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Environmental geochemistry study for water of fish farms in selected sites

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Abstract
The study aimed to assess the environmental geochemical in fish farms and ponds in selected sites, where the study included three sites within Salah al-Din Governorate distributed in (Balad, Mukishifa, and Oweinat) and water samples were collected from ponds for the purpose of examination. Less than the detection limit of the device, while the zinc element was visible in all stations and its concentration is acceptable according to the specifications of the World Health Organization (WHO, 2017), As for the main positive and negative ions and secondary ions, they were within the permissible limits according to the World Health Organization (WHO, 2017). The results showed that the concentration of the ion (Mg, Cl) for the sixth station is higher than the specifications of the World Health Organization (WHO, 2017) specification (EPA, 2012)) [8] and by applying the hydrochemical indicators represented by the water quality index WQI and the water quality index for drinking purpose DWQI, the water quality was drinkable water according to the specification for hydrochemical indicators.

Keywords: environmental geochemistry, water of fish, world health organization

Introduction

Fisheries is one of the main sectors that most countries rely on increasingly to bridge the food gap, as it constitutes an important resource in the Arab agricultural resource base, as the fish sector has achieved a high percentage in the Arab world, where fish and aquatic organisms are considered part of the environment, which have been affected by negative human activities that are harmful to the environment. Aquariums where fish ponds are exposed to many different diseases that affect fish, especially in winter. Water is one of the important media in the transmission of many diseases, which often take the epidemiological character, and the disease may begin and quickly end before controlling it, as the interest of countries in fish diseases varies with the progress of this problem and its importance from the environmental aspects, where it becomes necessary to study these diseases, which afflict Fish, as these diseases are getting more and more complicated with common diseases with fish and humans, as the transmission of these diseases from fish to the citizen poses a threat to him. As many lakes are exposed to acidification, which results from the accumulation of large quantities of nutrients, including phosphates, where algae grow, and after their death, they are subjected to decomposition by bacteria Where which consumes the bulk of the dissolved oxygen, the water becomes unfit for the continuation of aquatic life. In addition to the concentration of heavy metals that are present in fish ponds, including (mercury, lead, chromium, zinc, nickel, iron, and cadmium), these elements are concentrated in fish and thus affect human health. (Abdallah, 2007)) [2], as lead pollution It occurs as a result of eating fish in certain proportions, which leads to the breakdown of brain, liver, and kidney cells, as the accumulation of heavy metals in aquatic organisms and seasonal changes in living conditions have toxic effects on living organisms. Elements such as (copper, zinc, chromium, nickel, and manganese) in low concentrations are essential elements because they play a role in biological systems, while lead and cadmium are non-essential because they are toxic and cause serious damage to living organisms. The study area is located in Salah al-Din Governorate, which included seven basins from selected areas. The first area is located in the Balad District of Yathrib District along the road linking Balad Air Base and Dujail District. The second site is in Mukashifa District near the main road in the direction of Tikrit and the third site is located in an area Oweinat on the outskirts of the city of Tikrit. Figure (1)

Aims of the study

1. Assessment of the water quality used in raising fish in ponds and its suitability for irrigation, drinking, and swimming purposes.
2. Evaluation of sediments in basins using sediment indicators.
3. Evaluate the health hazard of heavy metals.
4. Evaluate this water before replacing it from the basins and the extent of its impact.
5. Evaluation of these basins when they are abandoned and the extent of their impact on human health and farms.
6. Determining the concentrations of physical variables (temperature, pH, total dissolved solids, electrical conductivity, and major and minor ions).
7. Application of models to calculate health risks in water samples
8. Applying water quality guide models to determine water quality.

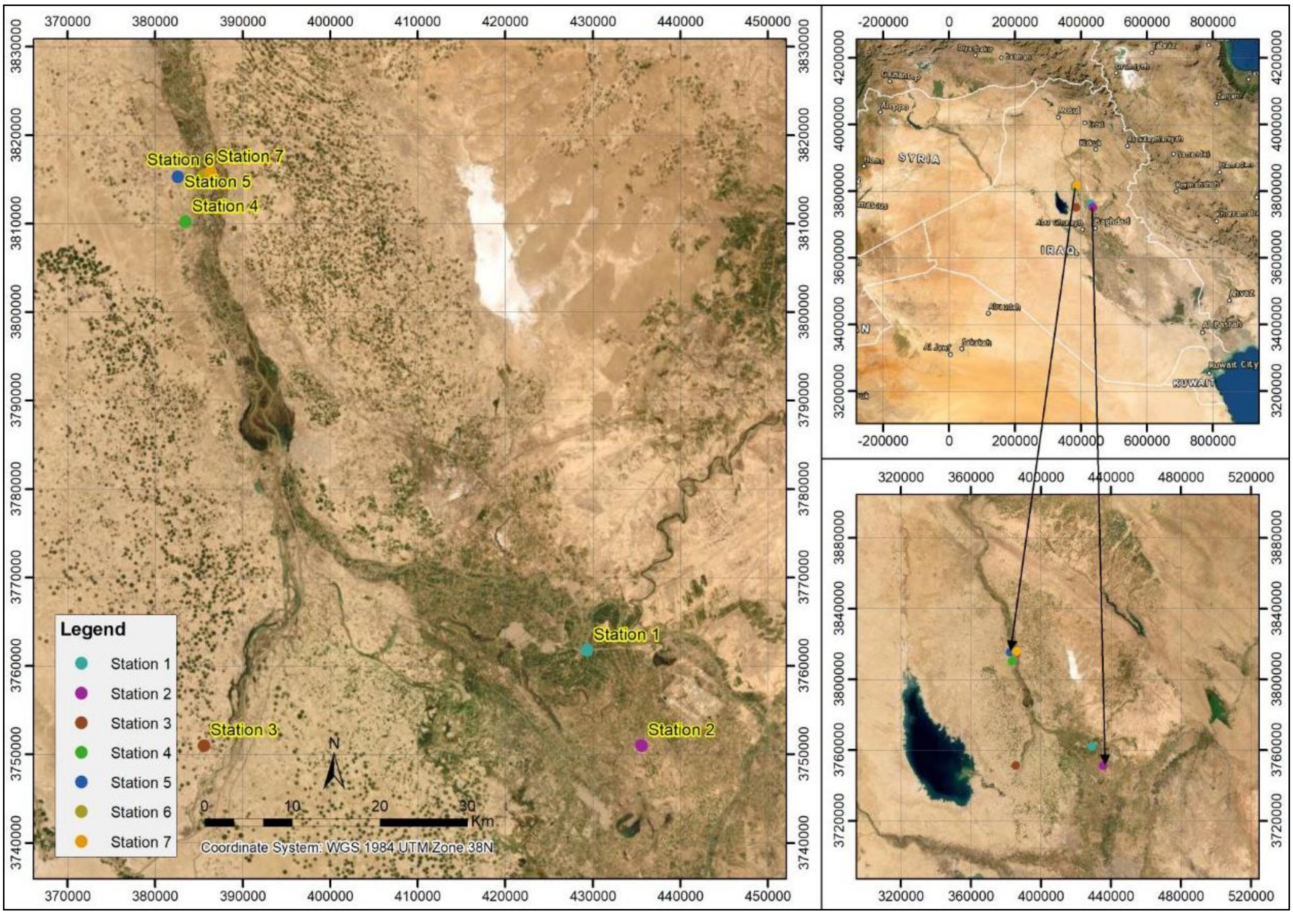

Fig 1: shows the locations of the stations in the study area

Materials and Methods

Field work

1. Conducting a reconnaissance tour on (5/1/2022) - (6/1/2022) to determine the locations of the stations using a GPS device that will be studied.
2. Collect the samples from the stations in plastic bottles with a capacity of (2 liters) two for each basin for water, and the bottle is washed with water from the basin at least three times before filling it and making sure that it is free of air.
3. Collection of samples from basins for sediment in bags of size (2 kg) for each basin.
4. Measuring the water temperature after taking the model from inside the basins where the measuring device is placed for a minute and then reading the temperature.
5. Measurement of (PH, EC, TDS) in the field by a PH METER).

Office work

Hydrochemical Indications

To evaluate water and know its quality and suitability for various purposes such as drinking, agriculture, and household uses, it is necessary to use hydrochemical indicators to find out whether this water is suitable or inappropriate, and in general water quality depends on the concentrations of dissolved ions in it. (Magesh et al., 2016) [3] A lot of chemical indicators were used in this study to assess the chemical water quality for different purposes:

1. Water Quality Index (WQI)

This indicator is considered one of the most effective indicators for measuring the quality of water for drinking, and the measurement depends on the results of the analyzes of the main negative and positive ions in the samples and the permissible concentrations of these ions according to the World Health Organization (Akter *et al*., 2016) [4]. It can be found through the following mathematical relationships:

$WQI = \sum_i^n wiqi / \sum_i^n = 1\ Wi$…. (1)
$qi = Ci/ Si \times 100$…… (2)
$wi = 1/ si$………… (3)

whereas:
qi: the quality index.
Ci: The concentration was measured in mg/L.
Wi: represents the relative effect of the ion.
Si: the globally permissible concentrations in mg/L.
n: represents the number of samples studied.
WQI: represents the water quality index.

House, 1989) [5] classified the water quality index as shown in Table (1).

Table 1: Classification of water according to the water quality index

Water Quality	WQI
Excellent Water	<50
Good Water	50-100
Poorly Water	100-200
Very Poorly Water	200-300
Unsuitable	>300

2. Drinking Water Quality Index (DWQI)

The water quality index for drinking is an indication of the water's suitability for drinking, and this gives evidence of water contamination with heavy metals, as well as gives important data for the public and decision-makers about the suitability of this water or not, or vice versa. Total solubility), main ions, and heavy metals. This indicator can be found by following the following steps according to (Thivya et al., 2014) [6].

Determining a weight for each Wi factor is one of the important parameters due to its importance in the quality of drinking water, as the minimum weight of the parameter is (1), which is considered the least impact on the quality of water for drinking purposes. And the upper limit of the weight of the parameter is (5), which is considered the highest impact on the quality of water for drinking purposes, then we assign the relative weight (RWI) for each factor, which can be found by dividing the weight of each factor by the sum of the weights of the parameters as in the following equations:

$$RWi= WI/\sum_{i=1}^{n} Wi …… (4)$$

whereas:

Wi: represents the weight of each parameter.

∑Wi: represents the sum of the weights of the coefficients as in Table (2).

$$Qi=(Ci-Li/Si-Li) *100…… (5)$$

whereas:-

Ci: represents the measured concentration of each parameter

Li: represents the ideal value of ions and is zero.

Si: the globally permissible concentration in mg/L.

$$SI_i =Qi*RWi…. (6)$$

whereas: -

SIi: the sub-index for water quality

Qi: represents the quality index.

RWi: represents the relative weight of the parameter.

$$DWQI=\sum_{i=1}^{n} SI_i …… (7)$$

whereas: -

DWQI: Water Quality Index for Drinking Purposes

Table 2: shows the relative weights and weights used in the application of the drinking water quality index (Thivya, 2014) [6]

Transactions	Unite	Wi	RWI
PH	Mg/l	5	0.166
TDS	Mg/l	5	0.166
K	Mg/l	2	0.066
Na	Mg/l	2	0.066
Ca	Mg/l	3	0.1
Mg	Mg/l	2	0.066
SO_4	Mg/l	1	0.033
Cl	Mg/l	4	0.133
HCO_3	Mg/l	1	0.033
NO_3	Mg/l	4	0.133
Zn	Mg/l	1	0.033
		∑Wi] =30	

(Thivya, 2014) [6] classified water according to the water quality index for drinking purposes, as shown in the following table (3).

Table 3: shows the classification of water according to the water quality index for drinking purposes

Water quality	DWQI
Excellent	<1000
Good	1000-2000
Medium	2000-3000
Very medium	3000-4000
Not suitable	>4000

Results

Table 4: Main negative and positive ions and secondary ions

Station Namber	Esting	Northing	Ph	TDS	SO4	CL	HCO3	NO3	K	Na	Mg	Ca	Zn	WQI	DWQI
1	429371	3761789	7.83	1690	330.05	195.25	330.05	0.571	15.125	87.38	75.883	94.929	0.483	20.6389	103.98
2	435601	3750997	7.82	1630	315.25	213.44	315.25	0.653	14.155	72.09	88.095	90.22	0.281	90.6224	102.05
3	385599	3750998	7.91	2250	432.29	319.5	432.29	0.426	16.095	98.63	105.603	203.189	0.533	99.1875	142.20
4	383483	3810225	7.93	2270	401.12	337.25	401.12	0.596	18.046	94.5	95.437	199.424	0.382	121.87	142.82
5	382623	3815308	7.82	1650	383	324.01	383	0.312	15.246	102.13	93.983	209.431	0.583	109.1570	125.08
6	385625	3815466	8.08	3170	453.48	467.11	453.48	0.284	14.033	136.5	154.892	193.775	0.483	107.9027	178.23
7	386398	3815832	7.72	420	71.04	41.16	71.04	0.090	1.254	26.21	17.472	40.334	0.392	13.3294	38.257

Discussion

The concentrations of the main negative and positive ions and secondary ions for seven stations in relation to PH were within the permissible limits according to the World Health Organization (WHO, 2017), the concentration of TDS, was higher than the permissible limit of the World Health Organization (WHO, 2017) (WHO, 2011). As for the seventh station, it is within the permissible limit of the World Health Organization (WHO, 2017), while the main positive, negative and secondary ions fall within the permissible limits according to the specifications of the World Health Organization (WHO, 2017) (WHO, 2011) [7] (EPI, 2012). When the concentrations of heavy ions in the water did not appear in the results of the examination, which indicates that the concentrations of ions were within the minimum detection limit of the device and the atomic device spectrometer, because these ions have no health damage to the water. Table 4

Conclusions

- The concentrations of heavy ions for the study station (As, Ni, Pb, Cu, Cr, Co) did not appear in the examination results because they are less than 0.05 and are within the minimum detection limit of the atomic absorption spectrometer.
- The concentration of zinc ions in water in all study stations appeared within the permissible limit according

to the specifications of the World Health Organization (WHO, 2017).

- As for the main negative and positive ions and secondary ions, all of them appeared in the results of the examination by an atomic absorption spectrometer within the permissible limit according to the World Health Organization (WHO, 2017) (WHO, 2011) (EPA, 2012) [8].
- While the ion concentration (Mg, CL) was read by the above device and it was higher than the permissible limit according to the World Health Organization (WHO, 2017) (WHO, 2011) (EPA, 2012) [8].
- By applying the Water Quality Index (WQI), the water in the station (1 and 7) was excellent water, while the station (2 and 3) was good, and the station (4, 5 and 6) was medium water according to the specification of the water quality index.
- The results of the Drinking Water Quality Index (DWQI) showed that all the stations' water was excellent according to the drinking water quality index.

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