



RESEARCH ARTICLE

Water Pollution in Karbala Province

Zuhair Abdul Wahab Al Jwahery,
Asst Prof, College of Engineering University of Karbala

Methak Hamed Hmeed
Eng, Directorate of Water Resources

Manuscript Info**Manuscript History:**

Received: 15 December 2014
Final Accepted: 26 January 2015
Published Online: February 2015

Key words: noise, GIS, pollution

***Corresponding Author**
.....

**Zuhair Abdul Wahab Al
Jwahery**

Abstract

The research deals with environmental pollution which has resulted from population activities affecting the quality of the streams of Al Hussaiya and Bani Hessen in Karbala Province by carrying out laboratory tests on water samples taken from the two streams. The tests covered CaCO_3 , TS, SO_4^{-2} as well as Cl-1.

The research results show an increase in some physical and chemical properties of the water of the two streams because the study of the physical properties has shown that CaCO_3 rates of Al Hussaiya and Bani Hessen are high but within acceptable limits. However, the total salt rate of Al Hussaiya stream is very high exceeding the acceptable limits. On the other hand, the total salt rate of Bani Hessen stream shows a noticeable increase but it does not exceed the acceptable limits.

The study results show that the chemical properties of the water of the two streams are equal properties which tend to be weakly alkali because PH values of the water of the two streams range between (7.1 and 8). It is noticed also there is increase in the concentration of SO_4^{-2} of the water of the two streams, exceeding the acceptable natural limits because wastewater stations discharge waste to the Euphrates directly without any kind of treatment. It is worth mentioning that the Euphrates is the main water source for the water of the two streams while the concentrations of Cl-1 are within natural limit, not, exceeding the acceptable natural limits.

The researchers would like to point out the rise in salt rate in Razzaza Lake is because of water scarcity and because the Lake is not supplied with water from Habaniya Lake. Thus Razzaza Lake depends on the dead water stored within it. In addition, there is another reason which is the discharge of the main drainage is in the Lake.

Copy Right, IJAR, 2015,. All rights reserved

INTRODUCTION

Karbala Province, like other Iraqi provinces, suffers from a number of pollution problems because of the increase in population of Iraq which has doubled in the last forty years, resulting in pressure on the natural resources because of industrial, agricultural, service, business and tourist activities to achieve economic development to meet the needs of population increase.

The most distinctive collateral problem that goes with development and population growth is environmental problem resulting from mismanagement and misuse of earth resources. When the population increases, wastes of all types increase. Furthermore, when industry expands, industrial wastes increase the most dangerous of which are chemical, food and service wastes. In addition, agriculture also produces wastes as a result of using fertilizers, pesticides and poisons without technical supervision or guidance from government agencies, resulting in serious environmental and health problems.

Water has gained increasing importance during the last decades because of its cost and increasing demand coupled with increased pollution as a results untreated wastewater discharged by rural and town communities. This untreated wastewater is one of the main factors in the pollution of rivers and lakes.

One the other hand, temperature is one of the main factors in the distribution of living organisms in water because the change in water temperature causes most poisonous materials to dissolve. Summer is the season when temperature rises to the highest degree and it is regarded as an effective factor in the pollution of rivers and lakes.

Because polluted water is sometimes used either for drinking or swimming or for some other uses, Msn is infected by a variety of

Diseases caused by Number of harmful bacteria types ⁽¹⁾

Research Aim

The research aims at shedding light on a number of factors which cause water pollution in Karbala Province

Research Problem

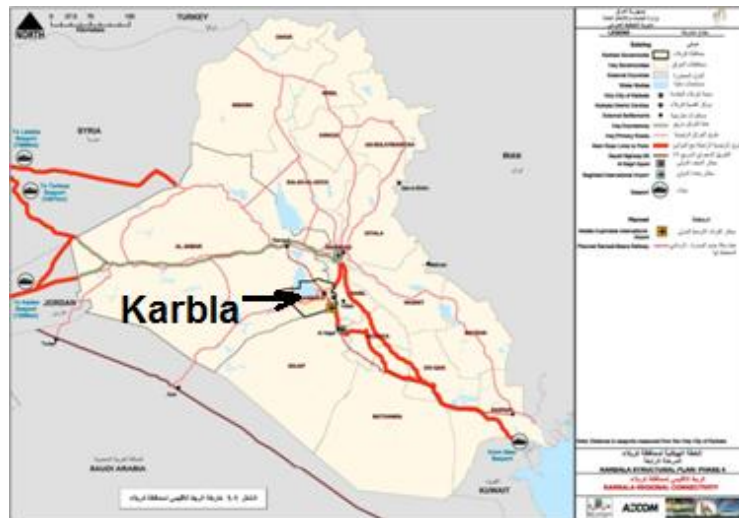
The research problem is represented by the water pollution of Al Hussaiya and Bani Hessen streams as well as other streams in the Province which are polluted to varying degrees by daily human activities

Research Materials and Procedure

The research will depend on lab tests and field recorded concentrations of a number of chemical and physical properties of the water of the two streams and compare them with the permissible limit for each

The Water Environment in Karbala City

Karbala City is an Iraqi city which lies in the south west of Baghdad at a distance of 100 km as shown in Figure (1).



Map (1)The location of Karbala Province relative to Iraq

Reference: Ministry of Municipalities and Public Works, General Directorate of Urban Planning, Structural Plan Project for Karbala Province, a Report on the Fourth Phase, August 2013 p13

The water sources of Karbala City include Al Hussaiya and Bani Hessen streams which branch off Euphrates at Hidiya Barrage. Al Hussaiya flows for 27 km, irrigating area of 186000 acres covering orchards and farms. It is also a source of water for water supply stations

From the main Al Hussaiya stream several small tributaries branch off. They vary in length and flow, the most important of which are BC1 canal (30 km), Abu Zareah (8 km), Al Wind stream (7 km). Some of these streams flow through towns, passing through urban areas such as Hinafeys stream (16 km) and Al Rasheediya stream (14 km) and part of Al Hussaiya stream from kilometer 25 to 27.

On the other hand, the length of Bani Hessen stream is (65 km) of which (44 km) is in Karbala. It irrigates 114000 acres covering orchards and farms in the Province Figure (2) shows the network of main rivers and tributaries within Karbala Province

A number of drainage canals are spread in the Province including field, assembly, branch and main canals all of which flow into the main drainage canal which flows into main Razzaza drainage canal which was dug in 1978. It discharges its water to Razzaza Lake. A lot of fish live in these drainage canals. They provide the Province people with one of the main foods. Drainage is sometimes used to irrigate special types of plants which can resist salinity especially during drought when water level in tributaries becomes very low in summer. Therefore, keeping the quality of water in the drainage canals is a priority to maintain water environment in a healthy state.

Karbala Province is the home of Razzaza Lake which is one of the important natural lakes. It lies at (18 km) to the north west of the Province. It consists mainly of two parts, the first is (Salt Sea) which is on the west side, the second is Abu Depis Swamp) which is on eastern side.

Razzaza Lake receives water from different sources one of which is Euphrates River through Habaniya Lake and Razzaza main drainage (as mentioned earlier) as well as groundwater represented by springs and rain and from valleys which collect rainwater from the west because of land slope towards the Lake such Al Garif Valley, AlArjawi Valley and Al Abyyad Valley

The lake is 1810 km² in area at 40+m above sea level that is 1810 km² with storage capacity of 25750 bm³ at the same level

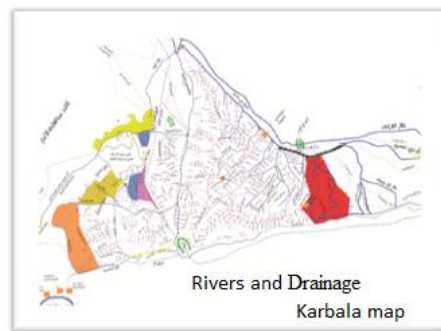


Fig (2) Kerbala irrigation network

Source Karbala Province/ Directorate of Water Resources

The water environment in Karbala Province faces many challenges which affect the public health because they are directly related to people's life as water is an essential requirement for everyday life. Among these challenges are ⁽³⁾

- 1- Province rivers suffer from water scarcity in summer
- 2- The discharge of organic pollutants and wastewater to some water resources and drainage canals
- 3- People throw rubbish into rivers and drainage canals
- 4- Rise in salinity in Razzaza Lake
- 5- Misuse of rainwater sewage system
- 6- The random use of fertilizers and pesticides and their discharge to the drainage water

Water is considered polluted if the structure of its elements is changed or its state (its chemical and physical properties) is changed so that the water becomes less usable for natural applications to which it is normally or sometimes use⁽⁴⁾. Moreover, water pollution threatens bio-diversity and affects the general food chain because it causes the extinction of some bio-organisms in number and type which live in this medium in its various forms of streams, drainage canals and Razzaza Lake. The following sections will deal with these items in detail

Challenges to Water Pollution Situation in Karbala Province

- 1- Scarcity of water in the Province rivers in summer

The water sector in Iraq in general suffers challenges at the local and external levels. At the external level, Iraq like other countries, suffers from decrease in water quantities as a result of climate change and global warming which have lately contributed to increase in evaporation rate all over the world. Furthermore Iraq is regarded as a country of estuary and not of source for both Tigris and Euphrates rivers which are considered the sinews of its life. Iraq neighbors always control them which have recently stated building large dams across them together with huge irrigation projects. As a result their water discharge and level have dropped, causing many arable acres to go out of cultivation reflected negatively on the Iraqi agricultural situation. This also has caused the extinction of types of fish and birds because of increase in salinity above its normal values thus putting bio-diversity in peril. When the Turkish irrigation projects in

south east Anatolia are completed, it is expected that river water levels will drop and the water quantity received will be only 55% of the total needed supply⁽⁵⁾

As a matter of fact, Karbala Province is affected by this situation because in recent years, the quantities of water supplied to the streams of Al Hussayiya and Bani Hessen have fluctuated causing increase in the rate of salinity. If the scarcity of water continues, the rate of salinity will exceed the permissible limit, thus increasing pollution level especially in summer when temperature rises causing increase in evaporation.

At the internal level, there is another type of challenge. The farmer still uses the old fashioned method of irrigation, that is, flooding the farm which is an aggressive method because flooding the farm with water causes some water to flow into drainage canals, damaging the soil, wasting the water. Farmers rarely use modern methods of irrigation such as sprinkler irrigation or drip or trickle irrigation

The case applies also to the groundwater, The random digging for groundwater and leaving the spring without closing it properly, thus causing the springs to dry up or their water level to go down. Groundwater is regarded as a safety valve and a strategic store; therefore we must do our best to maintain groundwater for future generations for sustained development. However, the Ministry of Water Resources has started recently irrigation by pipes in Ain Tamur Kadadah in the Province to control spring water by laying a network of pipes and installing pumps over the springs, thus irrigation is controlled by hand locks. Moreover, irrigation canals were lined which has played a great role in reducing water escape through canal walls and water loss.

2- The discharge of organic pollutants to water resources and drainage canals

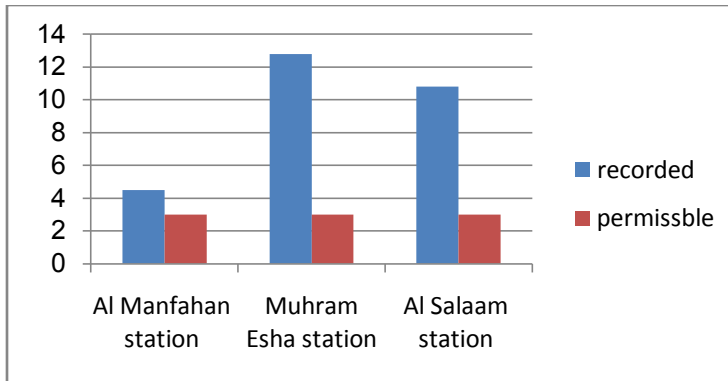
Wastewater discharged from residential areas contains a high percentage of phosphates and microorganisms. Many studies were carried out to determine the quantity of wastewater a person produces annually. It was found it ranges from 3 to 3.7 m³ ⁽⁶⁾. In home different types of chemicals are used in house cleaning as well as liquid fuels, etc. making the home a small plant for production of pollutants which are transported to the sewers by tanker trucks to rivers or drainage canals. Furthermore all vehicles, workshops and stores contribute to environmental pollution by solid, liquid and gaseous pollutants. They all operate in vicious circles whose end is the water canals. The part which flies into the air come back to the earth with rain or with dust particles, it decomposes or is transported by groundwater or washing water to the running water directly. Wastewater contains organic materials including human wastes, soap, industrial detergents, oils and fat, foodstuff, paper wastes, mineral salts especially phosphorous and nitrates in addition to bacteria and viruses. The main wastewater stations (Al Manfahan station, Muhram Esha station and Al Salaam station) in Karbala Province discharge their water to water resources. Table (1) and diagrams (1) and (2) show the concentrations of phosphorous and sulfates recorded at these stations ⁽⁷⁾

Table (1) shows quantities of flow and concentrations of phosphorous and sulfates recorded and their permissible quantities

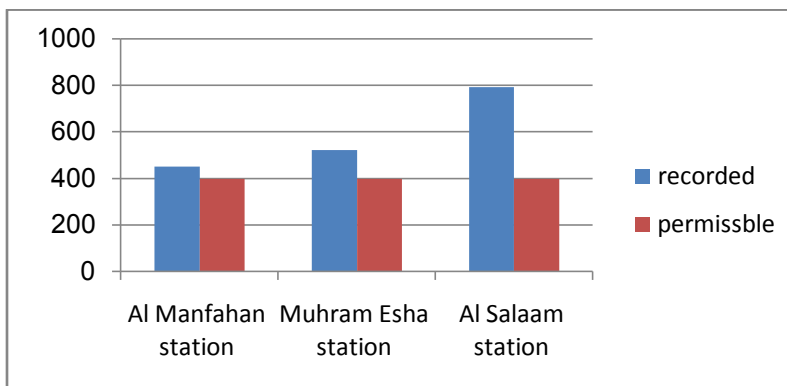
Wastewater St	Con PO4 (mig/L)		Con SO4 (mig/L)		Discharge m ³ /h
	recorded	permissible	recorded	permissible	
Al Manfahan station	4.48	3	452	400	200
Muhram Esha station	12.8	3	522	400	900
Al Salaam station	10.8	3	794	400	1667

Table (1) shows quantities of flow and concentrations of phosphorous and sulfates recorded and their permissible quantities

Source :The researchers



Graph (2) PO₄ concentrations versus the permissible quantities for Karbala wastewater stations
Source: The researchers



Graph (3) SO₄ concentrations versus the permissible quantities for Karbala wastewater stations
Source: The researchers

Wastewater especially that which contains hospital wastes transported through public sewers to the Euphrates and drainage canals is the most dangerous to water. Much of Karbala water has become contaminated due to low level flow and small amount of discharge in addition to liquid and solid pollutants thrown into streams and canals. Many studies have shown that hospital wastes and pollutants have a negative effect on water even when it is treated. It remains polluted with poisonous chemicals which are not removed by bio-treatment. It has been found out that Karbala hospitals liquid wastes are discharged to public sewers directly, causing danger to the public health because they are not sterilized. Studies stress that hospitals wastes should not be discharged to public sewers with town wastes directly, thus waste treatment cost is increasing because they contain lab wastes and dangerous and poisonous chemicals such as saline, acetone, mercury, radioactive materials, etc⁽⁸⁾ for these reasons:

- In hospitals wastes, there bacteria which can resist many types of antibiotics
- Bacteria concentration in hospitals wastes is more than that in other wastes
- Pollutant viruses are found in larger quantities in hospitals wastes than in public wastes such as blood viruses, Cirrhosis of the liver which are found in large quantities in patients' body liquids which finally go to hospitals wastes
- In hospitals wastes, there are large quantities of heavy metals or chemical compounds coming from dental centers and X-ray department, etc

3-Throwing rubbish and solid and liquid wastes

The local population of the city together pilgrims (estimated in millions) throws rubbish and solid and liquid wastes into streams. The wastes contain food left out from the huge meals served freely to pilgrims who come in millions to Karbala on two occasions, to commemorate the fortieth day on the assassination of Imam Hussain and on the Middle of Shabaan Visit. They stay for about two weeks during which huge meals are served three times a day. The food left out is thrown to streams and sewers. The same thing is applied to water bottles and soft drinks cans which are left at the banks of stream because wastes containers cannot contain so much rubbish.

In addition, villagers throw directly some quantities of rubbish and solid and liquid wastes into streams and drainage canals as well as dead animals thus increasing water pollution and slowing water flow. This will certainly a good culture for the growth of bacteria and viruses which causes danger to public health

Karbala is a holy city with population strictly adherent to religion. When people want to get rid of religious books, they throw them into the river and fresh water canals. Although this type of pollution is of minor importance, yet it hinders the flow of water in streams especially when water level in the streams is low. Moreover when the books decompose as a result of heat and water effect, the chemical materials of print ink and paper will change into chemical elements whose danger increases with drop in the flow. Photo (6-1) in the Appendix illustrates this.

4- The rise in salinity in Razza lake

Euphrates is considered the main water source of Razza Lake. Because water level of Euphrates has dropped during the last two decades, Razza Lake, in its turn, has suffered a great drop in its water level which was (38) m two decades ago then it began to decrease gradually coupled with evaporation rate reaching (2 cm) a day so that water level now stands at (20.5) m, causing a rise in salinity concentration. As a result many types of fish and organisms have died out which were living in the Lake. Another source of the Lake pollution is the water coming from Razzaza main drainage canal which flows into the Lake. The drainage canal contains a lot of pollutants. At present only one type of fish which is Shanik lives in the Lake. All other types have died out. Moreover many types of plants have also died out to the extent that the fish in the Lake cannot find the plant to eat with the result that big fish eat smaller ones and so on ⁽⁹⁾

The results of lab test of Razzaza Lake water samples show they contain high concentration of salts which recorded 11800 p.p.m, sulfate 3141 p.p.m and chlorides 3650 p.p.m. This is partly due to low level of water and partly due to Razzaza main drainage canal which flows into the Lake and which transports wastewater as well as chemicals resulting from the random use of fertilizers and pesticides thus causing a rise in pollutant concentrations.

5-The misuse of rainwater sewers

The rainwater sewers in the Province are being used for wastewater because the wastewater from housing quarters is being made to flow into rainwater sewers which discharge it to drainage canals polluting their water. For instance, the rainwater sewers pumping station for Western Drainage located in Al Jmeya suburb and al Rawthateyn pumps 600 m³ /h of untreated wastewater to North Karbala Drainage Canal. The same thing happens with MathimAl Tamaar rainwater sewers pumping station which pumps untreated wastewater in Abbssiya Al Sharkiya suburb to South Karbala Drainage Canal and Bahadeleya rainwater sewers pumping station pumps 600 m³ /h of untreated wastewater to Bahadeleya Drainage Canal in Hay Al Abbas where it pumps 200 m³ /h of untreated wastewater to Al Kurra Draiage Canal through the rainwater sewers in Hay Al Abbas

The same thing happens in Al Hidiya Kadda where every rainwater sewers station in Hay Al Jamreeya and Hay Thubaat pumps 200 m³ /h of wastewater to the drainage canals. On the other hand, Al Muthana rainwater sewers station pumps 600 m³ /h of untreated wastewater to Euphrates directly

Photo (1) shows the locations of pumping stations as well as the course of Al Hussaiya and Bani Hessen streams and Razzaz Lake



Photo (1) shows the locations of pumping stations

Source: The researchers

6-Random use of fertilizers and pesticides and their flow into drainage canals

The agricultural sector is regarded as the wasteful of water in Iraq and in Karbala in particular. The quantity of water consumed by the agricultural as reported by some academic studies 90% of this quantity goes to the streams either through drainage canals or through groundwater when water level in the streams goes down ⁽¹⁰⁾

Many farmers in the Province have adopted a faulty policy of using excessive quantities of nitrogen and phosphate fertilizers, thinking that using a large quantity of fertilizers will speed up plant growth and yield a good produce. However, plants make use of only a small quantity while a large part flows with drained water to drainage canals.

Using excessive quantities of nitrogen fertilizers is the main cause for the pollution of groundwater and drainage water. The environmental damage comes from the pollution with nitrate ions which some plants such as beans and vegetables store them in large amounts in their tissues, changing their color, taste and smell. Nitrate ions reach humans through food chain, causing anemia in children and cancer of pharynx and bladder in adults. The same thing applies to phosphate fertilizers whose increase in canal water causes damage to the life of microorganisms which live wastewater canals. Moreover these compounds are poisonous. The extent of the effect of runoff water depends on the type of fertilizer and pesticide used. Academic studies conducted recently confirm that crops use only 50% of fertilizers and the rest goes into the soil without any use made of. There is no doubt that nitrogen and phosphate fertilizers contribute to water pollution and very small amount of pesticides are useful while more than 44% go to the ecological systems including water. Al Sijil Pumping Station discharges the water of Al Sijil drainage canal to Euphrates directly, causing increase in the river salinity concentration as well as it discharges nitrates and phosphate compounds remaining from the excessive use of fertilizers and pesticides.

The danger from the random use of fertilizers lies in that any increase will leach to the underground water, causing its pollution and thereafter the surface water through drainage and water flow. The commonest types of fertilizers used are nitrogen and phosphate fertilizers in all their types. Excessive use of nitrogen fertilizers is the main reason for underground and drainage water pollution. The danger to the environment, pollution, comes from nitrate ions if they exceed the permissible limit which is 40 mg/lit ⁽¹¹⁾ in water. They reach humans through drinking water and are stored in the tissues of some plants such as beans and vegetables which lose color and taste. Nitrate ions reach humans through food chain, causing anemia in children and cancer of pharynx and bladder in adults.

Furthermore, the increase in nitrates in canal water helps weeds to grow, causing block of water flow resulting in the need for dredging and thus this increases cost and harms fish life.

The danger to the environment comes also from phosphate fertilizers because in their concentration leads to damage to the life of many microorganisms which live in sewers. The compounds are characterized by being poisonous in addition to their ability to precipitate some rare elements in soil which plants need to grow and change to insoluble materials ⁽¹²⁾

Table (2) lists some types of chemical fertilizers used in agriculture

Fertilizer	Ammonia sulfate	Ammonia nitrate	Tri-super phosphate	Urea	Compound fertilizer	Soluble compound
Ch symb	(NH ₄) ₂ SO ₄	NH ₄ NO ₃	Ca(H ₂ PO ₄) ₂	CO(NH ₂) ₂	NPK	NPK&Tr
Ratio	N21%,S24%	N33%	P2O546%	N46%	0-23-23	0.53-20- 20-20

Source . Karbala Agricultural Directorate

Streams and drainage canals in Karbala Province come under another type of pollution, coming from the use chemical compounds such as insecticides and poisons in random fishing. This dangerous method which has spread recently causes water pollution and death of fish. Table (3) shows the lab test result of Husseynia stream

From time to time an oil slick appears on the stream water when Al Messayib power plant is maintained and oil is replaced, causing visible oil slick resulting in the pollution of Husseynia and Bani Hessian streams. These oil slicks which occur twice in a year cannot be treated easily. The water which comes from the Industrial Water Treatment Unit of Al Messayib power plant and which flows into the Euphrates is wastewater as well as the cooling water. Oil slicks leak to the Euphrates and to Husseynia and Bani Hessian streams. This accounts for the rise in oil and sulfate percentages over the permissible limit in Husseynia stream as shown graph (4).

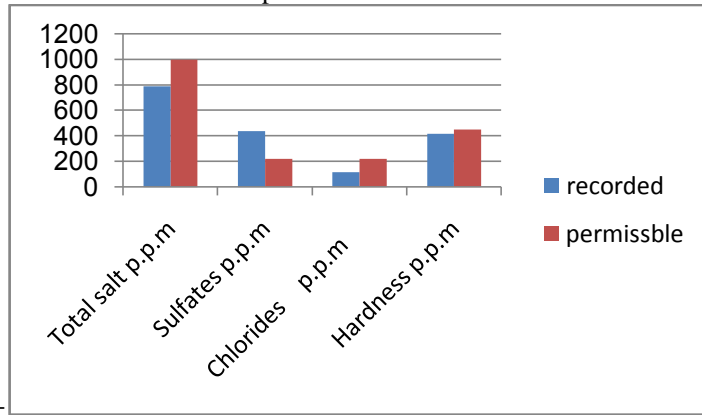
Although oil slick appearance is temporary, its effect remains a long time as shown by water tests which show a rise in sulfate ratio. Sulfates over the permissible limit will change over time to poisonous compounds,

Another type of pollution but a minor one is when trucks and heavy vehicles are washed and have their oil replaced illegally on the stream banks. Also oil from private generators is discharged into the streams.

Table (3) The lab test result of Husseynia stream

PH	Total salt p.p.m	Sulfates p.p.m	Chlorides p.p.m	Hardness p.p.m
7.53	790	440	116	420

. Similarly, hardness has shown noticeable increase but has not exceeded the permissible limit while concentrations of T.S and Cl are within the permissible limit



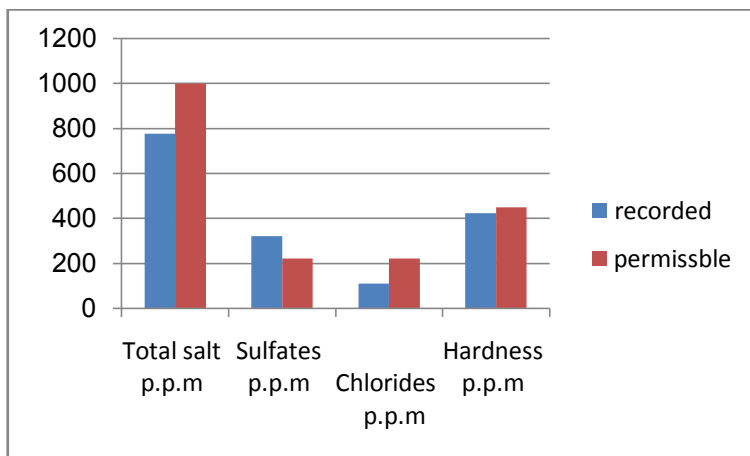
Graph (4) Lab water test results of Husseyinia stream compared with the specification
Source: The researchers

The same case is with lab test results of samples of water taken from Beni Hessian stream which supplies Water Plant in Hindiya in Karbala Province with water and irrigates thousands of acres as shown in Table (4).

Table (4).Lab water test results of Beni Hessian stream

PH	Total salt p.p.m	Sulfates p.p.m	Chlorides p.p.m	Hardness p.p.m
7.4	776	320	110	423

As with Husseyinia stream, the results show increase in SO₄ over the permissible limit. Similarly, hardness has shown noticeable increase but has not exceeded the permissible limit, while concentrations of T.S and Cl are within the permissible limit of the Iraqib Specification as shown in the figure



Graph (5) Lab water test results of Beni Hessian stream compared with the specification
Source: The researchers

Results

Disussion of parameters

-Total hardnss (TH)

It is the total salts of carbonates, bicarbonates, sulfates, chlorides, calcium nitrates, and magnesium nitrates.

As regards Husseyinia stream, the hardness value is 420 parts in a million, thus it is within the permissible limit while the maximum value is 500 parts in a million according to Iraqi and International specifications. The same parameter is applied to Beni Hessian stream total hardness recorded 423 which is within the permissible limit. Because of hardness, the water cannot be used for washing with soap and it plays a major role in the growth of algae and protection of water environment because magnesium and calcium ions are not regarded as reducing heavy metal poisonous effect as well as affecting algae growth on which fish depend on for food

-Total salts (TS)

The total salts in Hussynia stream recorde(790) parts in a million while for Beni Hessian stream it was 776 parts in a million which is within the permissible limit

-Sulfates (SO_4^{2-})

The concentration in sulfates Hussynia stream recorded the highest level which exceeds the permissible limit which is 250 parts in a million as a maximum level because lab tests of Hussynia stream water show sulfates to be (440) parts in a million. Similar case is found with Beni Hessin stream. Concentration of the sulfates shows noticeable rise of (320) parts in a million

-Clorides

From lab tests of Hussynia stream water, it is noticed that it has recorded (116) parts in a million which is within the permissible limit which is set by specification which is (250) parts in a million. . Similar case is found with Beni Hessin stream where chloride concentration reorded (110) parts in a million which is within the permissible limit which is set by Iraqi and American specifications illustrated in Table (5)

Table (5) Iraqi and American water specifications

Parameter	Who Specif 1996 MI/lit ⁻¹	IOS2996 MI/lit ⁻¹	USEPA 1975 MI/lit ⁻¹
TDS	1000	1000	500
pH	6.5-9.5	6.5-8.5	-
TH	-	500	500
K ⁺	-	-	20
N ⁺	200	200	200
Mg ²⁺	50	50	125
Ca ²⁺	200	150	200
Cl	250	250	250
SO ²	250	250	250
HCO ₃	-	-	500
NO ₃	50	50	-

The effect of water pollution on human health

Microbial or chemical pollution of water is regarded as the most harmful to man's health. Undoubtedly, wastewater, if not well treated, causes a lot of diseases especially if it leaks to drinking water. Microbial water pollution is the main cause of liver diseases in many countries.

As a matter of fact, wastewater contains a huge number of microorganisms such as bacteria, viruses, and parasites; they carry many diseases such as cholera, typhoid and poliomyelitis, Microorganisms play a major role in the change of methane, sulfur, phosphor and nitrates. Methane bacteria produce methane gas in aerated and un-aerated conditions. Nitrifying bacteria produce ammonia which oxidizes to nitrates which cause what is known as the green. They form a green layer on the surfaces of water tanks, lakes and river banks most often they form on still water and hinder the entry of oxygen into the water

The polluted home wastewater with human and animal waste is an important source of colon bacteria. Many studies confirm that polluted home wastewater causes a lot of diseases especially diaheria in children which causes the death of 46 million children under the age of 5 years all over the world. Water is regarded as a means for

transporting different diseases such as dysentery, typhoid, poliomyelitis, liver diseases and diseases of respiratory system⁽¹³⁾

This harmful effect is not restricted to man only; in fact it affects all living organisms in rivers and lakes. As stated previously, fertilizers and pesticides which leak into drainage canals help algae a variety of plants thus harming fish life because these plants prevent sunlight and oxygen from penetrating into the water and encourage the spread of insects such as mosquitoes and disease causing insects.

On the other hand, polluted water used for irrigation including drainage water used in irrigation when water is scarce helps to transport organic and chemical pollutants to plants and then to man.

Table (6) illustrates FAO 1989 specification for irrigation water

	Problem nature	Value of lowest use		
		No	Little –medium	Extreme
1	EC ds.m ⁻¹ at25°C	0.7>	0.7-3.0	3<
2	Soluble TS ppm	450	450-2000	2000<
	Sodium adsorption ratio		EC vkue	
	0-3	0.75	0.2-0.7	0.2>
	3-6	1,2>	0.3-1.2	0.3 >
	6-12	1.9<	0.5-1.9	0.5>
	12-20	2.9<	1.3-2.9	1.3>
	20-40	5<	2..9-5	2..9>
3	Ions side effects			
	Sodium meg ⁻¹ surface irrigation	3>	9-3	9<
	Chlorides meg ⁻¹ surface irrigation	4<	10-4	10<
4	Other side effects			
	No ₃ -N meg ⁻¹	0,5>	30-5	30<
	Bicarbonates meg ⁻¹	1.5>	8.5-1,5	8.5<

Table (7) below shows the discharge activities of sources in Karbala Province⁽¹⁴⁾

Table (7) shows the discharge activities of sources in Karbala Province⁽¹⁴⁾

	Activity	Location	Qty of liquid discharge m ³	Discharge type	Discharged to	Treatment
1	Rain water pumping station to western drainage canal	Residential area between Eawthaten and Jameyya	600	Wastewater	Western drainage canal	Not available
2	Rain water pumping station, Maythim Al Tammar	Residential area, Abbassiya Al Sharkiya	200	Wastewater	Al Jabir drainage canal	Not available
3	Wastewater pumping station, Al Minfahaan	Minfahaan area, Hindiya Kadaa	200	Treated	Minfahaan drainage canal	Bio treatment
4	Rain water pumping station, Al Bahadelya	Bahadelya area	600	Wastewater	Bahadelya drainage canal	Not available
5	Wastewater	Muhrm Abesha	9000	Treated	Euphrates river	Available

	pumping station, Muhrm Abesha	area, Hindiya Kadaa				
6	Kerbaka Wastewater pumping station	Freha area	1667	Wastewater	Freha drainage canal	Treatment plant under repair
7	Rain water pumping station, Hay Al Abbass	Hay A Abbass	200	Wastewater	AL kurra drainage canal	Not available
8	Rain water pumping station, Hay Thubaat	Hay Thubaat, Hindiya Kadaa	200	Wastewater	drainage canal	Not available
9	Al Mutyhana rain water pumping station	Al Mutyhana area, Hindiya Kadaa	600	Wastewater	Euphrates river	Not available
10	Rain water pumping station, Hay Al Jameya	Hay Al Jameya area, Hindiya Kadaa	200	Wastewater	Hilla –Kefil drainage canal	Bio treatment

Rnoitadnemmoce

- 1- Modern irrigation methods such as irrigation splinker, drip irrigation and underground irrigation which depends on underground pipes used for irrigation of some projects where they proved efficient because they improve water quality and speed up plant growth and reduce waste in irrigation water considering water scarcity.
- 2- Laws and regulations on the use of poisonous materials should be enforced. The public should be made aware that gaseous, liquid and solid pollutants will decompose and pollute water through groundwater whose level is high in middle and south Iraq. The lower the river water level is, the more groundwater flow in with its pollutants to main branch streams.
- 3- Efficient inspection units should be created to get rid of pollutants and poisonous wastes coming from plant, hospitals which encroach on sewers
- 4- Every hospital should be provided with mini waste treatment unit connected to hospital main sewers. It will carry out three types of treatment on liquid pollutants, thus eliminating pollutants
- 5- Agricultural drainage water can be used provided it is treated to remove poisonous wastes and mixed with fresh water to be within the limits acceptable in agriculture
- 6- Wastewater can be recycled for agricultural use to protect the environment.
- 7- Public media should be encouraged to expose the sources which feed pollution and uncover any failure to treat wastewater coming from any pollution sources or encroach on treatment plants. Furthermore, environment protection offices in all government department should pay more attention to environment protection by documenting pollution effect and if necessary put the matter before higher authority to bring the negligent to account
- 8- Effort should be made to supply Razzazza Lake with fresh water to reduce salinity and put an end to the extinction of living organisms in the Lake
- 9- Regulations should be laid down and teams are formed to educate farmers to use fertilizers in the correct proportion and according to actual need so that plants make use of them and random use is avoided which causes the loss of most of fertilizers, causing water pollution.

Appendix



Photo (2)

Photo (1)



Photo (4)

Photo (3)



Photo (6)

Photo (5)

Source: The researchers

References

- 1- Radhi,Enaas Mohammed,Water Pollution in Iraq and Howto Treat It
Available at
- 2- ×Owayid,Mohammed and Ibrahim, Murtada Jaleel, Historical and Intuitional Study of Razzazza Lake,
Scientific Journal, Karbala University, September 2005
- 3- Iraqi Ministry of Environment, National Strategy for the Protection of Iraqi of Environment (2013-2017)

- 4- Wikipedia, Water Pollution . Available at
- 5-Waheed,Kareem,Policy fo Building Power Plants in Iraq and Solution. Available at
- 6-Mohammed,Tawfiq Jassim, Management of Iraqi Water .Available at Resources.Avilahttp://www.acwua.org/sites/default/files/2_tawfiq_mohammad.pdf
- 7-Karbala Environment Directorate
- 8-Naem, Fatin Reyaad, A Manual on Razzazza Lake,Natural Sanctuary. Karbala Environment Directorate, Environmental System Branch,2010
- 9-ibid 6
- 10- Risk from Chemical Fertilizers. .Available at
- 11-Institute for Wetland Reearch, Water Pollution, available at
- 12-Al Zurfy,Sadik Kadum Lafta,Effect of Heavy Water on Some Chemical and Bacteriological Properties of Kufa River, College of Sciences,Kufa University Journal,2012
- 13- ibid 7
- 14-ibid 7