Journal of Chemical Health Risks

www.jchr.org

JCHR (2023) 13(3), 1036-1046 | ISSN:2251-6727

Environmental Assessment of the Impact of Water Pollution in the Bahar Al Najaf on Plants

Safaa M. Almudhafar[1], Russel Alaa Mohsen[2], Basim A. Almayahi[3]

[1,2]Department of Geography, Faculty of Arts, University of Kufa, Najaf, Iraq

[3]Department of Physics, Faculty of Science, University of Kufa, Najaf, Iraq

(Received: 04 August 2023 Revised: 12 September Accepted: 06 October)

KEYWORDS

Water Pollution, Gulf of Najaf, Plant Pollution, Environmental Impact Water Quality

ABSTRACT:

This study focuses on the environmental impact of water pollution in the Gulf of Najaf on plants. Water is a fundamental natural resource, and its quality is essential for the well-being of ecosystems and human societies. Water pollution has become a significant concern, posing threats to both human health and the environment. In this context, the research explores the specific issue of how water pollution affects plant life in the Gulf of Najaf, an area of great economic and ecological importance. The study analyzes the characteristics of plants and assesses the extent of pollution's impact on them. It also investigates the spatial and temporal variations in water quality and their relationship with plant pollution. Field samples were collected during the summer and winter, and laboratory analysis was conducted. The results are compared with international and local standards to evaluate the environmental quality of the study area.

Introduction

Water is one of the most important components of the natural ecosystem, and it plays a prominent role in determining the suitability of areas for human settlement or economic investment. Since ancient times, humans have been searching for sources of water in all its forms to establish themselves in these areas and utilize water for agriculture, industry, drinking, and all vital activities. The Quran emphasizes the significance of water in life, stating, "And We made from water every living thing," which serves as a clear testament to the importance of water in all its forms.

It is undeniable that water pollution is one of the most critical issues that receive a high level of attention and concern. This is because water faces increasing pressures from individuals and institutions, leading to pollution and mismanagement. Due to these pressures, water pollution has emerged as a significant environmental problem that requires continuous efforts to address and prevent further degradation of this vital resource. The continuation of water pollution can lead to the deterioration of water quality if left untreated and improperly managed, posing a significant threat to humans and other living organisms, including plants [1]. Researchers from various disciplines must address and study this issue. Geographers, in particular, should focus on the problem of water pollution. The Najaf Bahar, located adjacent to the Euphrates River just 15 kilometers away, is a vital natural resource and a distinct topographical feature. It suffers from environmental pollution in general and the pollution of plants in particular. This research aims to explore the environmental impacts resulting from water pollution in the Bahar on plants [2].

This is achieved by studying and analyzing the characteristics of plants and assessing the extent of the impact of this pollution on them. The research also aims to elucidate the impact of water pollution on aquatic and shoreline plants. Samples were collected from different locations during the summer (July) and winter (January). The results will help determine whether the environmental components in the study area are suffering from an increase in pollutants and whether polluted water affects plant characteristics. This will be accomplished

Journal of Chemical Health Risks

www.jchr.org

JCHR (2023) 13(3), 1036-1046 | ISSN:2251-6727

by comparing the findings with international and local standards [3].

First: Research Problem

In this research, the researcher investigates the reality of water pollution in the Bahar of Najaf concerning chemical and physical elements and whether they affect plants. Therefore, the research problem can be summarized as follows:

What is the impact of sea water on plant pollution?

Do the properties of water in the Bahar of Najaf vary spatially and temporally, and does this variation affect plant pollution?

Second: Study Hypothesis

The hypothesis is a proposed solution to the research problem that the researcher temporarily holds by formulating sub-hypotheses as follows:

Chemical and physical elements have a clear impact on plant pollution in the Bahar of Najaf.

The qualitative characteristics of water in the Bahar of Najaf vary spatially and temporally, and this variation affects plant pollution.

Third: Objectives of the Study

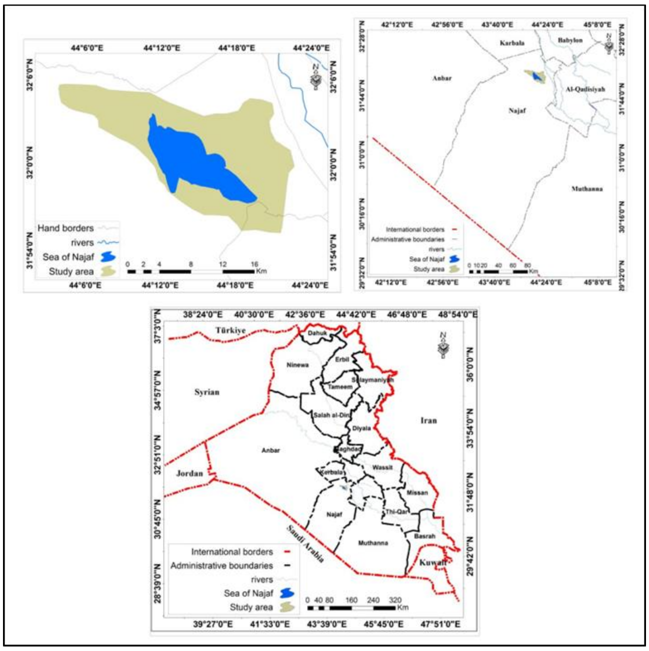
The study aims to elucidate the impact of chemical and physical elements on the pollution of plants in the Bahar of Najaf to determine spatial and temporal variations in water pollution. This will be achieved by identifying pollutants through field sampling, laboratory analysis, and subsequently, using the laboratory results to assess the spatial and temporal variations. The study also aims to assess the suitability of this water for various human uses by comparing it to global and local standards [4].

Fourth: Study Significance and Justification

The importance of the study lies in the fact that the Bahar of Najaf is an important economic and tourist resource for the province and neighboring provinces. The Bahar is facing environmental pollution problems, primarily due to industrial and urban activities, and these problems need to be addressed, given the significance of Najaf as a destination for millions of religious visitors. Therefore, the Bahar is a vital tourist attraction that requires attention. Furthermore, the study area lacks specialized studies on sea water pollution, making this research highly important and deserving of attention [5, 6].

Fifth: Location of Study Area

The study area (Bahar of Najaf) is located in the northeastern part of Najaf Province, west of the city center of Najaf. It is bordered by Tareq Al-Najaf to the north and east, extending for a distance of 44 km. To the northwest, it is bounded by the southern boundaries of the coastal hills, and to the south, it is bordered by the Al-Hira district. The total area of the study area is 281.949 square kilometers, with geographical coordinates ranging between 50° 29' - 32° 21' N latitude and 50° 42' - 44° 44' E longitude on the map.



Map (1): Spatial Boundaries of the Study Area [7]

Journal of Chemical Health Risks
www.jchr.org
JCHR (2023) 13(3), 1036-1046 | ISSN:2251-6727

The Impact of Sea Water Pollution on Plants

Through field observation, it was revealed that the natural vegetation in the Bahar of Najaf region is characterized by low density and diversity, which can be attributed to climate factors and soil quality. Moisture and temperature conditions are the primary influencing factors in this regard. A strong correlation was observed between actual rainfall values and the dominant plant cover type. The researcher conducted a study of some plants in the study area for both the summer and winter seasons on July 3, 2023, and January 20, 2022, respectively.

Field observations included taking plant samples, with a focus on important species such as reeds, rushes, and tamarisk, which are prevalent in the region, as well as palm trees. The study concentrated on analyzing the concentrations of chemical elements and heavy metals in these plants within the study area. These plants are crucial as they serve as a source of food for various living organisms. Notably, reeds and rushes are among the most widespread plant species in the region, known for their resilience to harsh conditions [12].

The increasing levels of pollution in the aquatic environment have led to higher concentrations of certain toxic elements in these plants. The danger of these elements lies in their potential bioaccumulation in the food chain. Pollution of the food supply with these metals can lead to their accumulation in tissues, causing various diseases. The danger also lies in the fact that the effects may not be immediately apparent but may manifest after a long period [13].

These toxic elements find their way into different parts of the plants from the environment in which they grow, mainly through the roots that absorb them. Additionally, they can be transferred from polluted air above the surface of the leaves, and then they can penetrate the plant's tissues. These accumulations of toxic elements in plant parts make these plants harmful to animals that feed on them. The toxins can further move through the food chain to humans, causing several diseases [14][15].

Through the study in the third section, it became clear that the waters of the Bahar of Najaf have a significant impact on the deterioration of plant quality. This is determined by assessing the increase in concentrations, which can reach hazardous levels according to international and local standards. This pollution affects the surrounding environment directly and indirectly, impacting its safety.

To understand the environmental consequences of various pollutants in the waters of the Bahar, it is essential to study and analyze the plants present in the study area to determine the extent of the impact of these pollutants on them [16][17].

Reed Plant

Through field observations, it was noticed that this type of plant has all or some of its parts protruding above the water surface and is abundant in the waters of the Bahar of Najaf, as mentioned in the second chapter (Natural Plants). However, these plants do not grow in the deep parts of the water, where the depth of the water prevents their growth and root development [18].

Table (1) shows that the Electrical Conductivity (EC) concentration in reed plants reached 17.3 deciSiemens per meter (dS/m) for the month of July and 15.3 dS/m for the month of January. When compared to the international standard in Table (2), which is 10.3 dS/m, it becomes evident that the EC for reed plants exceeds the international standard. Thus, its impact on these plants is high for both seasons. This is due to the increased biological activity in plants during the summer season, leading to higher nutrient absorption rates necessary for plant growth. Additionally, a significant amount of water is drawn due to elevated temperatures and increased transpiration rates from the leaves, along with the rising concentrations of elements and salts in the soil and water during the summer season. In contrast, during the winter season, biological activity in plants decreases, resulting in lower nutrient and water absorption. This is also accompanied by lower concentrations of elements and salts in the soil and water during the winter season, along with the rise in sea water levels, leading to a smaller increase in concentrations compared to the summer season.

Table (1) also indicates that the concentration of Total Dissolved Solids (TDS) in reed plants was 4518.4 ppm for the month of July and 2418.8 ppm for the month of January. When compared to the international standard in Table (3), which is 2000 ppm, it is significantly higher than the international standard. This high concentration poses a significant risk to the plants in the study area and may lead to osmotic pressure, causing salts to accumulate in the soil. This can gradually lead to the death of the plant, as observed in the field (Image 1), where the reed

Journal of Chemical Health Risks
www.jchr.org
JCHR (2023) 13(3), 1036-1046 | ISSN:2251-6727

plants in the study area during the summer season were just bare stems without leaves in all study areas.
Furthermore, the sodium (Na) concentration reached 752.32 ppm for the month of July and 540.22 ppm for the month of January. When compared to the international standard, which is 200-0 ppm, as shown in Table (3), it is higher than the allowed limit. This indicates a high concentration of sodium in the plant's body, which may affect its growth if the sodium concentration is too high.

Table (1): Concentrations of Chemical Elements in Plants from the Study Area 2022-2023 (PPM)

Sample Type	**EC July**	**EC January**	**T.D.S July**	**T.D.S January**	**Na July**	**Na January**	**Ca July**	**Ca January**	**K July**	**K January**	**Mg July**	**Mg January**
Al-Qasab	17.3	15.3	4518.4	2418.8	752.32	540.22	660	764	2573.12	1870.10	360.8	300
Al-Burdi	40.4	35.4	5220	5220	680	560	1220	983	978	820	997	780
Al-Turfa	87.4	76.3	6704	3210	2230	6704	1296	1120	962	790	1160	1110
Golan	40.8	35.3	4560	3120	450	410	1200	996	970	890	980	870
Date Palms	45.8	29.8	6520	4850	790	560	780	569	4320	3810	670	569

Table (2): Permissible Limits for Electrical Conductivity Concentration in Plants According to the American Salinity Laboratory [8]

Electrical conductivity (EC) decimens/m	**Plants**
22	Blink
8	Papyrus
10.3	cane
18	Palm
13	Golan

Table (3) Permissible Concentration Limits of Chemical and Heavy Elements in Plants [8, 9]

Element Name	**T.D.S PPM**	**Na PPM**	**Ca PPM**	**Mg PPM**	**K PPM**	**Cl PPM**	**SO4 PPM**	**Pb Micrograms/Gram**	**Cd Micrograms/Gram**	**Al Micrograms/Gram**
Worldwide Standard	2000	20-200	400	15-150	150-100	300	200	10	1	1000

Journal of Chemical Health Risks
www.jchr.org
JCHR (2023) 13(3), 1036-1046 | ISSN:2251-6727


Picture (1) is of sugarcane in the summer season (Bahr al-Najaf)

Calcium in this plant reached 660 ppm in July and 476 ppm in January. This concentration is very high for sugarcane according to the worldwide standard for plants in Table (3), which is 400 ppm. It has a negative impact on the plant as it leads to stunting and hinders proper growth, causing leaf drop. Furthermore, the chemical analysis of magnesium (Mg) in sugarcane (Table 1) shows a concentration of 360.8 ppm in July and 300 ppm in January. This concentration exceeds the worldwide standard for magnesium in plants, which is 15-150 ppm. This increase in concentration greatly affects the green color of the plant.
The concentrations of potassium (K) in sugarcane were 2573.12 ppm in July and 1870.10 ppm in January, as per Table (4). When compared to the worldwide standard in Table (3), it is evident that the concentration of Cl reached 582.2 ppm in July and 360.2 ppm in January, exceeding the worldwide standard of 300 ppm.
For both seasons, the concentration of SO4 in sugarcane was 850.88 ppm in July and 653.40 ppm in January. This concentration is higher than the worldwide standard in Table (3), which is 200 ppm, and it negatively impacts the plant by causing root zone toxicity and osmotic pressure increase, ultimately leading to the physiological death of the plant. This was observed in most study sites.
The concentration of Pb in sugarcane reached 77.80 and 60.50 micrograms/gram of dry weight in July and January, respectively. This concentration is significantly higher than the worldwide standard in Table (3) of 10 micrograms/gram of dry weight, causing plant death and yellowing. As for aluminum (Al), its concentration in sugarcane was 890 micrograms/gram of dry weight in July and 750 micrograms/gram of dry weight in January. When compared to the worldwide standard of 1000 micrograms/gram of dry weight, this concentration is acceptable globally.
However, the concentration of cadmium (Cd) in the plant exceeded the allowed limit for natural growth, measuring 22.3 and 18.5 micrograms/gram of dry weight for the two seasons, respectively. This exceeds the permissible limit of 1 microgram/gram of dry weight.
By comparing the laboratory analysis results in Table (1) and (3) with the permissible limits for chemical and heavy element concentrations in animal feed and feed products according to the General Authority for Food and Drug (SFDA) standards, it is evident that sugarcane is not suitable for use as animal feed due to the excessive concentrations of all elements in both seasons. However, sugarcane is suitable for use as green feed according to the aluminum concentration only, as it did not exceed the permissible limits worldwide. Therefore, using sugarcane as green feed will lead to the accumulation of pollutants in the organisms that feed on it within the marine environment, which can then transfer to humans through the food chain.

Table (4) shows the concentrations of heavy elements in plants from the study area for the year 2022-2023 in micrograms/gram.

Sample	July CL	January CL	July SO4	January SO4	July Pb	January Pb	July AL	January AL	July Cd	January Cd
Al-Qusab	582.2	360.2	653.40	850.88	77.80	60.50	890	750	22.3	18.5
Al-Burdi	1120	995	1538	1120	100	90.2	1200	1116	20.5	12.17
At-Tarfa	970	910	1200	9040	98.80	80.10	320	310	18.5	16.3
Golan	1130	1110	960	790	110.2	97.20	994	940	33.7	18.2
Nakhil	1230	997	1310	860	45	34.20	1340	1210	32.2	20.8

This plant is widely distributed in arid and semi-arid regions, with a higher prevalence in marshes and wetlands [10]. During the field visit to the study area, the growth of Tarfa plants was observed near water sources. Table (1) displays the concentration of electrical conductivity (EC) in Tarfa plants, which was 87.4 decisiemens/meter during the summer and 76.3 decisiemens/meter in the winter. When compared to the international standard in Table (2) of 22 decisiemens/meter, it is evident that the concentration exceeds the allowable limit for the plant, even though this plant is known for its tolerance to high salinity. The total dissolved solids (TDS) concentration in Tarfa plants reached 6704 PPM in the summer and 3210 PPM in the winter, surpassing the international standard of 2000 PPM as shown in Table (2).

The sodium (Na) concentration in Tarfa plants was 2230 PPM in the summer and 6704 PPM in the winter, significantly exceeding the international standard range of 20-200 PPM. The calcium (Ca) concentration in Tarfa plants for July and January was 1296 PPM and 1120 PPM, respectively, both considerably higher than the international standard of 400 PPM in Table (3), even though this plant is known for its high salinity tolerance. The magnesium (Mg) concentration for the summer was 1160 PPM, and for the winter, it was 1110 PPM. When compared to the international standard range of 15-150 PPM in Table (3), it is evident that these concentrations are significantly higher. The potassium (K) concentration for the summer and winter was 962 PPM and 790 PPM, respectively, surpassing the international standard range of 100-150 PPM.

As for the heavy elements, lead (Pb) showed the highest concentration in Tarfa plants during July, reaching 98.80 micrograms/gram of dry weight. In January, the concentration dropped to 80.10 micrograms/gram. When compared to the international standard of 10 micrograms/gram of dry weight, it is clear that these concentrations are above the allowable limit. Aluminum (Al) had the lowest concentration, reaching 320 micrograms/gram in July and 310 micrograms/gram in January, which is lower than the international standard of 1000 micrograms/gram of dry weight. Cadmium (Cd) had concentrations of 18.5 and 16.3 micrograms/gram for July and January, respectively, exceeding the international standard.

It is evident that all the elements showed elevated concentrations exceeding the international standard for normal levels in plants, except for aluminum. Tarfa plants, in their natural physiology, absorb salts from the soil and thrive in saline soil and water. However, at such high concentrations, it affects the animals that depend on them for food, making them unpalatable, and the plant cannot absorb additional salts from the soil and water since the salinity concentrations in the plant itself are already high. Consequently, this leads to the death of the plants, as depicted in Figure (2).

J - Al-Burdi Plant:

The Al-Burdi plant is another important plant in the environment of the marshes of Al-Najaf due to its significant role in the ecosystem. It ranks second in importance after the reed plant for both animals and humans. It is considered good fodder for animals. Seasonal variations in the concentrations of chemical and heavy elements in the Al-Burdi plant are evident from Table (1)(4). These concentrations increase during the summer and decrease during the winter, varying from one element to another.

From Table (1), it is apparent that the electrical conductivity (EC) in the Al-Burdi plant reached 40.4 decisiemens/meter in July and 35.4 decisiemens/meter in January. When compared to the international standard in

Journal of Chemical Health Risks

www.jchr.org

JCHR (2023) 13(3), 1036-1046 | ISSN:2251-6727

Table (2) of 8 decisiemens/meter, it is noticeable that the EC concentration is higher than the normal limit. This elevated concentration led to a reduction in the growth of the Al-Burdi plant. The total dissolved solids (TDS) concentration in the Al-Burdi plant was 5220 PPM for July and January, as shown in Figure (1), exceeding the international standard in Table (3) of 2000 PPM.

The sodium (Na) concentration in the Al-Burdi plant during the summer was 680 PPM, and during the winter, it was 560 PPM. When compared to the international standard, it is noticeable that these concentrations are also above the allowable limit.

Image (1) - The Impact of Seawater Pollution on Tarfa Plant

In accordance with the international standard ranging from 200 to 20 ppm in Table (3), it is observed that the concentration is not permissible. This concentration exceeds the natural limit required in plants, affecting the growth and reproduction of the plant. As shown in Table (1), the calcium (Ca) concentration in this plant reached 1220 ppm in the summer and 983 ppm in the winter. When compared to the international standard for plants in Table (3) of 400 ppm, it is evident that this concentration is significantly above the natural limit, thus slowing down the plant's growth.

The magnesium (Mg) concentration for the summer was 997 ppm, and for the winter, it was 780 ppm. When compared to the international standard in Table (3) ranging from 15 to 150 ppm, it is evident that the concentration is significantly higher than the required level in the plant. The potassium (K) concentration for the summer in the Al-Burdi plant was 978 ppm, and for the winter, it was 820 ppm. When compared to the international standard in Table (3) ranging from 100 to 150 ppm, it is noticeable that the concentration is significantly higher, causing damage to the plant.

As seen in Table (4), the concentration of chlorine (Cl) in the same plant for July reached 1120 ppm, and for the winter, it was 995 ppm. When compared to the international standard of 300 ppm, it is clear that the concentration is significantly higher than the natural limit. The sulfate (SO_4) concentration in the Al-Burdi plant for July was 1538 ppm, exceeding the international standard in Table (3) of 200 ppm. It also increased to 1120 ppm in January, as indicated in the analysis results in Table (4).

It is evident from the laboratory analysis results when compared to the permissible limits for element concentrations in feed and fodder products according to the General Authority for Food and Drugs (SFDA) standards, that Al-Burdi is not suitable for animal consumption due to the concentrations of all elements exceeding the permissible limits for both seasons.

Plant Al-Jolan is one of the most important forage plants for animals due to its short stature, evergreen nature, and its soft stems and leaves [11]. This means that all parts of the plant are edible in its natural state. However, according to the analysis results, it has been shown that the plant is not suitable for use. As shown in Table (1), the concentration of electrical conductivity (EC) in Al-Jolan plant for the summer season reached 40.8 decisiemens per meter (dS/m), while it was 35.3 dS/m for

Journal of Chemical Health Risks
www.jchr.org
JCHR (2023) 13(3), 1036-1046 | ISSN:2251-6727

the winter season. When compared to the international standard for plants in Table (61), which is 13 dS/m, it is clear that this concentration is not permissible.
The concentration of total dissolved solids (T.D.S) for the Al-Jolan plant in the summer season reached 4560 ppm, while it was 3120 ppm for the winter season. According to the international standard for T.D.S concentration in Table (62), it is evident that this concentration is not permissible. The sodium (Na) concentration reached 450 ppm for the summer season and 410 ppm for the winter season. When compared to the international standard in Table (62), it is higher than the standard. Similarly, from Table (60) and Figure (4), the calcium (Ca) concentration for the summer season reached 1200 ppm, and for the winter, it was 996 ppm. When compared to the previously mentioned international standard, it is higher than the international standard and is not permissible.
The magnesium (Mg) concentration for the Al-Jolan plant in the summer season was 980 ppm, while it was 870 ppm for the winter season. When compared to the previously mentioned international standard, it is evident that the concentration is very high compared to the standard, and this increase significantly affects the plant. As shown in Table (1), the potassium (K) concentration for both the summer and winter seasons reached 970 ppm and 890 ppm, respectively. When compared to the international standard, it is evident that it exceeds the permissible limits.
Additionally, the chlorine (Cl) concentration for the summer reached 1130 ppm, while it reached 1110 ppm for the winter season. When compared to the previously mentioned international standard, it is evident that it exceeds the permissible limits. The sulfate (SO4) concentration in Al-Jolan plant for both the summer and winter seasons reached 960 ppm and 790 ppm, respectively. When compared to the international standard, it is higher than the international standard.
There were variations in the accumulation of heavy elements in the Al-Jolan plant, with lead (Pb) showing a high amount of accumulation. The concentration during the summer season reached 110.2 micrograms per gram (µg/g) of dry weight, while it decreased to 97.20 µg/g during the winter season.
The lowest accumulation of heavy elements in the plant was for cadmium (Cd), with a concentration of 33.7 µg/g during the summer season and 18.2 µg/g during the winter season.
As for aluminum (Al), its concentration was 994 µg/g for the summer and 940 µg/g for the winter, within the permissible limits and not exceeding the standard, as indicated in Table (2).
It is clear from the above information that when comparing the laboratory analysis results with the international standard for each element and the permissible limits for element concentrations in feed and fodder products according to the General Authority for Food and Drugs (SFDA) standards, it is evident that Al-Jolan is not suitable for animal consumption due to exceeding the permissible limits for all elements and for both seasons, except for aluminum as it does not exceed the permissible limits.
Thirdly: The Impact of Seawater Pollution on Palm Trees:
The salinity of the waters of the Najaf Sea affects palm trees, and the deterioration of water quality and the increase in salinity over time are among the reasons behind the success of palm cultivation and its productivity. However, they have had a negative impact on the death of palm trees in very large numbers (Palm Cemetery). See Image (2).
Palm fronds were analyzed to determine the salt concentration during both the summer and winter seasons. Palm trees can grow in various types of soil, but palm productivity is directly related to soil fertility. Palm trees can grow in saline soils up to 3%, but it is best if the salinity does not exceed 1%. They can also grow in alkaline or calcareous soil.
Image (2): The Impact of Water Pollution on Palm Trees
And with relatively near-surface water levels (4). A model of palm fronds was analyzed for both the summer and winter seasons. Table (1) shows a clear variation in the concentrations of elements, with an increase in July and a decrease in January. This increase is attributed to the high temperatures during the hot season, as well as intense evaporation, a decrease in water levels, and an increase in salinity. From Table (1), it's evident that the electrical conductivity (EC) of palm fronds in July was 45.8 decisiemens/m. Comparing these concentrations with the international standard in Table (2), which is 18 decisiemens/m, it is clear that the values are high and not permissible for July. This is due to the calcareous soil type and its high salinity. This increase significantly

Journal of Chemical Health Risks
www.jchr.org
JCHR (2023) 13(3), 1036-1046 | ISSN:2251-6727

hinders the natural growth of palm fronds. On the other hand, concentrations decrease in January, reaching 29.8 decisiemens/m. Comparing these concentrations with the earlier international standard reveals that the analysis results exceed the permissible limit. Despite the drop in temperatures and evaporation, the analysis results show an increase in concentrations even in January.

For July, the total dissolved solids (TDS) concentrations reached 6520 ppm, which is much higher than the earlier international standard of 2000 ppm. However, these concentrations decreased in January to 4850 ppm, but they still exceeded the international limit. This increase in total dissolved solids has a negative effect on palm trees, as it leads to a significant reduction in the nitrogen content of palm fronds, affecting their appearance and color (5).

In July, sodium (Na) concentrations reached 790 ppm, while in January, they decreased to 560 ppm. These concentrations are much higher than the earlier international standard of 20-200 ppm.

Calcium (Ca) concentrations during July reached 780 ppm, much higher than the earlier international standard of 400 ppm. In January, the concentrations dropped to 540 ppm. These concentrations exceeded the permissible limits for both seasons.

Magnesium (Mg) concentrations during July were 670 ppm, much higher than the earlier international standard of 15-150 ppm. In January, they dropped to 569 ppm, still exceeding the international standard.

Potassium (K) concentrations were 4320 ppm in July, while in January, they dropped to 3810 ppm. Both values are significantly higher than the earlier international standard of 100-150 ppm.

Chloride (Cl) concentrations in July were 1230 ppm, and they decreased to 997 ppm in January. These concentrations exceeded the earlier international standard of 300 ppm.

Sulfate (SO_4) concentrations in July were 1310 ppm, while in January, they decreased to 860 ppm. Both values were much higher than the earlier international standard of 200 ppm. The increase in sulfate concentrations negatively affects palm growth and production, especially in soil with very high chloride levels.

Heavy metal accumulation in palm fronds is evident from Table (3). Lead, for example, recorded high accumulation with 45 micrograms per gram (dry weight) during the summer season and 34.20 micrograms per gram during the winter season. These concentrations exceed the earlier international standard of 10 micrograms per gram (dry weight) in Table (62). Aluminum concentrations during the summer and winter were 1340 and 1210 micrograms per gram (dry weight) respectively, which also exceed the international standard of 1000 micrograms per gram (dry weight). Cadmium concentrations for the summer and winter were 32.2 and 20.8 micrograms per gram (dry weight) respectively, exceeding the earlier international standard of 1 microgram per gram (dry weight).

The concentrations in July were very high due to the nature of the soil containing high salt concentrations, pollution, and the salt concentration in the water from Najaf Sea used for irrigation. These high concentrations have negatively impacted the palm fronds and led to varied differences in frond length and quantity from one palm tree to another. As a result, the palm trees in the study area have become more like a cemetery due to this pollution. See Image (3).

Image (3): Palm Trees

Results:

The study, through the evaluation of some environmental elements and the identification of environmental impacts resulting from water pollution, especially in plants, revealed temporal and spatial variations in the concentrations of chemical and physical elements in various parts of the studied plants. The accumulation of these elements increases during the summer and decreases during the winter season. Additionally, the quantity of accumulation varies from one plant to another and from one part to another. The findings can be summarized as follows:

The study, based on laboratory analysis results, found that concentrations of chemical, physical, and heavy metal elements were highest in plants that reside in polluted areas, especially reeds and tamarisk. The study also indicated that reeds and tamarisk are not suitable as green fodder for animals due to the high concentrations of heavy elements, exceeding permissible limits for both seasons, according to the SFDA standard.

When comparing the results of element concentrations in the plants in the study area with the international standard for plants, it was found that they have high concentrations, with each element's concentration varying from one plant to another.

The study determined that seawater has a significant impact on the destruction of plants and palm trees, rendering extensive areas of palm trees a "palm tree cemetery."

Proposed Solutions:

Considering the researcher's understanding of the various problems faced by the study area, the researcher has proposed a set of solutions that can contribute to addressing and mitigating the problem of environmental pollution in general and seawater pollution in the Najaf Sea and its specific impact on plants. The following solutions have been taken into account:

Recognize water as an economically valuable commodity to make citizens aware of its true economic, social, and cultural importance. This can be achieved through environmental and cultural awareness programs, particularly targeting those involved in urban planning, municipalities, and various segments of society using multimedia channels (audio, visual, and written).

Conduct regular laboratory tests on water and plants to determine the concentration of elements and salts. This should be done by the Agricultural Department in the study area to address the issue before it exacerbates.

Regulate the operations of quarry owners and brick factories in the study area and establish controls to prevent their adverse effects on the natural plants in the area.

Conclusion

In conclusion, this study reveals the critical issue of water pollution in the Bahar of Najaf and its impact on plant life. Water pollution, particularly in the form of chemical and physical elements, significantly affects plant health and characteristics. The qualitative properties of water in the Bahar exhibit spatial and temporal variations, contributing to varying levels of plant pollution. The study highlights the urgency of addressing these pollution problems, given the Bahar of Najaf's economic and ecological importance. The region's role as a destination for religious visitors underscores the need for remedial actions to protect its environmental resources. Additionally, the lack of specialized studies on seawater pollution in the area emphasizes the significance of this research. Addressing these issues is essential for the preservation of the Bahar vitality as a tourist attraction and its broader environmental well-being.

References

1. Almudhafar, S.M. Spatial Variation of Biological Contamination of Soil from Najaf City. Indian Journal of Environmental Protection this link is disabled, 2020, 40(2), pp. 192–196.
2. Almudhafar, S.M., Alattabi, I.A. Effect of environmental factors on drainage water network in Najaf governorate, Iraq. Indian Journal of Environmental Protection this link is disabled, 2019, 39(11), pp. 1050–1056.
3. Almudhafar, S.M. Environmental assessment of shut alkufa in Iraq. Plant Archives, 2018, 18(2), pp. 1545–1551.
4. Almudhafar, S.M., Abboud, H.A. Spatial variation of surface water contamination by heavy elements in Alhira relative to tourism. African Journal of Hospitality, Tourism and Leisure, 2018, 7(4)
5. KR Kadhim, S Almudhafar, BA Almayahi, 2023. An environmental assessment of the non-living natural resources and the available capabilities and

their investment in Al-Najaf Governorate, HIV Nursing 23 (3), 265–273

6. IA Alattabi, SM Almudhafar, BA Almayahi (2023). Natural constituents of the elements affecting soil pollution and health effects and changing their properties by wastewater in Najaf district center, Solid State Technology 63 (6), 5438-5452.
7. Republic of Iraq. General Authority for Survey. Administrative Map of Iraq 2022.
8. John Ryan and George Estephan, Laboratory Guide for Soil and Plant Analysis, International Center for Agricultural Research in the Dry Areas, Aleppo, Syria, 2003, p. 166.
9. FAO, Guidelines for Irrigation Water Quality, Ministry of Environment, Human Resource Development, and Employment Development of Environment, U.S.A., 1999.
10. Muneer Ibrahim and *et. al.*, Fruits of Arid Regions, Dar Al-Arabia for Publishing and Distribution, Cairo University, Egypt, 1999, pp. 213-311.
11. Hassan Abdulameem and Qasim Jasim Azafah, "Effect of Saline Stress on the Mineral Content of Leaves of Three Varieties of Date Palm," Basra University Journal, Issue (1-2), 2010, p. 132.
12. Mall, Pawan Kumar, et al. "Rank Based Two Stage Semi-Supervised Deep Learning Model for X-Ray Images Classification: AN APPROACH TOWARD TAGGING UNLABELED MEDICAL DATASET." Journal of Scientific & Industrial Research (JSIR) 82.08 (2023): 818-830.
13. Narayan, Vipul, et al. "A Comprehensive Review of Various Approach for Medical Image Segmentation and Disease Prediction.
14. Mall, Pawan Kumar, et al. "A comprehensive review of deep neural networks for medical image processing: Recent developments and future opportunities." Healthcare Analytics (2023): 100216.
15. Narayan, Vipul, et al. "Severity of Lumpy Disease detection based on Deep Learning Technique." 2023 International Conference on Disruptive Technologies (ICDT). IEEE, 2023.
16. Saxena, Aditya, et al. "Comparative Analysis Of AI Regression And Classification Models For Predicting House Damages İn Nepal: Proposed Architectures And Techniques." Journal of Pharmaceutical Negative Results (2022): 6203-6215.
17. Kumar, Vaibhav, et al. "A Machine Learning Approach For Predicting Onset And Progression"“Towards Early Detection Of Chronic Diseases “." Journal of Pharmaceutical Negative Results (2022): 6195-6202.
18. Chaturvedi, Pooja, A. K. Daniel, and Vipul Narayan. "A Novel Heuristic for Maximizing Lifetime of Target Coverage in Wireless Sensor Networks." Advanced Wireless Communication and Sensor Networks. Chapman and Hall/CRC 227-242.