) mg /l in water leads to great risks, because it turns into compounds known as nitrosamines, which are known to cause cancer.

As for the quantitative analysis of the compound "nitrite" in the "groundwater" samples in the "Kafra" oasis, it came at an average of (1) mg/l. Although this percentage increased in samples from the western region of the oasis, this can be explained by the negligence of residents in those areas in disinfecting the areas near the wells. This percentage is a dangerous indicator, and may represent health damage to the residents of those areas in the short term. Chart No. (3), (4) illustrates this:

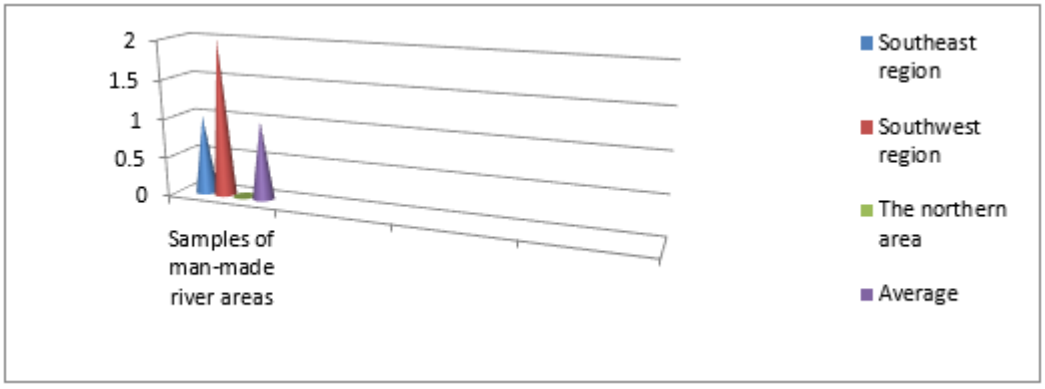

Figure (3): Shows the Quantitative and Average Analysis of Concentrations of "Nitrite" in Samples from Samples of Groundwater Areas in Libya.

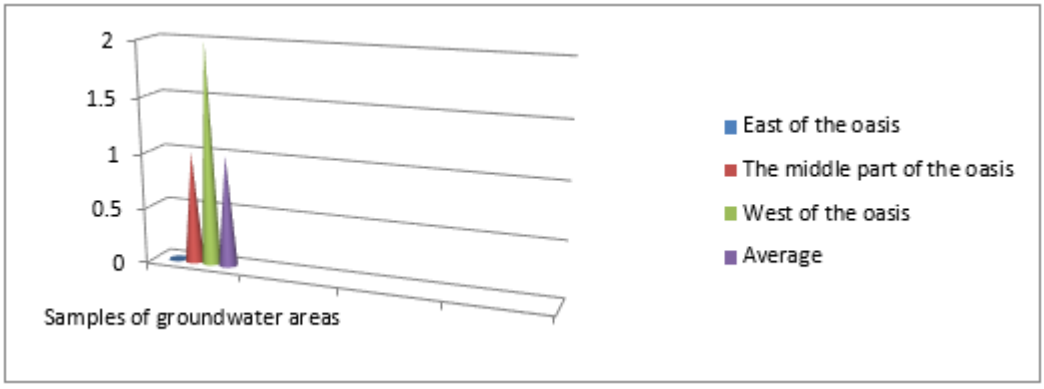

Figure (4): Results of Quantitative Analysis of Levels of the Compound "Nitrite" in the Two Study Areas (The Man-Made River and the Kufra Oasis in Libya).

C. Quantitative Analysis of the Levels of the Compound "Ammonia" in the Two Study Areas (The Man-Made River and the Kufra Oasis in Libya

Table (3): Results of Quantitative Analysis of Levels of the Compound "Ammonia" in the Two Study Areas (The Man-Made River and the Kufra Oasis in Libya).

Ammonia concentration (mg/L)	**Samples of man-made river areas**
18	Southeast region
16	Southwest region
21	The northern area
18.33	Average concentration of river samples
Ammonia concentration (mg/L)	**Samples of groundwater areas**
37	East of the oasis
40	The middle part of the oasis
36	West of the oasis
37.67	Average concentration of river samples

Table (3) shows the quantitative analysis of the compound "ammonia" from samples of the "Man-Made River" in Libya, which came at an average of (18.33) mg/L, which is a lower percentage than the average rate allowed in water, as the average percentage is (25) mg/L. While the trace percentage should not exceed (15) mg/L according to the World Health Organization, the sample percentages are close to the trace level, not exceeding (15) mg/L. This can be explained by the fact that ammonia does not react much here, because if it does react, it will cause many problems, because it is highly soluble in water. It forms a solution known as ammonium hydroxide, NH4OH.

Ammonia is not very effective when it is dry, but when it dissolves, it reacts with many chemicals.

the quantitative analysis of the compound “ammonia” in the “groundwater” samples in the “Kafra” oasis, it came in at an average of (37.67) mg/L. It is a percentage between the high rate (50) mg/L and the average rate (25) mg/L. This average percentage represents a kind of risk, as.:Aqueous ammonia, when used in water, causes inflammation and irritation of the skin, eyes, nose, throat, and upper respiratory system, and in a few cases in people with weak immune systems, it may lead to poisoning. Chart No. (5), (6) illustrates this:

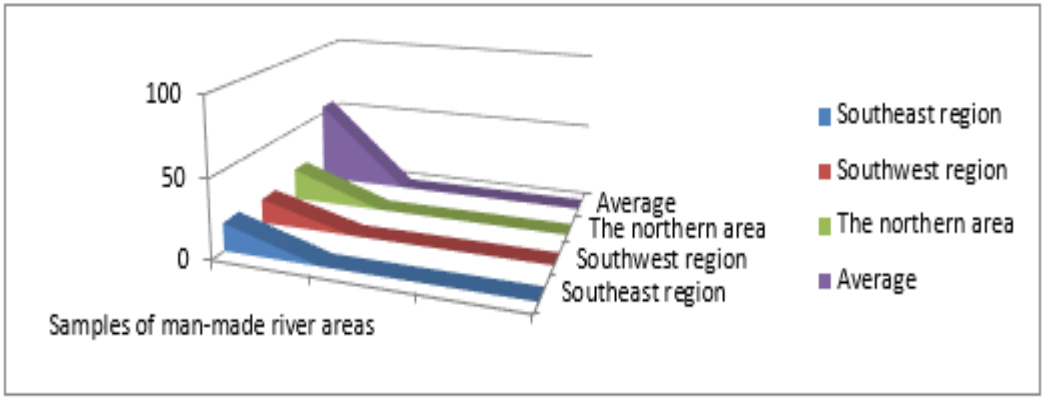

Figure (5): Shows the Quantitative and Average Analysis of Concentrations of "Ammonia" in Samples from Samples of Groundwater Areas in Libya.

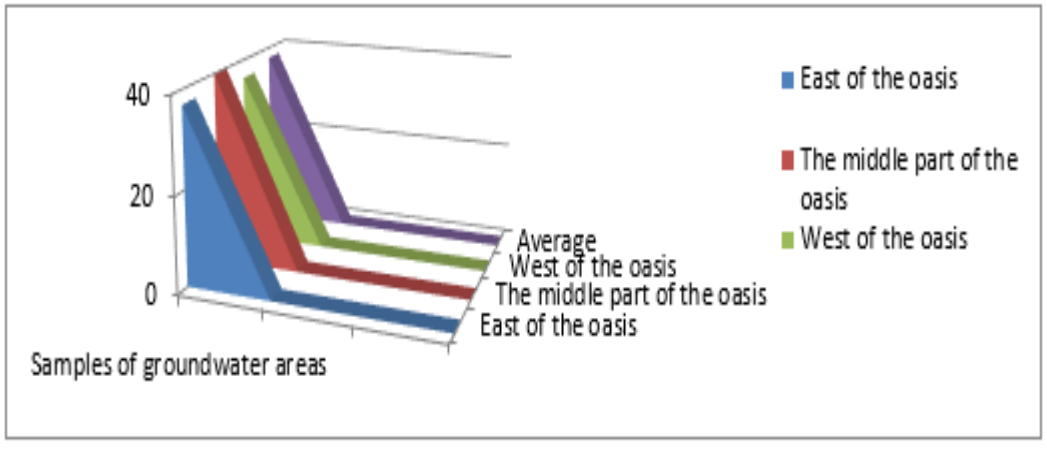

Figure (6): Results of Quantitative Analysis of Levels of the Compound "Ammonia" in the Two Study Areas (The Man-Made River and the Kufra Oasis in Libya).

D. Quantitative Analysis of the Levels of the Compound "Cyanide" in the Two Study Areas (The Man-Made River and the Kufra Oasis in Libya: Cyanide

Table (4): Results of Quantitative Analysis of Levels of the Compound "Cyanide" in the Two Study Areas (The Man-Made River and the Kufra Oasis in Libya).

Ammonia concentration (mg/L)	**Samples of man-made river areas**
1	Southeast region
0	Southwest region
0	The northern area
0.034	Average concentration of river samples
Ammonia concentration (mg/L)	**Samples of groundwater areas**
1	East of the oasis
1	The middle part of the oasis
0	West of the oasis
0.67	Average concentration of river samples

Table (4) shows the quantitative analysis of the compound "cyanide" from samples of the "Man-Made River" in Libya, which came at an average of (0.034) mg/L, which is a lower percentage than the normal percentage specified by the World Health Organization as not to exceed (1) mg/L. The quantitative analysis of the compound "cyanide" in "groundwater" samples in the "Kafra" oasis showed an average of (0.67) mg/l. It is also less than the normal percentage set by the World Health Organization, and this can be explained by the fact that the compound "cyanide" is extremely dangerous and deadly, as the toxic compounds containing cyanide are: hydrogen cyanide gas and a number of cyanide salts.

Cyanide is considered one of the most dangerous toxic substances to humans, as dealing with it requires a high degree of knowledge and safety, as cyanide can lead to death within a few seconds. Only 0.2 grams of cyanide, which is equivalent to 10 atoms of sugar, is enough for a person to die within just seconds. Chart No. (7), (8) illustrates this:

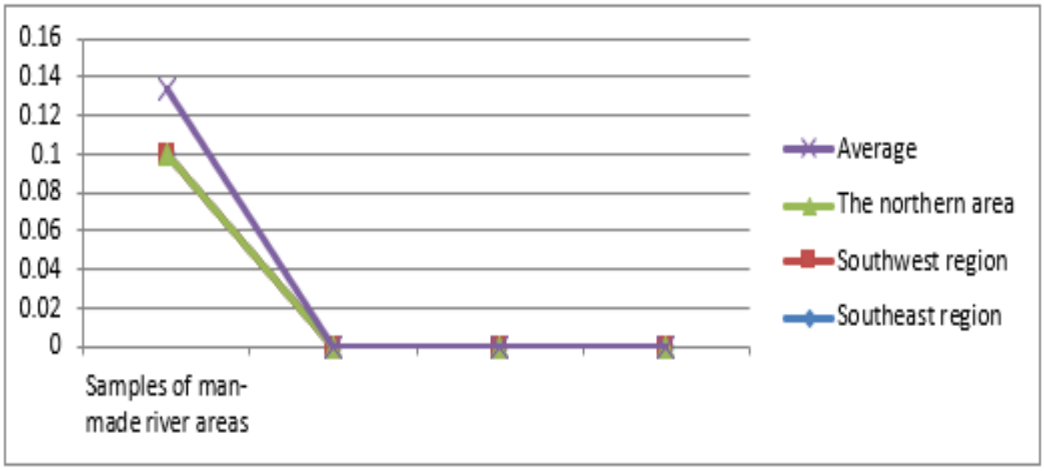

Figure (7): Shows the Quantitative and Average Analysis of Concentrations of " Cyanide " in Samples from Samples of Groundwater Areas in Libya.

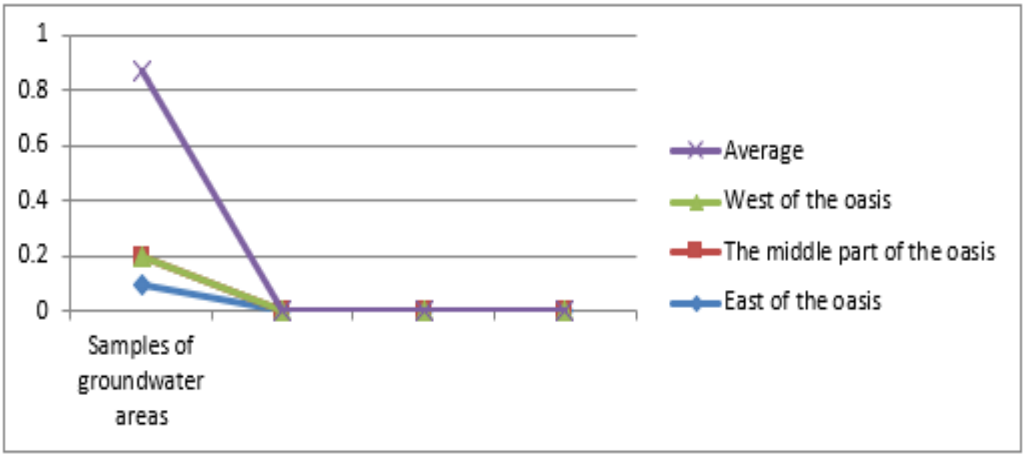

Figure (8): Results of Quantitative Analysis of Levels of the Compound " Cyanide " in the Two Study Areas (The Man-Made River and the Kufra Oasis in Libya).

Recommendations

Through the results of the study, we present procedural recommendations that will improve the degrees and level of water purity in wells in groundwater areas:

- Be careful not to mix wastewater with well water, to prevent the formation of solid and toxic compounds.
- Preserving wells from pollution that leads to the transformation of the “nitrate” compound into the “nitrite” compound, which leads to damage to the environment and human health.

- Periodic examination of water samples in groundwater areas to ensure that they are free of deadly levels of cyanide.
- Covering open wells in the Libyan oases to prevent environmental and physical pollution.
- -Treating irrigation water used from oases for farms to reduce levels of pollution that pose a threat to human and animal health.

References

- Garrett, Reginald H. (1999). Biochemistry (2nd ed.). Fort Worth: Saunders College Publ. ISBN 0030223180.

- Schrock, R. R. (2005). "Catalytic Reduction of Dinitrogen to Ammonia at a Single Molybdenum Center". Acc. Chem. Res. 962–955 :12 .

- Shaker, Muhammad Taher, (2014)." Health Risks of Nitrates in Drinking Water", Journal of Scientific Studies, Volume 6, April 2014.

- SIRAH DUBOIS (2018), "The Truth about Nitrates" - Fruits & Vegetables That Are High in Nitrates" ،www.livestrong.com, Retrieved 14-11-2018.

- Wolfgang Laue, Michael Thiemann, Erich Scheibler, Karl Wilhelm Wiegand (2006). "Nitrates and Nitrites" in Ullmann's Encyclopedia of Industrial Chemistry.