Study water quality of the Tigris and the Euphrates River with the progress of time

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Abstract

This investigation has been conducted to study water quality of the Tigris and the Euphrates River with the progress of time. The BOD values increasing with time increase from 1970 to 2010. The increasing was in Euphrates water more than Tigris water .Also, The EC values have been increased .

The relation between water discharge and TDS was (r = -0.838*). It is significant at 0.05 level. It means the TDS increases with decrease of water discharge .

The relation between water discharge and BOD was(r = 0.986(**)). It is highly significant at 0.01 level. It means the BOD increases with decrease of water discharge .

This is due to a combination of drought, and increased water withdrawal and damming in Turkey and Syria. In addition of increasing population.

Key words water quality, contamination , Tigris , Euphrates , BOD , EC , TDS , water discharge - Iraq.

Introduction

Decrease the amount of water in the Tigris and the Euphrates River during the past decades and continue in the next future, cause in deterioration of water quality. The water volumes in the Tigris and Euphrates Rivers entering Iraq have decreased since the 1990s. This is due to a combination of drought, and increased water withdrawal and damming in Turkey and Syria.

Water flows of the Tigris and Euphrates Rivers entering Iraq have decreased annually in a dramatic way for the past two decades, due to the major water impoundment projects constructed; some remain under construction on these rivers in the neighboring countries, Turkey, Syria and Iran (1). In addition, the problem has become more severe due to the recent dry climatic period in Iraq.

As a result the flow of the Tigris at Baghdad has fallen sharply (about 19% the trend of fall line according to the discharge values mentioned by (2).

Some recent studies have indicated that contamination of river water of the Tigris and Euphrates(3, 4 ,5) .

The increase in population in Iraq increased dramatically in recent decades in 1960 was 7379000 millions now in 2013 is 34 000000 millions .These led to pressure on natural resources, including water. (country economy.com/demography/population/Iraq).

Therefore, it is necessary to examine the quality of the water of the Tigris and Euphrates during the last three decades, and see the changes taking place through the study some indicators such as BOD , E.C and other indicators.

Materials and method

1 - Samples have been taking in 2010 from Baghdad (Tigris river) and Al-Musab (Euphrates) Figure1 .Three replicates each. Electrical conductivity (EC) , Biological oxygen demand (BOD) and water discharge (Km^3) have been measured (6,7).

Figure (1) Map of Iraq shows the sample collection area.

2 – Relationship has been done between electrical conductivity (EC) and biological oxygen demand (BOD) from the literature to estimate the missing values. So in 1970 and 1990 the results were obtained from the literature (Table 1) and the missing values were estimated using the following regression equation that formed from table 1 :

(Y = 290.09 + 5.6198 X) r = 0.8940

Where Y = TDS , ppm

X=BOD , ppm

Table (1)Relationship between electrical conductivity (EC) and biological oxygen demand(BOD) .

NO.	BOD	Ec ,mmhos/cm (ppm)	Reference
1	10.0	0.37(236.8)	Sahaf,1976
2	18.0	0.59 (377.6)	Abdulla, *et. al*.2009
3	7.5	0.625 (400.0)	Abdulla, *et. al*.2009
4	14.4	0.49 (314.4)	Abdulla, *et. al*.2009
5	9.5	0.39 (250.5)	Abdulla, *et. al*.2009
6	13.0	1.9 (1216)	Abdulla, *et. al*. 2008
7	3.2	0.98 (627.2)	AL-Husony,2010
8	291	1.78 (1139.2)	AGOSBA ,2003
9	223.43	3.45(2210.21)	Sachchida , *et. al*.2012
10	341.11	3.83 (2456.22)	Sachchida , *et. al*.2012

The following regression equation has been obtained:

Y = 290.09 + 5.6198 X r = 0.8940

3 - SPSS and Curve Expert 1.3 computer programs have been used for statistic analysis

Results and Discussion

Table (2) shows the mean and Standard error of biological oxygen demand (BOD) , electrical conductivity ,(Total Dissolved Solids , TDS) and water discharge in Baghdad (Tigris river) and Al-Musab(Euphrates) in the years1970, 1990and 2010.It can be seen that the BOD values increasing with time increase from 1970 to 2010. The increasing was in

Euphrates water more than Tigris water .Also, The EC values have been increased .

These due to The decrease of water volumes in the Tigris and Euphrates since the 1990 as showing in the table. This is due to a combination of drought, and increased water withdrawal and damming in Turkey and Syria (1).In addition of increasing population .

The increase in population in Iraq increased dramatically in recent decades in 1960 was 7379000 millions now in 2013is 34 000000 millions .These led to pressure on natural resources, including water. (country economy.com/demography/population/Iraq)

This is clear in figures (2 ,3 and 4) , The relation between TDS , BOD and Water discharge for the year 1970 ,1990 and 2010 for Baghdad (Tigris river) and Al-Musab (Euphrates)

In figure (2) the equation:

a –Y = 204.0 + 57.6X

b-Y = 156.8 + 204.0X

Describe the relationship of TDS with time.

In figure (3) the equation:

(a) $Y = 10.053x^{0.3819}$

(b) $Y = 16.9861x^{1.4888}$

Describe the relationship of BOD with time.

In figure (4) the equation

(a) Y = 3.42 – 0.795X

(b) Y = 2.4 – 0.500X

Describe the relationship of water discharge with time.

Table (3) shows the correlations coefficient (r) among water discharge , BOD and TDS. The relation between water discharge and TDS was(r = -0.838*) . It is significant at 0.05 level. It means the TDS increases with decrease of water discharge .

The relation between water discharge and BOD was(r = 0.986(**)) . It is significant at 0.01 level. It means the BOD increases with decrease of water discharge .

The combination increasing with time increase from 1970 to 2010. The increasing was in Euphrates water more than Tigris water .Also, The EC values (salt) have been increased .

The relation between water discharge and TDS was(r = -0.838*) . It is significant at 0.05 level. It means the TDS increases with decrease of water discharge .

The relation between water discharge and BOD was(r = 0.986(**)) . It is highly significant at 0.01 level. It means the BOD increases with decrease of water discharge .

This is due to a combination of drought, and increased water withdrawal and damming in Turkey and Syria. In addition of increasing population.

Table (2) Biological Oxygen demand (BOD) , Electrical Conductivity ,(Total Dissolved Solids)and water discharge in Baghdad(Tigris river) and Al-Musab (Euphrates) in the years 1970, 1990 and 2010

Measurements	Baghdad (Tigris river)			Al-Musab(Euphrates)		
	1970	1990	2010	1970	1990	2010
BOD(ppm) Mean ± S.E	9 ± 1.00	14.00* ± 0.97	11.0 ± 1.3	12.0* ± 0.7	51.9 ± 2.8	83.6 ± 4.9
(Ecmmhos/cm) Mean ± S.E	0.37 ± 0.02 (236.8)	0.58 ± 0.09 (368.8)	0.55 ± 0.1 (352)	0.50 ± 0.04 (357)	0.91 ± 0.01 (582.4)	1.5 ± 0.05 (760)
discharge (Km^3) Mean ± S.E	2.79 ± 0.8	1.50 ± 0.03	1.20 ± 0.06	2.00 ± 0.035	1.20 ± 0.02	1.00 ± 0.05

*Estimated using the equation Y = 290.09 + 5.6198 X .

(a) Y = 204.0 + 57.6X (b) Y = 156.8 + 204.0X

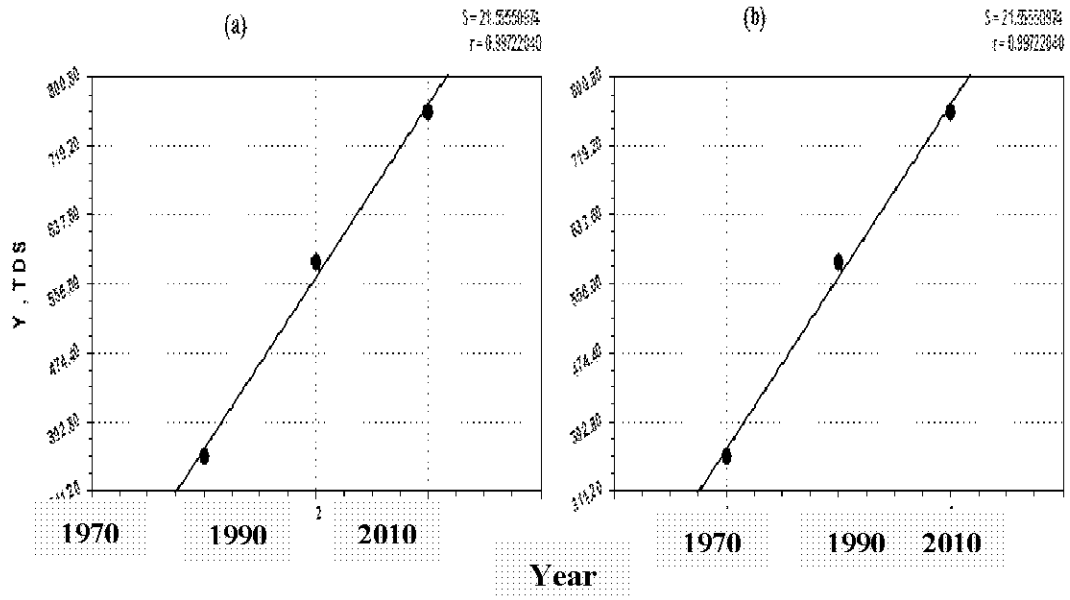

Figure (2):The relation between TDS and the year (1970) , (1990) and (2010) for Baghdad(Tigris river) and Al-Musab(Euphrates)

(a) $Y = 10.053x^{0.1919}$ (b) $Y = 16.9861\,x^{1.4688}$

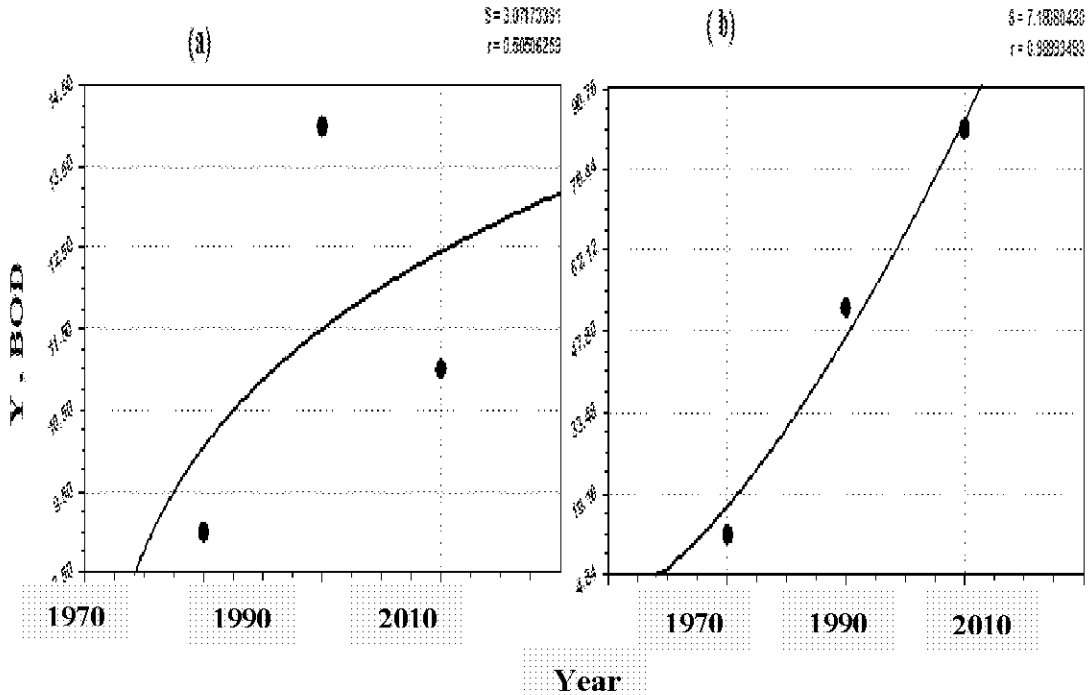

Figure (3):The relation between BOD and the year 1970 ,1990 and 2010 Baghdad(Tigris river) and Al-Musab(Euphrates)

(a) Y = 3.42 – 0.795X (b) Y = 2.4 – 0.500X

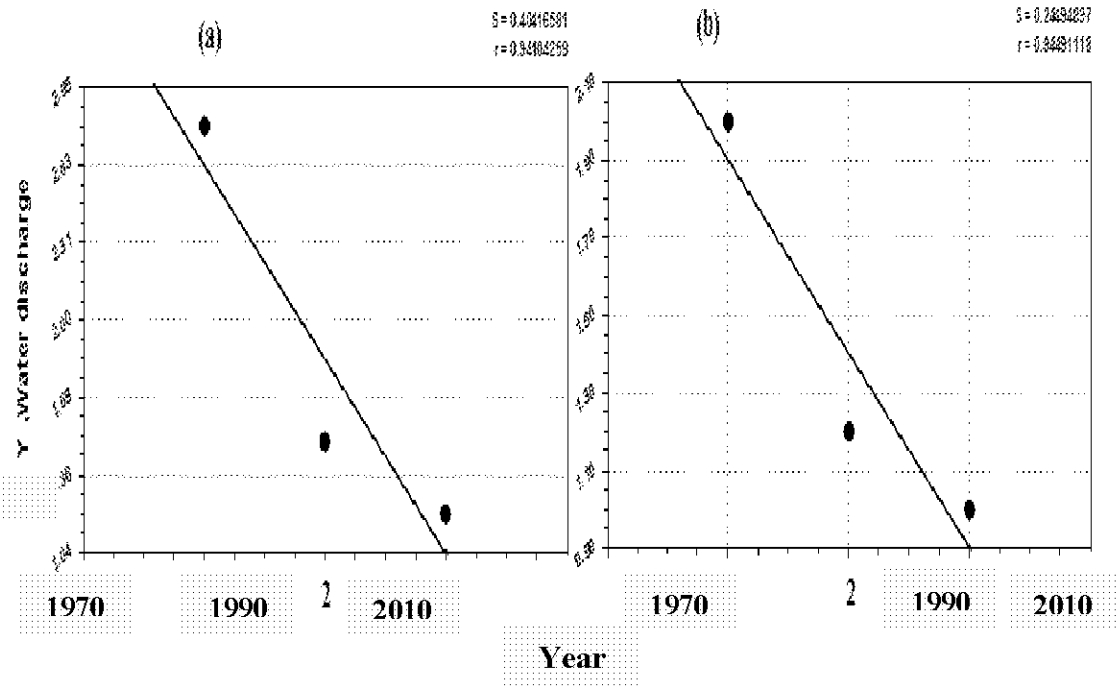

Figure (4):The relation between water discharge and the year 1970 ,1990 and 2010 Baghdad(Tigris river) and Al-Musab(Euphrates)

Table (3) the correlations among Water Discharge , BOD and TDS

Water Discharge	BOD	TDS	
-0.838(*)	0.986(**)	1.000	TDS
-0.754	1.000	0.986(**)	BOD
1.000	-0.754	-0.838(*)	Water Discharge

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Conclusion

Based on the results of the present investigation , the following conclusions may be drawn :

- The contamination increasing with time increase from 1970 to 2010. The increasing was in Euphrates water more than Tigris water .Also, The EC values (salt) have been increased ..
- The relation between water discharge and TDS and BOD was highly significant .
- This is due to a combination of drought, and increased water withdrawal and damming in Turkey and Syria .In addition of increasing population.
- Farther study should be done on this subject to cover more areas and get more information .Because of the circumstances experienced by the country the author could not expand in this investigation.

Acknowledgement

The assistance and the co-operation of biology dep. Staff College of Science / University of Al- Mustansyriah are gratefully acknowledged.

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دراسة نوعية مياه دجلة والفرات مع تقدم الزمن

الملخص

أجري هذا البحث لدراسة نوعية مياه دجلة والفرات مع الزمن .

بينت النتائج ان قيمة BOD المتطلبات الحيوية للأوكسجين تزداد مع الزمن من 1970 الى 2010 وان الزيادة في نهر الفرات اكثر من نهر دجلة .اظهرت نتائج التوصيل الكهربائي (الملوحة) حصول زيادة طردية مع الزمن .

وكانت العلاقة بين مياه التصريف و TDS مجموع الأملاح الذائبة علاقة سالبة (r = -0.838*) في حين كانت بين مياه التصريف و BOD r=0.986(**) علاقة عالية المعنوية .

واظهرت الدراسة الى سبب زيادة التلوث في مياه دجلة والفرات يعود الى تداخل الجفاف مع قلة المياه الداخلة الى العراق من تركيا وسوريا فضلا عن بناء السدود على أعالي هذين النهرين مما أدى الى انخفاض تصريف المياه وزيادة نسبة التلوث.