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Original Research Article

Evaluation of the Water Quality of the Drainage Alhfar in Al-Diwaniyah Governorate According to the Iraqi Guide WQI

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Abstract: A study was conducted on the eastern drainage of the Euphrates River (Alhfar) in Diwaniyah at three stations, summer and winter. The drainage Alhfar was evaluated using the WQI and Was selected 12 parameters, namely (PH, E.C, TDS, Turb., T.H, Cl, Mg, Ca, Zn, Pb, Cu, Cd), From the results, it is noted that the first site recorded (302, 290) in summer and winter, respectively, according to WQI, while the second site recorded (294.5, 298.8) in summer and winter, respectively, The WQI value for the third site was (310 a, 380), according to WQI the water in the first and second sites was very poor water due to the increase in the proportion of determinants. In the third site, the water was unsuitable water because the WQI was very high in summer and winter.

Keywords: Havey metal, WQI, Drainage Alhfar, Un suitable water quality.

INTRODUCTION

Water quality is a susceptible issue that is critical to economic development and environmental sustainability [1]. Human activities affect aspects of water, such as surface runoff, rainfall, and evaporation [2]. The changes that occur in Iraqi water basins lead to interactions that change the quality and type of water, as well as a change in the ecosystem due to pollution, high salt water, etc. [3]. Regular monitoring of water is essential to evaluate the quality of water for various uses [4, 5]. To evaluate water quality, there are traditional methods that rely on comparing parameter values with current standards [6]. Given this, the water quality index (WQI), which may be used to simplify the expressions of a complicated set of river water quality variables, is regarded as a crucial component of good water resource management [7]. When values are standardized to the rating curves, the Water Quality Index (WQI) becomes a dimensionless number that simplifies the understanding of data for data monitoring [8].

Aim of Study: Study and evaluation quality of water by WQI and the suitability of this water for irrigation purposes.

MATERIALS AND METHODS

1. pH, EC, TDS, Turbidity These parameters were measured in the Environmental Research Unit - College of Science - Al-Qadisiyah University using devices after calibrating them (pH meter, EC meter, TDS meter, and turbidity meter).
2. Total hardness was calculated by [9].
   Total Hardness (mg/ l) = A×1000 / V ml of sample
   Where:
   A= EDTA solution
3. Chlorides ion calculated according to [9]. Chloride is calculated in mg/L units as in the equation:
   Cl (mg / L) = (A-B) * N * 35450 ml of sample
   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).
4. Calcium and Magnesium ions: Calcium ion was calculated by hardness of calcium [9]. Ca (mg/l) =A * B * 400.8/ volume of sample
   Ca hardness (mg/l) =A*B*1000// volume of sample
5. Mg (mg / l) = Total Hardness (mg/l) – Hardness of Calcium (mg/l) * 0.224
6. Heavy Metals: The concentrations of heavy elements were calculated from the calibration curve with the equations [9].
   Econ. =(A×B)/C×1000
   Where:

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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).

7. Over all WQI = $\frac{\sum wi \times qi}{\sum wi}$

Where:

qi = $\frac{ci}{si} \times 100$
wi = $\frac{1}{si}$
wQi =∑ wi× qi
where:
ci: Measured concentration
si: Universal value

RESULTS AND DISCUSSION

Table (1): Concentrations of parameters in S1 in Summer.

parameters	Ci	Si	Wi	qi	Wi*qi
pH	8	7.5	0.133	106.6	14.1
EC	21000	2250	0.0004	933.3	0.37
TDS	12800	2000	0.0005	640	0.38
Turbidity	0.82	7	0.14	11.7	1.63
Total hardness	8100	1000	0.001	810	0.81
Cl	7219	250	0.004	2887	11.5
Ca	270	200	0.005	135	0.67
Mg	285	125	0.008	228	1.82
Zn	1730	200	0.005	865	4.32
Cu	2116	50	0.02	4220	84.52
Pb	604	50	0.02	1208	24.6
Cd	2.7	5	0.2	54	10.8
			0.536		155.39

Overall WQI = 239

Table (2): Concentrations of parameters in S1 in Winter

Parameter	Ci	Si	Wi	qi	Wi*qi
pH	8.4	7.5	0.133	112	14.9
E.C	10440	2250	0.0004	464	0.185
TDS	6162	2000	0.0005	308	0.154
Turb.	14.4	7	0.14	205	28.7
T.H	3750	1000	0.001	375	0.375
Cl	2140	250	0.004	856	3.424
Ca	295	200	0.005	147	0.735
Mg	193	125	0.008	154.4	1.235
Zn	1500	200	0.005	750	3.75
Cu	2080	50	0.02	4160	83.2
Pb	435	50	0.02	870	17.4
Cd	2.05	5	0.2	41	8.2
			0.536		162.258

Overall WQI = 302

Through the tables and equations, the water in the first site was very poor according to the Iraqi guide, and the reason for the increase is due to the high concentrations of the studied values, especially (TDS, T.H, Cl, Zn, Cu), where the reason for the increase is due to high temperatures and increased evaporation, which leads to increased concentrations of salts. Ions and pollutants increase at this site [10]. In winter, it was slightly higher than in summer, and it was also very poor, according to the Iraqi guide, as the reason for the rise was due to the high values of (Turbidity and Calcium ion) due to surface runoff due to rain that carried away organic materials, agricultural fertilizers, and clay blocks to this location from the drainage [11].

Table (3): Concentrations of parameters in S2 in Summer

Parameters	Ci	Si	wi	qi	Wi*qi
pH	7.9	7.5	0.133	105.3	14
E.C	20850	2250	0.0004	926.6	0.370
TDS	12402	2000	0.0005	620.1	0.310
Turb.	0.89	7	0.14	12.71	1.77

Parameters	Ci	Si	wi	qi	Wi*qi
T.H	8200	1000	0.001	820	0.82
Cl	3852	250	0.004	1540.8	66.16
Ca	265	200	0.005	132.5	0.662
Mg	290	125	0.008	232	1.856
Zn	1409	200	0.005	704.5	3.52
Cu	2460	50	0.02	4920	98.4
Pb	500	50	0.02	1000	20
Cd	2.4	5	0.2	50	10
			0.536		157.86

Overall WQI = 294

Table (4): concentrations of parameters in S2 in Winter

Parameter	Ci	Si	wi	qi	Wi*qi
pH	8.3	7.5	0.133	118.5	15.7
E.C	10010	2250	0.0004	444.8	0.177
TDS	58336.9	2000	0.0005	291.6	0.145
Turb.	6.9	7	0.14	98.57	13.79
T.H	3937	100	0.001	393.7	0.393
Cl	2068	250	0.004	827.2	3.30
Ca	594	200	0.005	297	1.48
Mg	187	125	0.008	149.6	1.196
Zn	1405	200	0.005	202.5	1.012
Cu	2430	50	0.02	4860	97.2
Pb	433	50	0.02	866	17.32
Cd	2.1	5	0.2	42	8.4
			0.536		160.18

Overall WQI = 298

The WQI recorded 294 summers, and the water was classified as very poor according to the Iraqi guide, due to the increase in some of the studied values (E.C, T.H, Cl, TDS, Ca, Zn), The reason for the rise is due to high temperatures and increased evaporation, which leads to high levels of heavy metals in the water, as well as high salts and ions, which leads to high water hardness due to organic materials and organic waste, which greatly affects the quality of the water in this drainage [12].

In winter, the WQI was 302, which is also considered very poor water due to high turbidity due to surface runoff from agricultural areas near the sewer and the discharge of sewage as well [12].

Table (5) concentrations of parameters in S3 in Summer

Parameter	Ci	Si	Wi	qi	Wi*qi
pH	7.6	7.6	0.133	101.3	13.47
E.C	21960	2250	0.0004	967	0.390
TDS	13390	2000	0.0005	669.5	0.334
Turrb.	0.56	7	0.14	8	1.12
T.H	8230	1000	0.001	823	0.823
Cl	4053	250	0.004	1621.2	6.484
Ca	274	200	0.005	137	0.685
Mg	335	125	0.008	628	2.144
Zn	1567	200	0.005	783.5	3.91
Cu	2350	50	0.02	4700	94
Pb	761	50	0.02	1522	30.44
Cd	3.1	5	0.2	62	12.4

Overall WQI = 310

Table (6): Concentrations of parameters in S3 in Winter

Parameter	Ci	Si	wi	qi	Wi*qi
pH	8.5	7.5	0.133	113.3	15.07
E.C	10814	2250	0.0004	480.6	0.192
TDS	7625	2000	0.0005	381.25	0.190
Turb.	7.8	7	0.14	111.4	15.59
T.H	4080	1000	0.001	408	0.408
Cl	4285	250	0.004	1714	6.85
Ca	314	200	0.005	157	0.785
Mg	205	125	0.008	164	1.312
Zn	1822	200	0.005	911	4.55
Cu	3150	50	0.02	6300	129
Pb	545	50	0.02	1090	21.8
Cd	2.8	5	0.2	56	11.2
			0.536		203.94

Overall WQI = 380

The WQI at this site was recorded at 310, as it exceeded the permissible limits and was classified as unsuitable water due to the high temperatures and increased evaporation, which leads to an increase in salts and positive and negative ions. Its increase is due to the increase in village waste that is on both sides of the site, according to what was observed during the study [13].

In winter, the WQI was also very high, as it recorded 380, and it was also classified as unsuitable water due to the high (Turb., Zn, Cu, Cl,) due to the collection of the entire septic tank water and its concentration in this location of the study area, due to rainwater that washes away pollutants. In addition to this site, there are pollutants containing salts resulting from household waste and sewage, which made this water unsuitable, and since no agricultural lands were observed in this site it depends on irrigation from this water [14].

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