Comparison Study of The Physico-Chemical Parameters Between A River and A Hand-Dug Wells Inside It

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ABSTRACT

Three wells were drilled inside Al Dehissyia river in the Al_Shafia /SaidTalib along 1.5 Km distance, and the some common physical and chemical parameters weremeasured. The results were compared between wells samples and the river samples. It was clear from this comparison study that drilling a well inside the river can give a water with less percentage of TSS, TDS, chloride level, turbidity and electrical conductivity, where it can be considered as a new method to obtaina safe source for delivering the water for different domestic uses instead of the pumping the water from the river directly to be treatment.

Keyword : Comparison study, river, well, Hand-dug wells, physical and chemical parameters.Shafia, SaidTalib, Al-Dehissyia, ground water.

الخلاصة

في هذا البحث تم حفر ثلاثة ابار في داخل نهر الدهيسية في ناحية الشافعية بمنطقة سيد طالب حيث توزعت الابار الثلاثة على امتداد مسافة بمقدار 1.5 كيلو متر من منطقة الدراسة وقد تم اختيار مجموعة من المواصفات الفيزيائية والكيميائية الشائعة للمياه من اجل المقارنة. جرت المقارنة بين نتائج عينات الماء المأخوذه من الابار مع عينات مياه النهر لتلك المواصفات.حيث اظهرت المقارنة امكانية الحصول على ماء يحتوي على نسبة قليلة من المواد الصلبة العالقة، المواد الصلبة الذائبة، مستوى الكلور، الموصلية الكهربائية والعكورة مقارنة مع ماء النهر، ويمكن اعتبار هذا الاسلوب كطريقة جديدة للحصول على مصدر اكثر امنا للماء بدلا من اعتماد مياه النهر بشكل مباشر والتي يتم معاملاتها لاحقا لمختلف اشكال الاستخدام.

كلمات مفتاحية : دراسة مقارنة ، نهر، بئر، حفر يدوي ، مواصفات فيزيائية وكيميائية ، الشافعية ، منطقة سيد طالب ، الدهيسية ، مياه جوفية .

NOMENCLATURE

W.H.O	World Health Organization
COSQC	Central Organization for Standardization and Quality Control
W	Well
R	River
TSS	Total Suspended Solids
FAU	Formazin Attenuation Unit
mg/lit	Milligram per liters
µs/cm	Microsiemens per centimeter
DO	Dissolved oxygen
TDS	Total Dissolved Solids
Fe	Iron element
Zn	Zinc element
Cr	Chromium element
Pb	Lead element

1. Introduction

In the last years, pollution of the rivers was increased gradually due to the increasing of pollution sources especially from the waste streams, where a lot of researches around the world were made to study the chemical and physical properties of

different rivers, all these studies were confirmed that the water of these rivers was pollution Pramod, 2012;Arnelia 2002;Mora,2012. Richard, where according to WHO organization, about 80% of all the diseases in human beings are caused by water, or with another word, exactly every year more than 3.4 million people die as a result of water related diseases(WHO, 2013), (Peter, 2002).

However, in many cities in Iraq a raw waste streams is discharged to the rivers without any pretreatment(Hussein, 2012,Wisam, 2013)Where many thesis and papers discussed the pollution of the Tigris and Euphr at esrivers Thair *et.al*., 2014; Ibtihaj, 2009 ; Al-Tikrity, 2001; Ahmed, 2012 .

Hayder A. Al-Thamiry, (Hayder, 2013), confirmed that Euphrates River water suffer from significant increasing in salinity through AlShinnafiyah and AlSamawa cities.(Thair *et.al*, 2014), found that TDS was increased during the time and distance depending on them Artificial Neural Network Model.

(Obais, 2010), studied Water pollution in Middle Euphrates region of Iraq through Babylon, Al-Najaf, Kerbela and Al-Diwaniya provinces by using regression models obtained by Data Fit Software program. He found that Euphrates River was polluted.

It is estimated from those published researches that the water problem is in increasing day after day. Therefor these challenges must playa major factor for leading our researches to repeat our consideration about the safe source to delivering drinking water for the costumer, satisfy the standard characteristics of the COSQC sheets within Iraq standards.

However, the only two sources for drinking water are the surface and the ground water and no more(Michael, 1991), where each type has advantages and disadvantages, but in different countries across the world the surface water is preferred due to the high flow rate as a compare with the ground water.

The ground water generally can be in safe from the pollutants that come from municipal waste water, industrial effluents, and agriculture waste(Michael 1991),because it is less interference with the pollution sources than the surface water streams (the rivers and the lakes), But the disadvantage of the ground water is that still has a dissolved salt which make it has an unfavorable taste as well as a low flow rate.

Finding an alternative source of drinking water combines the advantages of surface water and groundwater refer to another choice.

How this can be accomplished?

Basically, the river bed filtration process can be represent good method to purify naturally the river water. first, this idea can be accomplished by drilling a well inside the river, where the layers of the sand and the clay that consist bed of the river can work as natural filter to reduce the amount of the pollutants that come from the river water itself. Second, a comparative study between the river and the well must be made for checking this choice as a safe source to drinking water or not.

Finally, water balance calculations must be made in order to determine the expected flow rate and number of the wells necessary to deliver the water for treatment plant.

How river bed filtration works?

Surface water contains more than one pollutant such as suspended solids, dissolved solids substances. Also water in river may be contaminated by waste, sewage, chemicals, fertilizers, bacteria and viruses. However, natural filtration removes much of these different pollutants from the water of the river. Natural purification effects within filter

layers of sand and clay within the river bed. This natural filter consist of clay minerals, iron-hydroxides, amorphous silicic acid, and organic substances where it can adsorbed the dissolved compounds and play as natural Ion exchanger

This paper was thus undertaken as a comparative test of the Physico-Chemical Parameters between the river and wellsdrilled inside it to estimate the feasibility of this idea.

2- Experimental Work

The Section of the river flowing flows through agricultural areas has been selected: i.e. Al-Dehissyia river, SaidTalib village in the Al-Diwaniya city, and three hand-dug wells (with 6 inch diameter and 6 meter deep) were drilled inside it along 1.5 Km. the first well in the middle, the second inside to the left side and the third inside to the right side of the river.Thisriver is subject to the Almrashenh system where in dryness period the Water Resources office in Al_Shafia cuttingthe flow according to this systemby aregulatorwhich was built by the government there to control the river flow,during this period (cutting the flow) we built a dam (from a brick and clay) after and before each site that assistance for pumping the remaining water a way and let the surfacedrying there, practically after 6 days the river bed was dry according to this method (in the summer season), directly the wells were drilled and the surface of each well was protected by building a cement base around it to prevent possible interactions between the river water and the well. Then a water pump was used to cleaning each well from remaining sand or clay inside it, after 3 hours the water of pumping be a clear, a pieceof clothes was putted onthe upper outlet of each well to protect it. Aftersome days later, the water is returned to the stream.

Thewater samples were collected in during the dry condition and wet condition from these sampling sites .the river sample points and three well locations were selected as shown in figure.1 and figure 2.

The samples were labeled and kept in plastic bottles which was washed with strong nitric acid and then washed with deionized water in the laboratory and then was homogenized with sampling water in the site, The parameters are measured or calculated according the table 1.

3- Results and Discussion

The results from the analysis during the summer period of physical and chemical parameters are presented in table 2&3 respectively, while table 4 contained the results of the selected physiochemical parameters during winter season.

The R letter refers to the river source while W refers to the wells samples sources, and the point 1 represent the location where the well drilled inside the river, the point 2 represent the location where the well drilled to the left side of the river, and the point 3 represent the location where the well drilled to the right side of the river. All the results showed in these tables are represent an average value of 2-3 recorded reading or measured values of the parameters. The comparing study between the river samples and the wells are including the most commonly physical and chemical parameters of water. The table properties was colored to observe it, where the blue column represent the results of the river samples, and to observe the increasing or decreasing the well readings from the corresponding river values the green and red colors is taken, where the green for positive deviation and the red for negative deviation.

The selected parameters are effects on user's heath if they use this water as source for drinking. Therefor the guideline for drinking water quality (Guidelines for DrinkingWater Quality 2004), was used for discussing and comparing the results obtained.

From the table (2) it was clear that significant difference between the value of the river parameters and the values of well parameters, such as TSS, total hardness and chloride level.

Also the results showed that the temperature and pH scale and other parameters have had a close relation to the samples of the three wells where the variation was very small among them (table 2).

pH of the wells samples was ranged between 7.5-7.4 and it were greater than pH of the river but all them wryer in the range of W.H.O standard, turbidity of the river was 5 FAU and TSS was 4.2 mg/liter while the highest value of turbidity in the wells was 0.7 and 0.12 mg/liters of TSS, these huge differences can be were continued to give objectionable Taste and objectionable odor in river sample and palatable taste, non-objectionable odor of the wells water. The recordings value gave high value in electrical conductivity of the river as compare with the wells water.

The river water is unpalatable because of unwanted odor associated with water, which is due to the presence of some algae and aquatic compared with the well water samples that showed a taste palatable the absence of any unpleasant odor

Turbidity of the river was gave meaning that the river water was containing high amount of outstanding and colloidal substances in the water of the river rather than in the water of the well which is small as compare, as shown by the results (table 2).

total hardness of the wells samples (500 mg/lit, 512 mg/lit, 480 mg/lit) and total hardness ofriver sample (310 mg/lit) have higher levels above the permissible limits ofWHO specifications .The same case was obtained in the winter season as 280 mg/lit for water samples from river and (388 mg/lit, 477 mg/lit, 312 mg/lit) for water samples from wells (W1, W2, W3 respectively).

The physical parameters total alkanity, nitrate, phosphate and sulphate were found relatively lower in the river but the chloride and dissolved oxygen levels in all wells were much less than the water of the river and lower than W.H.O standard .

Heavy metal generally were has negligible value in both the river and wells samples.

In winter season the measurements were repeated for selected physical parameters in form of mean value in order to see the difference of the results with the summer season.

The winter results indicate that the mean temperature of the water river is much than wells samples temperatures, where this can be attributed to the size of the water body and surface area and mean depth of the river that contact directly or indirectly with the atmosphere.

The pH of the well water samples was in the range of 7.5to 7.7as recommended byWHO [2].

Electrical Conductivity values of the river samples (800 µs/cm) and well water samples (1042 µs/cm, 1180 µs/cm, 1340 µs/cm) during the study period were generally higher than WHO acceptable limit.

It was clear that the soil is play as natural filter according to the variation in the total suspended solids values between the wells (0.15 mg/lit, 0.09, mg/lit, 0.1 mg/lit) and river samples (3.2 mg/lit).

4- Conclusion

The results made an evident for the significant differences between the properties of wells and river water. It shows that the well water is considered more purity and clarity by comparison conducted between well water and river water.

The layers of the soil and clays into the bed of the river played as a natural filter where it reduced the total suspended solid, total dissolved solid, chloride level, turbidity, electrical conductivityand it maintained the water within its pores.This method representsa sustainable water treatment technology.

Table 1: The measuring or calculating method to the selected physical and chemical parameters.

The Property	Measuring Device or Calculating method	Notes
temperature	mercury thermometer	at the location point
pH	pH meter	In the laboratory
DO	Wrinkle's modified iodide-azide method	It is determined in the laboratory where these samples were fixed in the sites with the manganese sulfate and alkali-iodide-azide solution (2ml each).
Electrical conductivity	conductivity meter of model EC214	
TDS	evaporation	
TSS	Filtration	
alkalinity	Potentiometric titration method	with the help of pH meter and diluted H_2SO_4 and NaOH
Chloride	Mohr's argentometric method	using Potassium
total hardness	Titrimetric method	
Turbidity	Turbidity meter	
Phosphate	Stannous chloride method	
nitrate	the phenol – di sulphonic acid Colorimetric test Jackson.	
The heavy metals	The atomic absorption spectrophotometer.	(Fe, Zn, Cr and Pb)

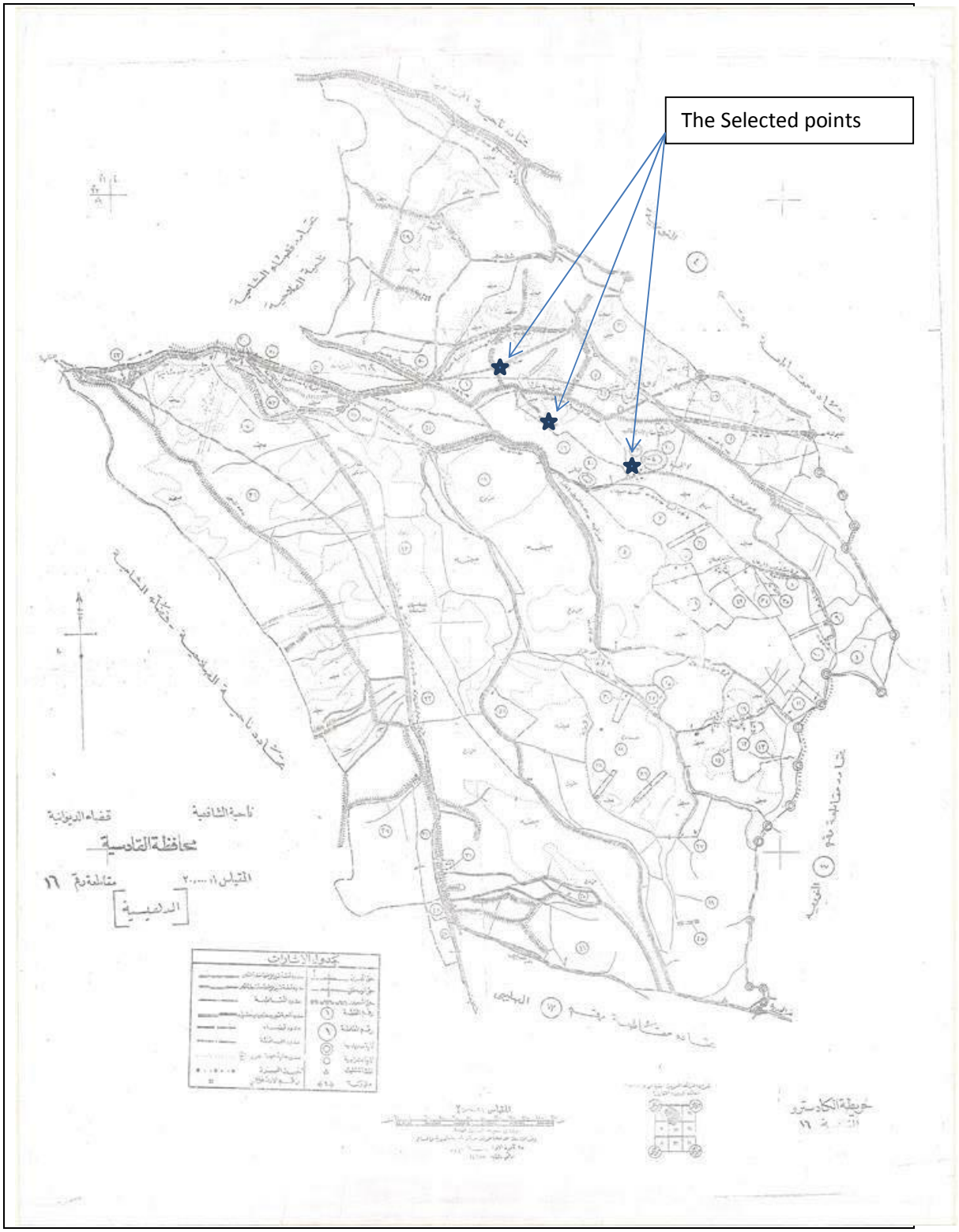

Figure 1: CountyNO. 16 (Al-Dehissyia)map from the kadistro map.

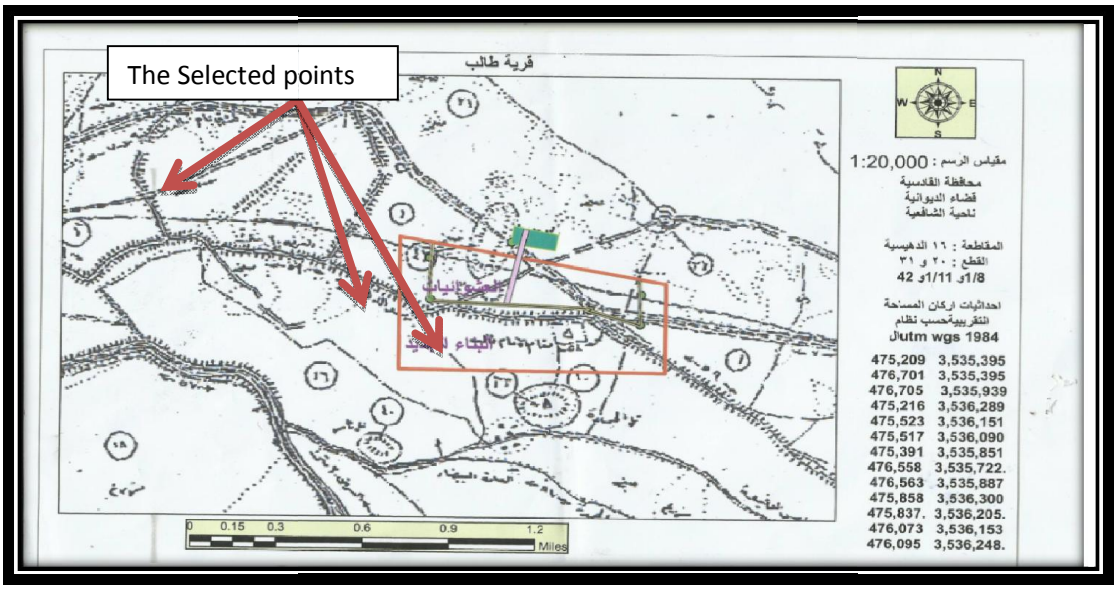

Figure 2:Al-Dehissyia River throughSaidTalib village in AlShafia /Diwaniya city.

Table (2) Physico-chemical data of the Aldhesseh River and the wells, physical parameters (the summer period).

Location		Physical parameters						
		Temperature °C	pH	EC µs/cm	Taste/odor	TDS (mg/l)	Turbidity (FAU)	TSS (mg/l)
River	R	33.5	8	1900	Objectionable	950	5	4.2
Sration1	W1	34	7.5	1460	Non-Objectionable	733	0.3	0.009
Sration2	W2	34	7.4	1902	Non-Objectionable	987	0.7	0.12
Sration3	W3	33	7.5	1610	Non-Objectionable	823	0.4	0.1
W.H.O Standard [7]		25	6.5–8.5	1		500	Clear	1

Table (3) Physico-chemical Data of the Aldhesseh River and the wells,Chemical Parameters (summer period).

Physical parameters	R	W1	W2	W3	W.H.O Standard [7]
Total alkanity	**113**	136	133	112	200
Total hardness	310	500	512	480	100
Chloride mg/l	254	148	139	143	250
Nitrate mg/l	3.3	6	8	12	10
Phosphate mg/l	0.32	0.35	0.6	0.29	5
Sulphate mg/l	203	340	200	243	250
Iron mg/l	0.053	nil	nil	nil	0.3
Zinc mg/l	0.014	0.001	nil	0.0012	1
Chromium mg/l	Nil	nil	nil	Nil	0.01
Lead mg/l	Nil	nil	nil	Nil	0.001
Dissolved Oxygen mg/lit	7	trace	2	3.4	2

Table (4) Selected Physico-chemical Data of the Aldhesseh River and the wells, (Winter Season).

Physical parameters	R	W1	W2	W3
Temperature ^{o}C	16	12.5	12.5	13
pH	7.9	7.5	7.5	7.7
Taste/Odor	Objectionable	Objectionable	Objectionable	Objectionable
Electrical Conductivity µs/cm	800	1042	1180	1340
Total Hardness mg/l	280	388	477	312
Chloride mg/l	140	122	112	100
Total Alkalinity mg/l	**123**	130	136	109
TSS mg/l	3.2	0.15	0.09	0.1

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