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Investigation of Kufa drainages and its impact on the chemical pollution in water of the Euphrates river

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Abstract

The research aims to prepare an integrated study to investigate drainages discharged in Kufa river within the district of Kufa and evaluate the quality and quantity of water and chemical impact on the river, with appropriate methods for disposal or re-use it for different purposes. The study included a modeling for the entire year with four winter seasons and the spring and summer and autumn, which brought water samples monthly from Kufa river and drainages discharged it by 2 stations of water each, and 2 station of Kufa river water before and after the discharge of water each to it, and the analysis is performed physical and chemical these waters. The results indicated that the water drainages specifications of the four seasons within a few salinity class as classified by the International Organization for Food and Agriculture, S1 or S2 little damage to the average damage according to the classification system, the US Salinity Laboratory. The Kufa river water they fall within the class a few salinity or S1 little damage by both classifications and chemical impact resulting from the discharge of contaminated water to the Kufa river drainages was a slight, it is possible to use the river water for different purposes to the fact that their specifications within the permissible limits as water collapsed.

Keywords: River water, Drainages water, Irrigation water, Chemical analysis, Salinity.

Introduction

With the beginning of the atheist and the twentieth century water resources become critical importance strategy in most regions of the world including Mesopotamia region where the problem with the first two-dimensional quantitative and the other qualitative, it has become rivers salinity waters of the Euphrates river, increasing continuously due to reduced discharges the river on one side and water drainage many drainages of the river, including in respect of heavy water and pollutants increase with increasing population and urban development and industrial (Newborn, 2013), where the salt concentration of the waters of the Euphrates river rate during the years 2007, 2008 and 2009 about 600,720,855 mg/l respectively (Abdul Abbas, 2012).

Water quality depends on the physical, chemical and biological properties of these characteristics that make use of what is possible for the purpose of directly or is only possible after an address specific to modify one or more of these characteristics, The most important criteria for determining the rivers quality that must be studied as pointed Laboratory, US Salinity is the value of electrical conductivity unit measure dS/m or S/cmμ which are closely linked to the solid dissolved materials, the total concentration of salts unit mg measure/l (ppm), which include Total ions dissolved positive and negative in the water (Na +, Ca ++, Mg ++, Cl-, HCO3-, SO4 =), and the proportion of sodium adsorption and the concentration of boron (Zidane, 2009), while the rating food and Agriculture Organization of the United Nations has adopted the value of electrical conductivity of the impact direct in plant growth and the ratio of sodium to influence adsorption in the soil permeability and the concentration of each of chlorides, sodium and boron cations harmful and other important such as the concentration of nitrates and bicarbonates and the degree of water interaction determinants (Tanji and Kielen, 2003; Ayers and Westcott, 1994).

The saline and sodic and toxicity of the most important risks caused by salt water discharged into rivers when the last use for agricultural and industrial purposes (Salman, 2006), is the degree of sodium adsorption SAR Sodium Adsorption Ratio proposed laboratory salinity in the United States (Richards, 1954) an important indicator to predict the seriousness of the sodium irrigation water, and more water as high sodic when SAR exceeds the value of 10 (Rhoades and Kandiah, 1992).

Increase the risk of toxic water at increasing the proportion of SAR where about 10, and boron if exceeded mg/l 5, and nitrates if mg/exceeded l30 and bicarbonate if exceeded mg/l 520 (Fahad, 2001), when exceeded the concentrations of elements and compounds of permissible limits waters of rivers due to the discharge of contaminated water it will adversely affect the different varieties to aquatic organisms, also lead to increase the concentrations of nitrates and phosphates to increase food enrichment plants and algae thus increasing phytoplankton causing problems when used in industrial fields, as well as brownish color in the water which gives recipes undesirable for many manufacturing processes, and pesticides in rivers resulting from water agricultural drainage causing poisoning of a large number of fish and aquatic organisms and the human being when used as drinking water (Haidari, 2005; Sabri *et al*., 2009) so it is supposed to assess the quality and quantity of water to learn how to use it for agricultural purposes and industrial.

Branches of the Euphrates river south rump city about 5 km to the two branches river Kufa Abbasid and river, and the total length of Kufa river in the province of Najaf 75.200 km, and the rate of discharge variable within months a year and that this change is due to several factors, including climate and the level of decline and geological nature of the river, which greatly affect the concentration of oxygen

Dissolved and the neighborhoods, especially phytoplankton density (Al-Saadi, 2006), research has indicated that the discharge of the Euphrates river water continuously decrease from year to year discharge rate recorded m^3/S 120 for the year 2007 while in 2009 it dropped to m^3/S 90 and continues down year after year because of the decline of water and the lack of natural drainage of water sources to the Euphrates River.

Total number of main branches and secondary river Kufa in Najaf province up to 37 branches and has a total length of up to 281 km, there are many drainages flowing waters in Kufa river, the most important to Qazwini and drainages northern and to Albouhdara South drainages, has drainages designed to collect agricultural water waste in a wide agricultural areas adjacent to the river from Kufa and then discharged into the river (Hussein, 2012; Abdul Abbas, 2012; Zurfi *et al.*, 2010).

Numerous studies grassroots nature of the waters of the Euphrates river and a high degree of electrical conductivity and salts total soluble and high hardness shown at a low level of the river and because of water drainage discharge it, and in some cases exceeded the permissible limits as drinking water (Imran *et al.,* 2010; Carpal, 2001), saluting the maximum concentration permitted for ten as drinking water to exceed mg/l 500, according to WHO standards (WHO, 2011), has increased the concentration of brackish water used in the industry to affect clogged piping at the use of water for industrial purposes. And there either chlorides exceeded its focus on mg/l 400, and sulfates from mg/l 600 will affect the taste and smell of the water with the incidence of diarrhea and disorders of the digestive system to humans (WHO, 2011).

The research aims to prepare a full study on the investigation of drainages flowing waters in Kufa river and evaluate the quality of the chemical and its impact on the river water with finding the appropriate methods for disposal or re-use it for different purposes. Dissolved and the neighborhoods, especially phytoplankton density (Al-Saadi, 2006), research has indicated that the discharge of the Euphrates river water continuously decrease from year to year discharge rate recorded m^3/S 120 for the year 2007 while in 2009 it dropped to m^3/S 90 and continues down year after year because of the decline of water and the lack of natural drainage of water sources to the Euphrates river.

Materials and Methods

The study conducted a monthly modeling for the entire year with four seasons, winter and spring and summer and autumn and represents all analyzes season rate for four months, and as follows:

Modeling: brought water samples monthly from Kufa river water and water drainages four discharged him for four sites, the first site to Qazwini second location north to third location to Albouhdara fourth location south drainages (each site includes 4 stations) Station 2 of water each to and station 2 of Kufa river water before and after discharge drainages it, and Figure 1 shows the sampling of river water and four drainages drained the sites.

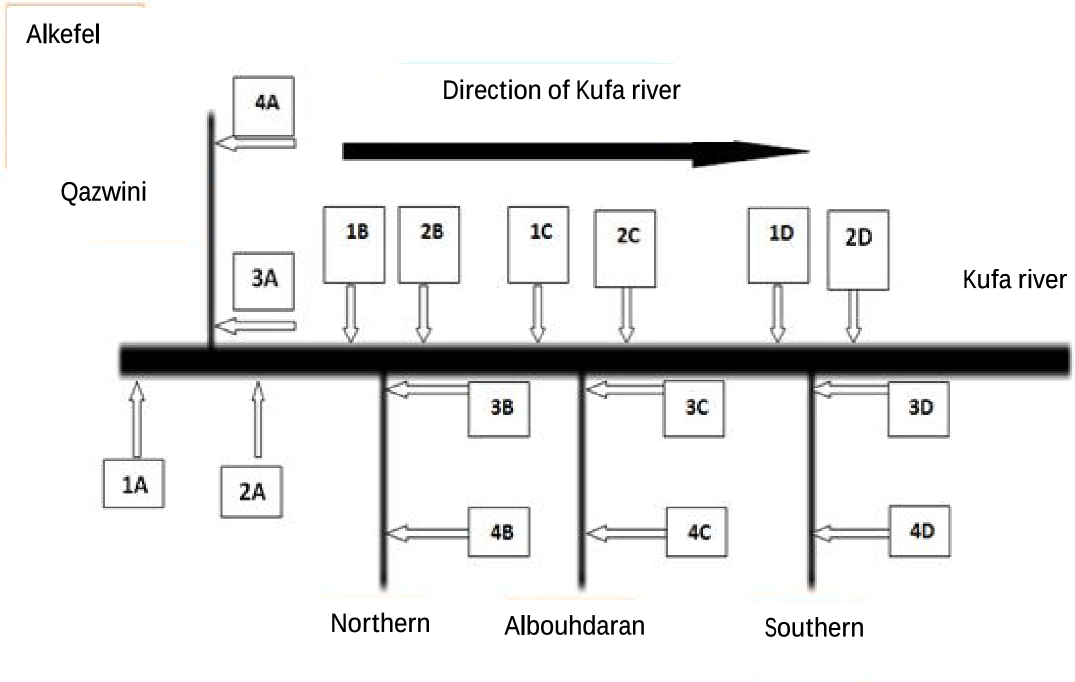

Figure (1): Modeling stations planned to Kufa river four drainages discharged it
A1: Euphrates river water before discharge to Qazwini a distance of 50 m.
A2: River water after discharge to Qazwini 200 m.
A3: The end of the Qazwini.
A4: The beginning of the Qazwini.
B1: Euphrates River water before discharge northern drainages a distance of 50 m.
B2: River water after discharge northern drainages a distance of 200 m.
B3: The end of the northern drainages.
B4: The beginning of the northern drainages.
C1: Euphrates river water before discharge to Albouhdara a distance of 50 m.
C2: River water after discharge to Albouhdara 200 m.
C3: The end of the Albouhdara.
C4: The beginning of the Albouhdara.
D1: Euphrates river water before discharge southern drainages a distance of 50 m.
D2: River water after discharge southern drainages 200 m.
D3: The southern end drainages.
D4: The beginning of the southern drainages.

Analyses: The analysis is performed physical, chemical, in the Department of Water Reuse / labs / Water Environment and Water Department Research Center Research, included analyzes of pH acidic function using a device (WTW inolab pH meter level 1) German-made, salinity, which include electrical conductivity EC and salts measurements total dissolved TDS using a device (WTW inolab electric conductivity meter 720) German-made, brackish using titration method with EDTA-Na solution, and bicarbonates titrated with H2SO4 acid, cations (Ca, Mg, Na, K), where was measured Na, K using a (Flame photometer AFP100) English-made, and the concentration of Ca was measured titrated with EDTA-Na solution, and the concentration of Mg is calculated in terms of hardness concentration and Ca, the negative ions (Cl, PO4`, SO4, NO3), which was measured Cl titrated with nitrate silver, the PO4`, SO4, NO3 was measured using a device (UV-1700 Shimadzu spectrophotometer) German-made, the expense ratio of the sodium adsorption SAR has been this ratio calculation to know the concentration of sodium, calcium and magnesium ions, as in the following equation (Johnson, 2003):
Where [Ca ++] and [Mg ++] and [Na +] calcium, magnesium, sodium concentration b (meq/l) and the previous equation can be written in the following manner: -
As: [Na +], [Mg ++], [Ca ++] represent the

concentrations of calcium, magnesium, sodium, respectively (ppm).

Boron was measured using a device (UV-1700 Shimadzu spectrophotometer) German-made, while the heavy elements have been measured using the device (atomic absorption Nova 400) US-made.

Results and Discussion

The results of the water analysis presented in the Tables (1, 2, 3 and 4) that the value of EC water four drainages ranged between dS/m (2.5-6.8), while the proportion of SAR water drainages ranged between (3-5) for four seasons, and are classified this water within the class medium salinity according to the UN Food and Agriculture Organization (FAO, 1992) or S1 to S2 few average damage according to the classification system, the US salinity Laboratory (Appendix 1 and 2).

Drainages supply salty water resulting from washing the soil of agricultural land has caused in Kufa river slight rise in the value of the electrical conductivity of river water (Tables 1, 2, 3 and 4), but it was within the permissible limits waters of rivers (WHO, 2011), was also noted that there is an increase of the value of conductivity electrical river water for the summer season compared to other seasons due to increased output evaporation of high summer temperatures and low river water level due to lack of rainfall and the lack of drainage natural freshwater sources to the river, and this is consistent with Zurfi *et al.* (2010) as the lower the water level has increased electrical conductivity value and health, industrial and agricultural drainage water always lead to a significant rise in most of the environmental risk factors. Qazwini drainage has water speed rate of about m^3/s 1 and the rate of rise in water drainages m2 level, either Albouhdara and southern drainages was high water level of the two rate (0.5 and 2m), respectively, and the rate of discharge of two m^3/s (1.2), respectively, during the four seasons.

Results indicated that the chemical effect resulting from the discharge of contaminated water to drainage Kufa (Qazwini, northern, Albouhdara, south) to Kufariver was a slight The value of electrical conductivity of the water Kufa river before and after discharge drainages it for the winter season and the spring and summer and autumn (1.41, 1.34) (1.53, 1.49), (1.72, 1.54), (1.299, 1.299, respectively (Tables 1, 2, 3 and 4), either sodium adsorption ratio SAR they reflect the seriousness of the toxicity of sodium or water, the SAR value for water rate the river for four seasons up to 3 (Table 1, 2, 3 and 4), has been ranked Kufa river water quality for four seasons within a few salinity classified by the UN Food and Agriculture Organization and S1 little damage as a rating system, the US salinity Laboratory (1 and 2) extension.

The concentrations of phosphate, nitrate and potassium are caused by agricultural and animal waste in the river water, which increases the summer launch, however, was within the permissible limits as water collapsed due to consumption by aquatic plants and algae (Ragab, 2008; Johnson, 2003). The availability of dissolved oxygen in surface waters led to the superiority of the concentration of nitrate nitrite concentration of nitrogen compounds other due to oxidation processes which the dominant form in the waters of rivers and lakes, while the concentration of sulfates and chlorides in the river water they result from household water discharged into the river or from leveling soil and rocks through drainage process (Hussein, 2012).

She also noted the results of river water tests after water drainage drainages to it that can be used as water irrigation, and that this water specifications were identical to the specifications of the water used for watering poultry and cattle, where the value of conductivity less than S/cmμ 1900 is the water with a few salinity and excellent for all kinds of livestock and poultry, but if exceeded these limits may lead to the emergence of a few cases of diarrhea, according to the World Health Organization determinants of WHO (2011).

The measurement function acidic pH of the water drainages and river water of the four seasons described the four tables were between 1/8 to 8/6, that this discrepancy is caused by the difference in the concentration of basal ions resulting from the melting of some soil components in water or due to high temperatures and increased decomposition of organic materials rates with increasing conversion calcium carbonate is dissolved into bicarbonate, or as a result of the interaction of CO_2 gas with limestone and production of bicarbonates, which lead to increased pH value or because of the presence of free ammonia in the water where the ammonia with water leads to the formation of ammonium hydroxide, which increases the value of pH, as the increased interaction carbon dioxide, which increases the value of pH consumption has attributed the cause to the high density of plant plankton during the summer season, which increases the photosynthesis process and consumption of CO_2, and this is consistent with the policies included in Taha *et al.* (2003) that the pH of water increases with basal ions and that the importance of the exponent pH comes from the fact that many of the chemical reactions are affected by this function, although high basal or acidic high unacceptable because of corrosion problems in the pipe carrying water during the agricultural and industrial operations and the potential difficulties in water treatment, as observed during the sampling of water drainages season autumnal that water drainage level Qazwini and the South has dropped due to lack of water drainage to drainages during the harvest season, so workers cannot bring samples each Table (4).

Results also indicated that the concentration of heavy metals in the water and river water drainages four seasons were minimal and were within the permissible limits as water collapsed, according to WHO determinants of WHO (2011).

Table (1): Physical and chemical analyses of water and river water Kufa drainges for the winter season.

Mn++ ppm	Fe++ ppm	Pb++ ppm	Cu++ ppm	SAR	B ppm	HCO3- ppm	NO3- ppm	Cl- ppm	PO4-- ppm	SO4-- ppm	K+ ppm	Na+ ppm	Mg++ ppm	Ca++ ppm	Turbidity ppm as caco3	Ec dS/cm	TDS ppm	pH	Sample	Site	
0.1	0.3	0.05	0.02	2.4	0.5	45	9	99	0.1	108	4	125	11	168	466	1.34	805	7.5	A1	River	Site 1
0.2	0.5	0.06	0.02	2.5	0.7	55	9	101	0.1	122	4	130	4	180	468	1.35	911	7.5	A2		
0.3	1.2	0.07	0.04	5	3	99	10	565	0.1	3000	24	624	210	444	1944	5.00	3221	7.4	A3	drainge	
0.3	0.9	0.06	0.03	5	2.7	80	11	576	0.2	2990	21	612	209	450	1988	5.10	3232	7.0	A4		
0.09	0.2	0.03	0.02	2	0.4	44	8	112	0.1	112	3.4	110	36	132	480	1.32	813	7.7	B1	River	Site 2
0.1	0.3	0.03	0.02	2	0.8	65	8	112	0.2	114	2.9	105	31	122	432	1.33	826	7.6	B2		
0.2	0.7	0.08	0.04	3	2	166	9	365	0.2	900	6	250	158	321	1450	3.41	2050	7.2	B3	drainge	
0.2	0.5	0.05	0.04	3	2	167	8	370	0.3	988	5.8	245	152	334	1465	3.43	2044	7.2	B4		
0.08	0.1	0.02	0.03	3	1	60	9	115	0.1	120	3.8	125	49	115	490	1.31	822	7.4	C1	River	Site 3
0.08	0.3	0.04	0.02	2.4	0.9	59	8	116	0.1	123	4.2	125	46	123	498	1.30	810	7.3	C2		
0.4	0.5	0.09	0.05	3	1.7	205	9	272	0.3	400	5.1	175	168	344	1554	3.10	2099	7.2	C3	drainge	
0.3	0.6	0.09	0.06	3	3	188	8	164	0.3	413	4.7	172	132	422	1600	.003	2000	7.3	C4		
0.1	0.4	0.05	0.02	2	0.7	38	8	99	0.3	130	4.3	127	13	188	523	1.41	820	7.0	D1	River	Site 4
0.1	0.4	0.04	0.02	2.3	0.6	46	10	110	0.4	128	3.9	125	24	174	533	1.41	1050	7.0	D2		
1.2	1	0.1	0.05	5	3	130	10	1256	0.6	1000	22	568	215	432	1965	5.21	3300	7.0	D3	drainge	
1.3	1.2	0.1	0.04	5	3	243	11	1258	0.6	1132	16	558	195	487	2020	5.11	3222	6.8	D4		

Table (2): Physical and chemical analyzes of water and river water Kufa drainge discharged for the spring season.

Mn^{++} ppm	Fe^{++} ppm	Pb^{++} ppm	Cu^{++} ppm	SAR	B ppm	HCO_3^- ppm	NO_3^- ppm	Cl^- ppm	PO_4^{--} ppm	SO_4^{--} ppm	K^+ ppm	Na^+ ppm	Mg^{++} ppm	Ca^{++} ppm	Turbidity ppm as $caco_3$	Ec dS/cm	TDS ppm	pH	Sample		Site
0.2	0.3	0.06	0.03	2.4	1	55	9	100	0.3	120	5	133	21	155	474	1.49	944	7	A1	River	Site1
0.2	0.3	0.06	0.02	2.7	0.7	65	9	98	0.3	122	5	144	8	146	400	1.55	987	7.2	A2		
0.4	1.1	0.04	0.03	5	3	100	9.1	611	0.5	2889	19	663	171	475	1890	5.0	2800	7.4	A3	drainge	
0.4	0.9	0.04	0.03	5	3.2	144	8	543	0.6	2900	20	643	130	532	1865	5.0	2750	7.3	A4		
0.09	0.3	0.07	0.03	2	1.4	50	8.5	99	0.4	133	5	110	30	124	433	1.45	900	7.5	B1	River	Site2
0.08	0.3	0.08	0.02	2	1.8	65	9	90	0.4	153	5	122	39	132	485	1.5	890	7.4	B2		
0.1	0.8	0.08	0.03	3	4	166	9	376	0.6	500	7	265	128	356	1412	3.7	2300	7.0	B3	drainge	
0.1	0.6	0.08	0.04	3	3	167	8.5	368	0.9	521	7	254	127	351	1420	3.6	2289	7.2	B4		
0.08	0.1	0.04	0.05	2	1	70	9	117	0.2	132	4	123	45	120	483	1.44	988	7.4	C1	River	Site3
0.08	0.5	0.05	0.02	3	1.3	66	9	154	0.4	133	4.6	132	37	137	489	1.52	999	7.0	C2		
0.6	0.5	0.09	0.05	3	1.8	235	10	290	0.5	602	5	187	164	375	1577	4.0	2550	7.0	C3	drainge	
0.4	0.7	0.09	0.03	3	3	198	11	310	0.4	577	4.2	175	253	194	1614	4.0	2520	7.3	C4		
0.1	0.3	0.03	0.02	2.5	0.9	68	10	99	0.3	128	4	132	13	187	499	1.5	1010	7.4	D1	River	Site4
0.1	0.4	0.04	0.02	2.8	1.6	56	8	89	0.3	143	3.5	131	14	204	500	1.53	990	7.0	D2		
1.1	1	0.08	0.04	5	4	180	9.4	1300	0.7	3122	31	623	170	512	2320	6.8	4500	7.5	D3	drainge	
1.2	0.9	0.09	0.05	5	4.1	253	11	1354	0.9	3133	28	611	164	519	1998	6.9	4010	7.5	D4		

Table (3): Physical and chemical analyzes of water and river water Kufa drainage discharged for the summer season.

Mn^{++} ppm	Fe^{++} ppm	Pb^{++} ppm	Cu^{++} ppm	SAR	B ppm	HCO_3^- ppm	NO_3^- ppm	Cl^- ppm	PO_4^{--} ppm	SO_4^{--} ppm	K^+ ppm	Na^+ ppm	Mg^{++} ppm	Ca^{++} ppm	Turbidit yppm as $caco_3$	Ec dS/cM	TDS ppm	pH	Sample	Site	
0.2	0.3	0.05	0.02	3	1.0	30	9	88	0.5	150	10	155	33	177	500	1.54	900	8.0	A1	River	Site1
0.3	0.4	0.05	0.02	2	0.8	44	9	120	0.3	157	4	120	20	128	455	1.55	910	8.0	A2		
0.3	1.3	0.06	0.03	4	2.5	134	10	390	0.8	2228	18	433	150	466	1640	4.2	2800	7.5	A3	drainge	
0.2	0.9	0.05	0.04	5	2.0	179	10	405	1.0	2000	16	524	166	535	1600	4.4	2900	7.4	A4		
0.09	0.5	0.03	0.04	3	1.2	80	9	144	0.4	177	10	200	25	188	522	1.6	914	7.7	B1	River	Site2
0.1	0.5	0.04	0.03	3	1.0	66	9	123	0.7	183	6	136	21	130	499	1.62	915	7.6	B2		
0.2	0.7	0.05	0.07	5	3.0	175	8	394	0.9	2130	29	480	88	560	1677	4.0	2740	7.5	B3	drainge	
0.1	0.7	0.05	0.05	5	2.6	166	11	433	1.1	2177	26	477	101	500	1598	4.0	2750	7.4	B4		
0.2	0.3	0.02	0.03	3	0.7	60	8	100	0.3	200	4	161	11	159	511	1.65	917	7.6	C1	River	Site3
0.1	0.5	0.03	0.03	3	0.8	44	7	97	0.3	195	5	130	15	133	444	1.66	918	7.7	C2		
0.6	0.5	0.09	0.05	4	1.5	90	9	333	1.0	1988	19	410	112	455	1446	4.2	2880	7.3	C3	drainge	
0.5	0.7	0.09	0.06	4	2.0	198	9	369	0.5	1930	18	454	145	610	1655	4.1	2790	7.4	C4		
0.1	0.4	0.03	0.05	3	1.8	88	7	155	0.4	190	4	162	20	168	606	1.7	955	7.7	D1	River	Site4
0.1	0.4	0.03	0.02	3	2.2	58	7	168	0.6	199	3	152	30	184	580	1.72	960	7.3	D2		
1.3	1.2	0.08	0.05	5	3.0	200	15	675	1.5	4000	7	644	29	768	2488	6.7	4022	7.4	D3	drainge	
1.2	0.9	0.08	0.05	5	3.3	195	12	600	1.7	3788	11	577	34	779	2800	6.6	4208	7.2	D4		

Table (4): Chemical and physical analysis of water and river water Kufa drainage of the autumn season.

Mn^{++} ppm	Fe^{++} ppm	Pb^{++} ppm	Cu^{++} ppm	SAR	B ppm	HCO_3^- ppm	NO_3^- ppm	Cl^- ppm	PO_4^{--} ppm	SO_4^{--} ppm	K^+ ppm	Na^+ ppm	Mg^{++} ppm	Ca^{++} ppm	Turbiditypm as $caco_3$	Ec dS/cM	TDS ppm	pH	Sample	Site	
0.1	0.2	0.05	0.01	2.8	0.5	31	10	88	0.3	136	9	150	25	141	500	1.28	998	8.0	A1	River	Site1
0.1	0.4	0.05	0.01	2.5	0.8	39	11	89	0.5	134	10	146	30	157	508	1.26	1090	7.8	A2		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A3	Drainge	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	A4		
0.09	0.3	0.04	0.02	3	0.7	38	9	100	0.6	105	8	100	23	125	600	1.19	633	7.7	B1	River	Site2
0.1	0.2	0.02	0.03	2.5	0.6	29	8	97	0.7	111	8	99	31	133	622	1.06	722	7.6	B2		
0.1	0.3	0.06	0.06	3	1.2	70	14	133	1.0	150	15	198	33	195	776	2.60	1544	7.0	B3	drainge	
0.1	0.4	0.04	0.04	4	1.3	67	13	142	1.0	132	16	179	29	184	730	2.7	1248	7.1	B4		
0.2	0.2	0.06	0.04	2	0.4	28	11	102	0.4	99	10	99	20	121	599	1.18	790	7.3	C1	River	Site3
0.2	0.3	0.03	0.03	3	0.7	26	12	99	0.8	98	7	105	22	120	564	1.19	793	7.5	C2		
0.3	0.4	0.09	0.07	3	1.7	40	13	89	1.1	130	12	187	19	200	600	2.6	1220	7.8	C3	drainge	
0.3	0.5	0.09	0.05	4	1.6	41	16	109	0.9	140	20	202	30	169	767	2.8	1322	7.8	C4		
0.2	0.3	0.06	0.06	3	0.8	27	11	88	0.8	105	7	112	21	159	500	1.29	679	8.0	D1	River	Site4
0.2	0.4	0.04	0.04	2.8	0.7	22	10	87	0.7	123	9	124	20	166	597	1.29	698	8.1	D2		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	D3	drainge	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	D4		

Conclusions

Drainages waters classified four seasons as having low salinity by FAO and the International Agriculture FAO or S1 little damage to the S2 average damage according to the classification system Laboratory US salinity, and Kufa river water quality of the seasons, the four were in the brackish class and S1 little damage by both classifications. We recommend using the river water in different industrial and agricultural areas being within the allowable limits. The water drainages can be reused after following method is suitable for water management.

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Appendix

Annex (1): Food and Agriculture Organization specification (1992.FAO) to determine the validity of water for irrigation

Water quality	TDS PPM	Ec ds/m	Class water	Sequence
Drinking and irrigation water	500<	0.7>	Non-saline	1
Irrigation water	500-1500	2-0.7	Low-salt	2
Initial water drainage and groundwaterInitial water drainage and groundwater	1500-7000	2-10	Medium salt	3
High water drainage and groundwater	7000-15000	10-25	High salinity	4
Underground water too salty	15000-35000	25-45	Very high salinity	5
Sea water	35000<	45	Severe salt water	6

Extension (2): Classification of the USA Salinity Laboratory System

Classification of water quality depending on the risk of sodium				
Classification of the USA Salinity Laboratory				
Electrical conductivity (Ec) ds/m				class
2250 <	2250 - 750	750 - 250	250 - 100	
Sodium adsorption ratio(SAR)				
4 - 0	6 - 0	8 - 0	0 -10	Little damage S1
9 - 4	12 - 16	15 -8	18 -10	Medium S2
14 - 9	18 - 12	22 - 15	26 - 18	Severe damageS3
14<	18<	22<	26<	Very Severe damage S4

S/cm = 1000 μ1dS/cm