Chemical and Physical Water Characterizations in Alhfar Drainage in Al-Diwaniyah City of Iraq

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Chemical and Physical Water Characterizations in Alhfar Drainage in Al-Diwaniyah City of Iraq

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Abstract: The chemical and physical characteristics of the eastern drain of the Euphrates River (Al-Hafar) at AL-Diwaniyah\Iraq was studied for three different sites during summer and winter seasons. The water characteristics including: temperature, pH, electrical conductivity, total dissolved salts, turbidity, total hardness, chloride, calcium, magnesium, and heavy metals, zinc, chromium, zinc, cadmium was measured using (Ph,E.C,TDS,Turb) calibration using standard solutions and (T.H,Mg,Cl) process by plastering EDTA, HCL, and Agno3 solutions with several evidence (APHA, 2003). The results showed, the highest value of 380 in the third site in the winter. The lowest value for the first site in winter is 290. The study on the chemical and physical properties of water in Alhfar Drainage in Al-Diwaniyah City of Iraq investigated the seasonal variations and key parameters affecting water quality. The research identified fluctuations in parameters such as pH, electrical conductivity, total dissolved solids, turbidity, chloride, calcium, magnesium, lead, and cadmium concentrations at three different sites during summer and winter seasons. During summer, higher values of electrical conductivity and salt rates were observed, attributed to factors like high temperatures, evaporation, and human activities. In contrast, winter showed lower values due to increased rainfall and dilution effects. The study highlighted the impact of agricultural and industrial activities on water quality, emphasizing the presence of heavy metals like lead and cadmium as potential risks to human health and the environment. Overall, the findings underscored the importance of proper waste management, pollution control measures, continuous monitoring, and sustainable water management practices to ensure the suitability of water resources for various uses in Al-Diwaniyah City.

Key words: Alhafar, drainage, pollution, Al- Diwaniyah.

I. Introduction

The drainage is of great importance because it works to rid the soil of salts and excess water, water storage reservoirs connected to subsurface drainage systems in fields make up drainage water recycling [1]. Water in Iraqi environment has been facing significant pollution since the last century, and there is difficulty in combating and reducing this pollution because many Iraqi villages and cities are on the banks of lakes and rivers, which are an essential resource for the population [2]. When dissolved salts, acids, fluorides, metals, organic compounds, fertilizers, and pesticides are present in excess, it leads to water pollution. Therefore, a considerable number of metals, including some dangerous ones like mercury, lead, and cadmium, are soluble in water. However, certain disorders are brought on by an increase in non-toxic metals like calcium, magnesium, salt, iron, and copper [3]. Water pollution is a change that occurs in the condition of water due to human activity, which makes this water unsuitable for natural uses such as drinking, irrigation, and agriculture [4]. Industrial and agricultural activities are also considered among the main pollutants of water [5]. Liquid waste from factories that result from manufacturing, such as power generation, iron factories, glass products, as well as cement, plastic and chemical products, and the textile industry, are considered among the most common pollutant sources [6]. Pesticides and concentrated chemical fertilizers can affect the aquatic environment, and now Iraq lacks treatment systems, so these untreated pollutants are disposed of directly into the rivers [7]. There are several factories and companies that do not have treatment systems, as they dispose of waste directly into rivers, which contain heavy metals and other polluting elements, which makes the water unsuitable for use by humans, animals and plants [8].

This paper aims to study several physical and chemical properties of water in Al-Hafar drainage of Al-Diwaniyah city in Iraq. This study is conducted to realize of such water suitability for use. Therefore, in section II, the methodology of testing is discussed. In section III, the obtained results are discussed. Finally, the paper is concluded in section VI.

II. Methodology

For this work, three stations were considered to collect water samples for two seasons, summer and winter, in polyethylene bottles and then transported to the laboratory. The physical and chemical parameters in terms of pH, EC, TDS, Turbidity were collected. These parameters were measured with the aid of the Environmental Research Unit-College of Science-Al-Qadisiyah University using laboratories tools of pH meter, EC meter, TDS meter, and turbidity meter were calibrated. The total hardness was calculated by titration sample with (EDTA2 Na) solution in the presence of a regulator ammonia solution with (Erichromic black T) as indicator and the results were expressed in (mg/l) [8].

$$Total\ Hardness\ (mg/\ l)\ =\ A \times 1000\ /\ V\ ml\ of\ sample\ (1)$$

Where: The chloride ion was estimated by titration of the sample with a silver nitrate according to [8]. Chloride is calculated in mg/L units as in the equation:

$$Cl\ (mg\ /\ L)\ =\ (A - B)\ \times\ N\ \times\ 35450\ ml\ of\ sample\ (2)$$

Where:

A = volume of silver nitrate used in the sample titration (ml).

B = the volume of silver nitrate used for the titration of distilled water (ml).

Calcium ion was evaluated by titration sample with solution (EDTA 2Na) after adding 2 ml of (NaOH 1N and Murexide) as an index and expressing it in an mg/l unit. While the magnesium ion was calculated mathematically based on the total hardness and hardness of calcium (8). Ca (mg/l) =A * B * 400.8/ volume of sample

Ca hardness (mg/l) =A*B*1000// volume of sample

Mg (mg / l) = Total Hardness (mg/l) – Hardness of Calcium (mg/l) * 0.224

According to [10] 100ml-1000ml of the water sample is dried at 80 °C and then transported in Teflon containers and added 6ml of the concentrated mixture of (HCL) and (HNO_3) in a ratio of 1:1 then heated at 80 °C until dry, then add 4 ml of a mixture of concentrated (HF) and ($HClO_4$) in a 1:1 ratio until the dehydration. The precipitate then dissolves in 20 ml of dilute Hydrochloric acid (0.5N) Samples are stored until the heavy elements are measured with a Flame Atomic Absorption Spectrometer. The concentrations of heavy elements were calculated from the calibration curve with the equations.

$$Econ. = \frac{A \times B}{C} \times 1000 \quad (3)$$

Where:

Econ =Concentration of soluble element in water (µg/l).

A = The concentration of extracted element from the calibration curve (mg/l).

B =The final size of the candidate sample (ml).

C =The initial size of the candidate sample (ml).

III. Results and Discussions

The study highlights the impact of agricultural and industrial activities on water quality, emphasizing the need for proper waste management and pollution control measures. The presence of pollutants like heavy metals (lead and cadmium) indicates potential risks to human health and the environment. The findings underscore the importance of continuous monitoring, regulation, and sustainable water management practices to ensure the suitability of water resources for various uses in Al-Diwaniyah City.

In Fig. (1), the highest value was 8.5 in S3 in winter, the lowest value was 7.6 in S3 in summer, Cause of high winter due to the elevated bicarbonate and carbonate concentrations. Rainwater accelerated the dissolution of carbon dioxide, turning dissolved calcium carbonate into insoluble form. It was also noted that all of the water samples ranged from neutral to somewhat basic due to the fact that the majority of Iraqi water is basic and the country has a lot of calcium carbonate-rich soil. Additionally, the hard water in the region has a high buffer capacity that prevents pH changes [1]. However, agricultural wastes may have an impact on summertime pH values, lowering them even slightly [13].

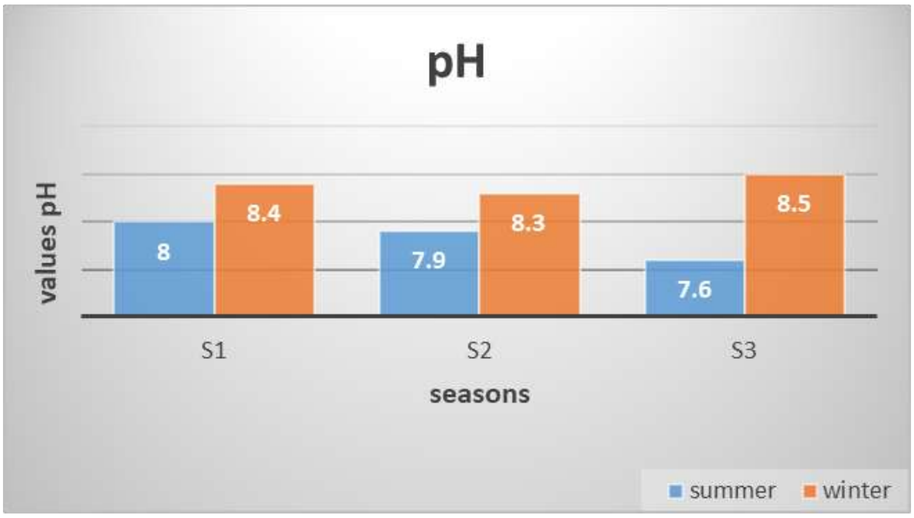

Fig. (1): PH rates in study stations.

In Fig. (2) the highest value was 21960 µs/ cm S3 in summer, the lowest was 10010 µs\ cm S2 in winter. The increase in electrical conductivity in summer is due to high temperatures, evaporation occurring in summer, and increased decomposition of organic waste, in addition to the discharge of sewage and agricultural waste, which leads to high concentrations of ions and salts within the drainage water [19]. The reason for its decrease in winter is due to increased rainfall and high-water levels in the drainage [18].

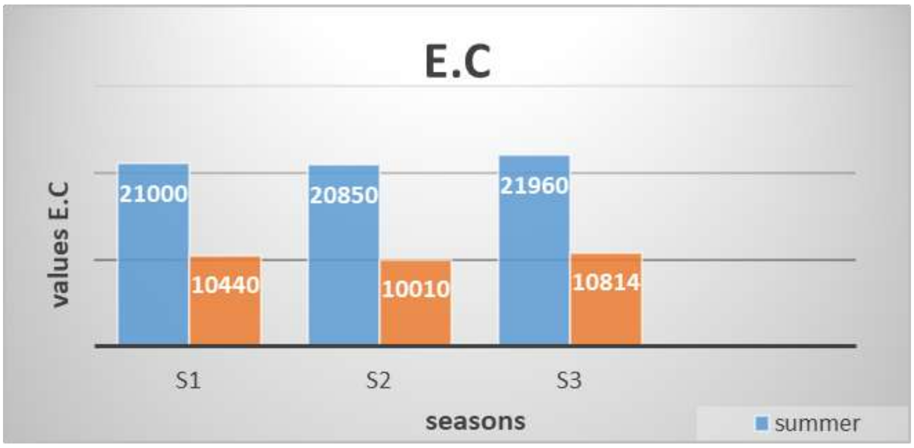

Fig. (2): Electrical connection rates in study stations.

In Fig. (3) the highest value was 13390 gm\l S3 in summer, the lowest was 5833 gm\l S2 in winter. The increase in salt rates in the drainage water is due to agricultural activities as a result of the excessive use of pesticides and chemical fertilizers [19]. The reason for the decrease is due to the increase in surface runoff due to rain, which leads to the dilution of dissolved salts [18].

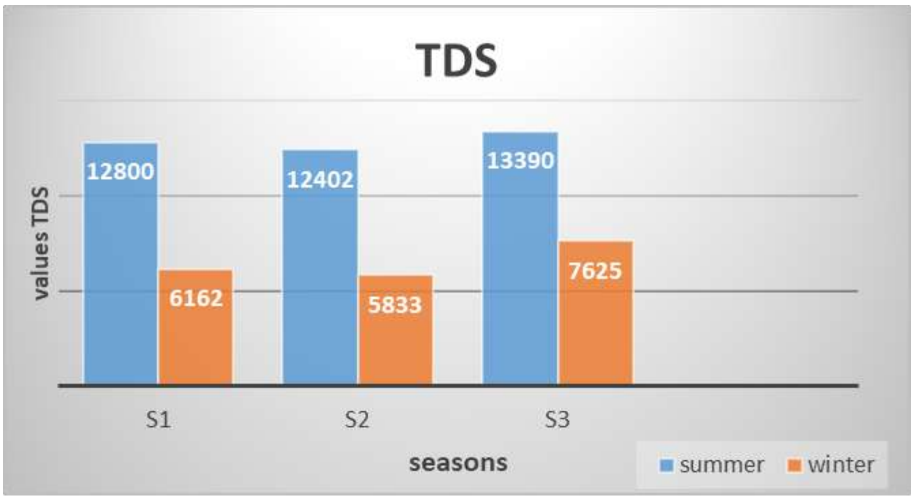

Fig. (3): Total dissolved salts rates in study stations.

In Fig. (4) the highest value was 14.4 gm\l S1 in winter, the lowest was 0.56 gm\l S3 in summer, turbidity increases in winter due to rain that washes away pollutants, as well as organic and inorganic pesticides, clay masses, and silt [13]. The reason for the decrease in summer is due to stagnant water [2].

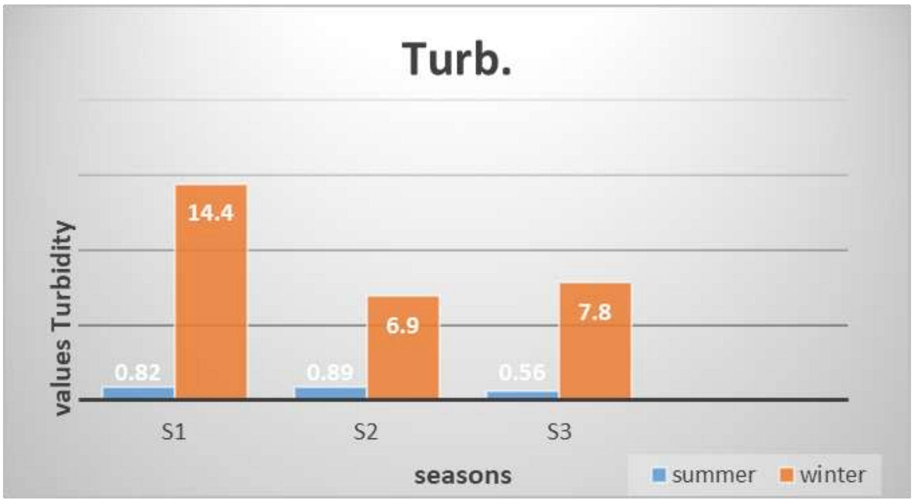

Fig (4): Turbidity rates in study stations.

In Fig. (5) the highest value was 8230 mg\l S3 in summer, the lowest was 3750 gm\l S1 in winter, The high total hardness is due to Iraq's limestone soil, high dissolved solids, and high alkalinity, which leads to hardness [16]. The decrease is due to rainfall, which in turn leads to a reduction in ion concentrations [13].

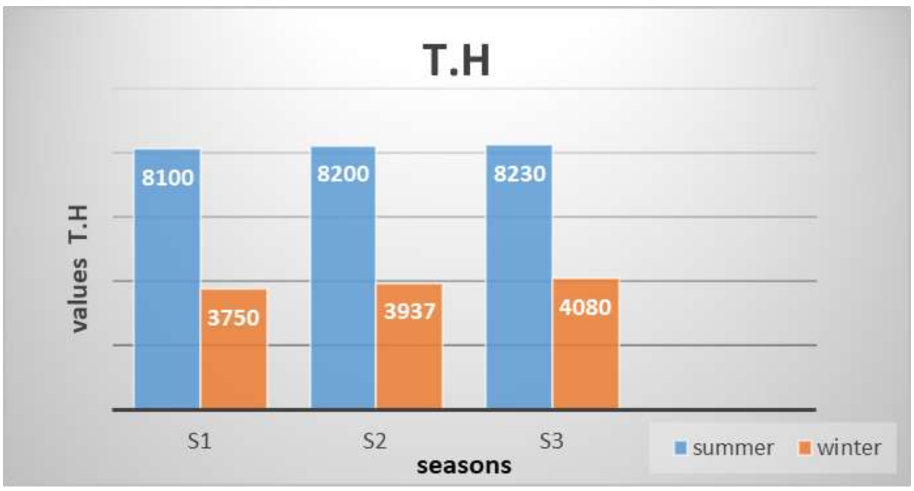

Fig. (5): Total hardness rates in study stations.

In Fig. (6) the highest value was 7219 mg\l S1 in summer, the lowest was 2068mg\l S2 in winter, The reason for the rise in chloride ions in summer is due to high temperatures, which leads to increased evaporation and increased salt concentrations [22], or due to pollution with sewage and chemical pesticides [7].

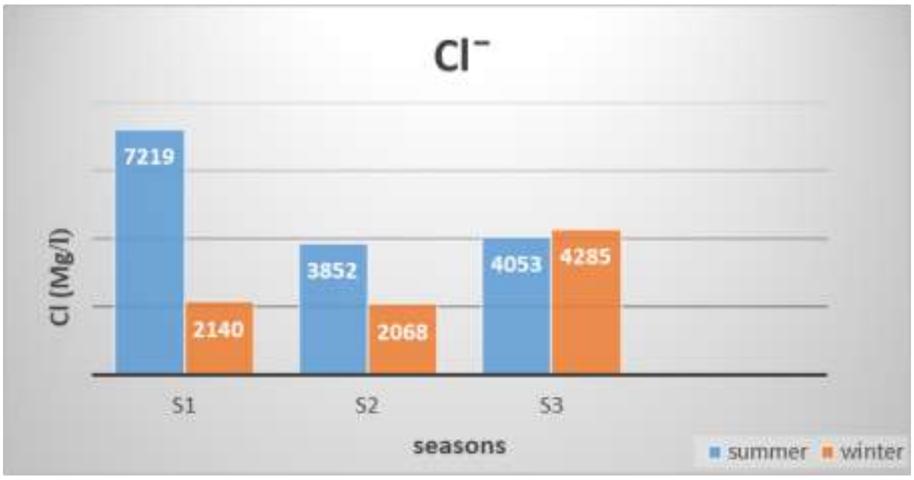

Fig. (6): Chloride rates in study stations.

In Fig. (7) the highest value was 594mg\l S2 in winter, the lowest was 265 mg\l S2 in summer, The reason for the rise in winter is due to soil washing of neighboring lands due to rainfall, which leads to an increase in salt concentrations [1]. The reason for the decrease is due to the extreme hardness of the water [11].

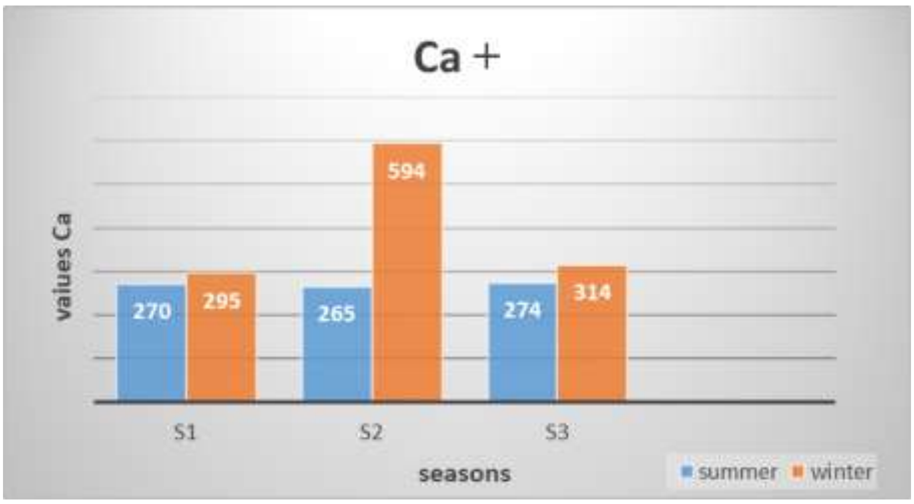

Fig. (7): Calcium rates in study stations.

In Fig. (8) the highest value was 335 mg\l S3 in summer, the lowest was 187 mg\l S2 in winter. The reason for the increase in magnesium ions is attributed to the increase in the total hardness of the drainage water in summer due to the deposition of completely dissolved salts and also from domestic and industrial activities [6]. The reason for the decrease in winter is due to the presence of a high percentage of sulfates, which leads to the deposition of magnesium in the water [4].

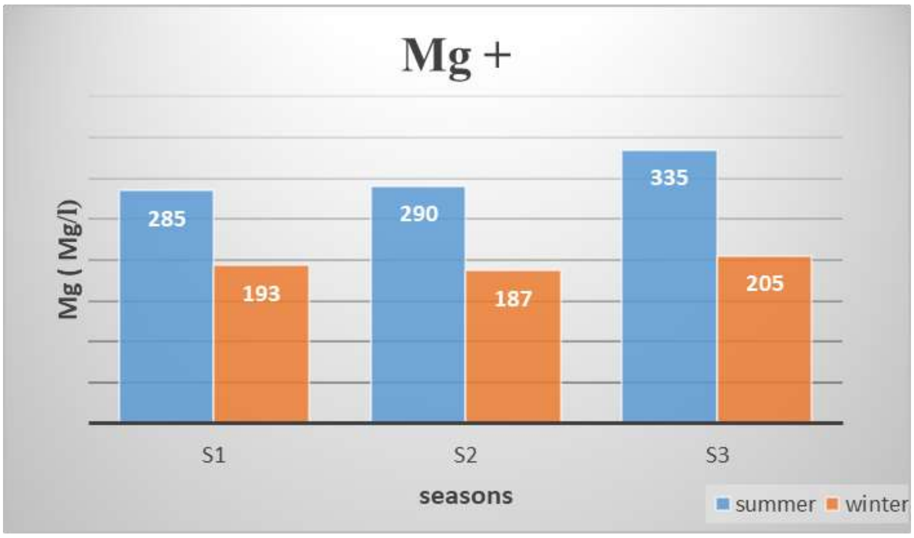

Fig. (8): Magnesium rates in study stations.

In Fig. (9), the highest value was 18822 mg\l S3 in winter, the lowest was 1409 mg\l S2 in summer and also in S2 in winter was 1406 mg\l, The reason for the increase in zinc in winter is due This is due to surface runoff due to rain that carries pesticides and fertilizers due to agriculture and agricultural waste [5].

Fig. (9): Zinc rates in study stations.

In Fig. (10) the highest value was 3150 mg\l S3 in winter, the lowest was 2110 mg\l S1 in summer and 2080 mg\l S1 in winter. The increase in copper in winter is due to liquid waste that is discharged through sewage, as well as when it rains, as heavy metal pollutants are transferred through surface runoff (21).

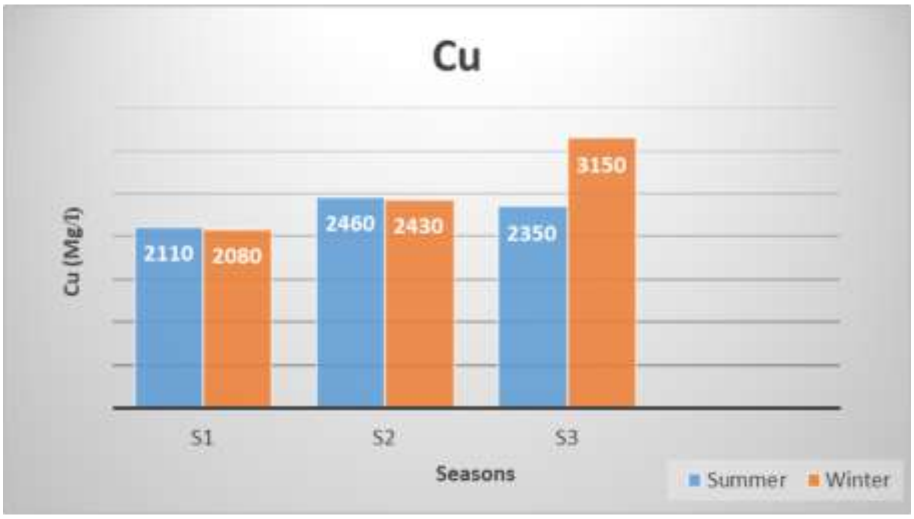

Fig. (10): Copper rates in study stations

In Fig. (11) the highest value was 761 mg\l S3in summer, the lowest was 433 mg\l S2 in winter. We notice increase in the concentration of lead in the summer due to the natural decomposition of agricultural waste generated in the river basin and in the vicinity of other bodies of water, such as lakes and ponds, exposes the water to harmful metals over time [3].

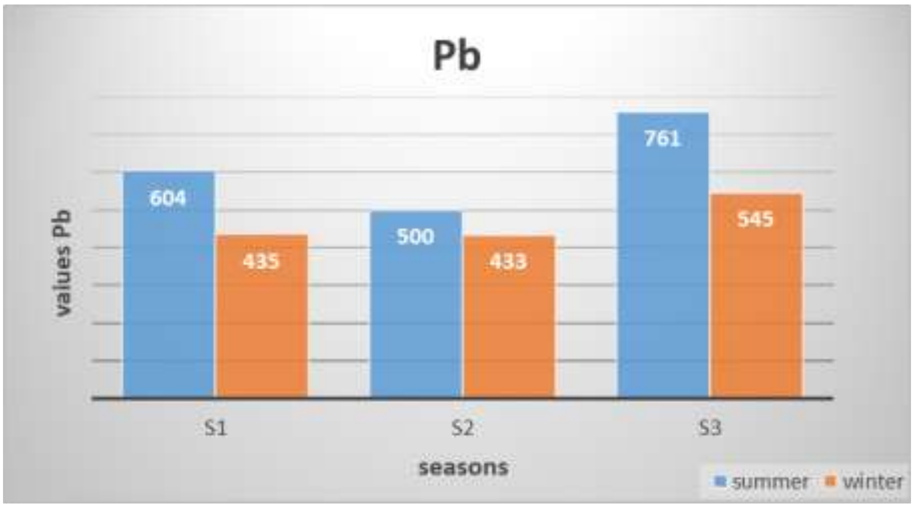

Fig. (11): Pb rates in study stations.

In Fig. (12) the highest value was 3.1 mg\l S3 in summer, the lowest was 2.05 mg\l S1 in winter, The reason for the high concentration of cadmium in summer is the reason for the increase was observed through studying this site in the summer, as there is an abundance of solid waste, including organic and inorganic materials, as well as liquid waste on both sides of this drainage [10].

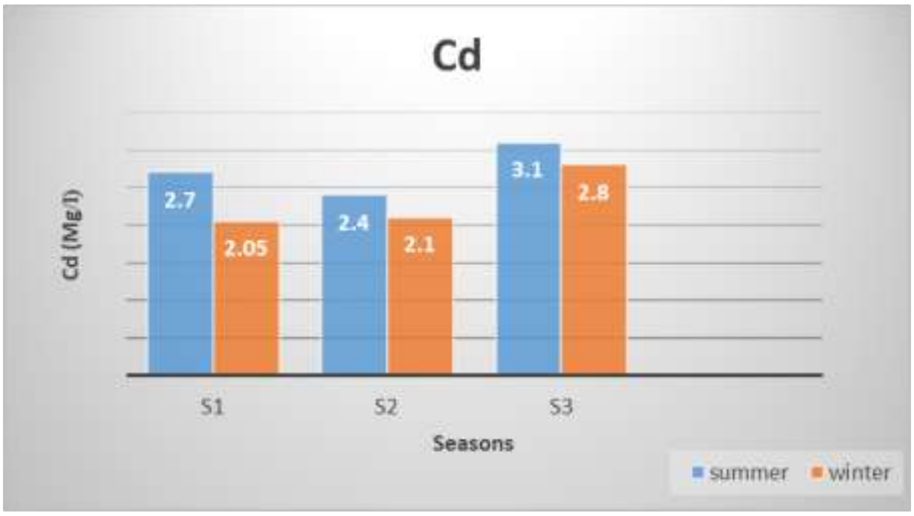

Fig. (12): Cadmium rates in study stations.

Overall, this study underscores the urgency of addressing water pollution issues in Alhfar Drainage to safeguard public health, ecosystem integrity, and sustainable water resource management in the region. The study on the chemical and physical properties of water in Alhfar Drainage in Al-Diwaniyah City of Iraq achieved the following results:

1- Identified seasonal variations in water quality parameters such as pH, electrical conductivity, total dissolved solids, turbidity, chloride ion concentration, calcium ion concentration, magnesium ion concentration, lead concentration, and cadmium concentration.
2- Highlighted higher values of electrical conductivity and salt rates during summer, attributed to factors like high temperatures, evaporation, and human activities.
3- Noted lower values of these parameters during winter due to increased rainfall and dilution effects.
4- Emphasized the impact of agricultural and industrial activities on water quality, particularly the presence of heavy metals like lead and cadmium.
5- Stressed the importance of proper waste management and pollution control measures to mitigate risks to human health and the environment.
6- Signaled the need for continuous monitoring, regulation, and sustainable water management practices to ensure water resource suitability for various uses in Al-Diwaniyah City.

These achievements provide valuable insights into the current state of water quality in Alhfar Drainage and underscore the importance of addressing pollution issues to protect public health and promote sustainable water resource management in the region.

IV. Conclusion

Based on the information provided in this work, it can be concluded that the water quality in Alhfar Drainage in Al-Diwaniyah City of Iraq is significantly influenced by seasonal variations and human activities. The study conducted on three stations during summer and winter revealed fluctuations in parameters such as pH, electrical conductivity, total dissolved solids, turbidity, chloride ion concentration, calcium ion concentration, magnesium ion concentration, lead concentration, and cadmium concentration. It is found that during summer, higher values of electrical conductivity and salt rates were observed, attributed to factors like high temperatures, evaporation, decomposition of organic waste, discharge of sewage and agricultural waste, and excessive use of pesticides and chemical fertilizers. In contrast, winter showed lower values due to increased rainfall and high-water levels leading to dilution of salts. The future work stemming from the study on the chemical and physical properties of water in Alhfar Drainage in Al-Diwaniyah City of Iraq could include the following aspects: Long-term Monitoring: Conducting continuous and long-term monitoring of water quality parameters to assess trends, seasonal variations, and the impact of changing environmental conditions on water quality in Alhfar Drainage. Source Identification: Identifying specific sources of pollution, such as industrial discharges, agricultural runoff, and urban wastewater, to implement targeted pollution control measures and remediation strategies. Risk Assessment: Conducting a comprehensive risk assessment to evaluate the potential health and environmental risks associated with the presence of heavy metals and other pollutants in the water, and developing mitigation strategies accordingly. Community Engagement: Engaging with local communities, stakeholders, and policymakers to raise awareness about water quality issues, promote sustainable water management practices, and foster community participation in conservation efforts. Water Resource Management: Developing integrated water resource management plans that prioritize water quality protection, sustainable water use, and ecosystem conservation in Alhfar Drainage and the surrounding areas.

Research Collaboration: Collaborating with multidisciplinary research teams, governmental agencies, and international organizations to enhance knowledge sharing, capacity building, and the implementation of innovative solutions for water quality management. By focusing on these future directions, the study can contribute to ongoing efforts to improve water quality, protect public health, and ensure the sustainability of water resources in Al-Diwaniyah City and the broader region.

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