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RESEARCH ARTICLE

Al-Masab Al-Aam River (Third River) and Surface Water Pollution Within Baghdad Division

Allaa M. Aenab[1], S. K. Singh[2]

1. PhD student, Environmental Engineering Department, Delhi Technological University (DTU), Delhi, India,
2. Professor & Head of Environmental Engineering Department, Delhi Technological University (DTU), Delhi,

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Corresponding Author

Allaa M. Aenab

Abstract

The project Al-Masab Al-Aam (Third River) of major development projects in Iraq because it is important in the transport of salt water from the reclamation of farmland in central and southern Iraq through an interconnected network of main and secondary canals and all of the estuary in which the transfer of salt water and residues of chemical fertilizers widely used in agriculture to the Arabian Gulf through the Shatt Al-Arab.
In this study we evaluate the water quality of Al-Masab Al-Aam River within Baghdad City by using ANOVA two-way test (space and time)**.** Samples were collected from two stations in Baghdad City (ST1 located in Abu Ghraib west of Baghdad & ST2 located in Al-Mahmudiyah South of Baghdad) monthly collection for three years (2010, 2011 & 2012).

INTRODUCTION

Water Resources 15% of the area of Iraq in the form of different systems as rivers, lakes, streams and springs. Very necessary to keep the water sources ready for needs of the population and other household requirements and irrigations and industrial alike. Therefore, it is imperative to fully studied have those resources benediction numerous studies addressed the physical and chemical factors. River runs along the Al-Masab Al-Aam 565 km north of the Baghdad City from Al-Ecihaqi Distract until Khor Al-Zubair south of Basrah City and aims to transfer drains and water activities on Civil and Industrial away into the sea. The construction of the Al-Masab Al-Aam River create a new environment in central and southern Iraq, and this spirit built this study to build the base for sound scientific assessment of water quality and environmental factors influencing them and the impact on the river water drains (Kamil, 2005).

2. Objectives and Approach

In the last years the level of pollution increasing year by year and for Al-Masab Al-Aam River no study done before to evaluate and managing the pollution in the river.For this purpose we plan to do this study and our main objective is:

- To establish a baseline of Tigris water quality and its changes.
- To evaluate the Al-Masab Al-Aam River specific water quality standards pursuant to international standard including development of appropriate reference conditions.
- To study the present status of water quality and services in Baghdad, Iraq.
- To predict future changes in water quality resulting from the developmental activities in the region.
- To provide an advance information for downstream users about adverse water quality conditions.
- To determine seasonal and temporal discharge variation for stream water treatment.

3. Study Area

The idea of the project Al-Masab Al-Aam River since the fifties when it commissioned a company to prepare a map of the U.S. networks drains confined between the Tigris and Euphrates Rivers and has direct the project through the implementation of the main Musayyib drain in 1954 as the Dutch company began in 1959 West Shatra drain, which is the southern part of the central part of the current project. In 1963 company McDonald (British) made a study for the establishment of the central part of Lake Al-Delmj down to the Nasiriyah City as the two Philip Holzman (German Bank) and Pulaski Zollner (Dutch) the completion of the southern part and a length (172 km) has also been contracted with a company Mendes (Brazilian) the implementation of the facilities under the Euphrates River with the creation (6) bridges for cars and (2) of the trains have continued to work successively in the completion of the project to be stopped in 1990 because of the circumstances of the siege at the time. Work resumed in 1992, the local possibilities as completed works that were not completed in a timely manner and began working again at a pumping station Al-Masab Al-Aam after 2003 and continued until the completion of the station on 01.12.2008 (MoWR, 2013).

Is responsible for maintenance and operation of the projects implemented on a column Al-Masab Al-Aam as part of the administrative border of the province of Baghdad from 442 km to 528 km as it shows in table (1), in addition to the follow-up variables in the water parameters and calculating water discharge within boycotted the responsibility and control abuses.

4. Estimation of variability by ANOVA – 2 way (space and time)

The ANOVA test is used to test the equality of variances of several normal populations. Let X_{ij} (j=1,2,…,n) be a random sample of size n_i from the normal population $N(\mu_i,\sigma_i^2)$, i=1,2,…,k. We want to test the null hypothesis (Gupta et al., 2000, Allaa et al., 2013):

$H_0= \sigma 1^2 = \sigma 2^2 = \sigma^2$ (unspecified), with μ_1, μ_2 (unspecified) against the alternative hypothesis:

H1: σ_i^2 (i=1, 2) are not equal; μ_1, μ_2 unspecified

$$F= (m (n-1)s_1^2)/(n(m-1)s_2^2)\_ F(m-1,n-1)$$

$$F1= F_{m-1,n-1}(1-\alpha/2) \text{ and } F2= F_{m-1,n-1}(\alpha/2)$$

If F2<F<F1

Thus the variances do not differ significantly.

5. Results

Tabal (1) Salt-water drains connected with Al-Masab Al-Aam River

No.	Drains	Discharge Design (m3/s)	Distance (km)
1.	Al-Saqlauiyah	12.7	528
2.	Al-Ecihaqi	15.6	528
3.	Sabaa Al-Bur	6.3	528
4.	Al-Shuala	3.0	527
5.	Abu Ghreeb	3.0	510
6.	Al-Rathwaniah	6.1	504
7.	Badoon	1.3	500
8.	Al-Yousifiyah	4.0	485
9.	Hoor Rajab	4.1	471
10.	Al-Latifiyah 1	1.2	460
11.	Al-Latifiyah 2	1.3	442
12.	North Musayyib	6.4	441
13.	Jebala	2.4	427
14.	Kaseeba	2.7	411
15.	South Musayyib	11.9	398
16.	Al-Shahamiyah	3.3	398
17.	Hashmiya	15.0	354

18.	Daghara	17.0	283
19.	Great Al-Gharaf	20.0	217
20.	Eastern Euphrates	81.0	186
21.	Eastern Al-Gharaf	50.0	172
22.	Al-Malha	25.0	124

Analysis of variance or ANOVA was done for the water quality parameters (BOD PO_4, NO_3, SO_4 and Cl) for the years (2010, 2011 & 2012). The consistencies are checked with respect to time and space (Gupta and Kapoor, 2001; Allaa et al., 2013).

The test results for BOD values for the year 2010 indicated that except for the months of April, May, June, July, August, September and November all the other months showed consistent values. All the results were consistent with respect to time. The test did not failed with respect of space.

The test results for BOD values for the year 2011 indicated that except for the months of January, April, May, September and October all the other months showed consistent values. All the results were consistent with respect to time. The test did not failed with respect of space.

The test results for BOD values for the year 2012 indicated that except for the months of January, February, April, July, September and November all the other months showed consistent values. All the results were consistent with respect to time. The test did not failed with respect of space.

The test results for PO_4 values for the year 2010 indicated that except for the months of February, July, August and November all the other months showed consistent values. All the results were consistent with respect to time. The test did not failed with respect of space.

The test results for PO_4 values for the year 2011 indicated that except for the months of April, May, June, August and September all the other months showed consistent values. All the results were consistent with respect to time. The test did not failed with respect of space.

The test results for PO_4 values for the year 2012 indicated that except for the months of January, May and June all the other months showed consistent values. All the results were consistent with respect to time. The test did not failed with respect of space.

The test results for NO_3 values for the year 2010 indicated that except for the months of January, February, May, June, October and November all the other months showed consistent values. All the results were consistent with respect to time. The test did not failed with respect of space.

The test results for NO_3 values for the year 2011 indicated that except for the months of May, June, August and September all the other months showed consistent values. All the results were consistent with respect to time. The test did not failed with respect of space.

The test results for NO_3 values for the year 2012 indicated that except for the months of January, April, May, June, July, August, September and October all the other months showed consistent values. All the results were consistent with respect to time. The test did not failed with respect of space.

The test results for SO_4 values for the year 2010 indicated that except for the months of January, April, July, September and October all the other months showed consistent values. All the results were consistent with respect to time. The test failed for the station ST1with respect of space.

The test results for SO_4 values for the year 2011 indicated that except for the months of March, May, June, July, August, September and November all the other months showed consistent values. All the results were consistent with respect to time. The test did not failed with respect of space.

The test results for SO_4 values for the year 2012 indicated that except for the months of January, April, June, July, August, September, October and November all the other months showed consistent values. All the results were consistent with respect to time. The test did not failed with respect of space.

The test results for Cl values for the year 2010 indicated that except for the months of January, February, March, April, June, August and September all the other months showed consistent values. All the results were consistent with respect to time. The test did not failed with respect of space.

The test results for Cl values for the year 2011 indicated that except for the months of February, March, May, July, August, September, October and November all the other months showed consistent values. All the results were consistent with respect to time. The test did not failed with respect of space.

The test results for Cl values for the year 2012 indicated that except for the months of February, March, May, August, September and November all the other months showed consistent values. All the results were consistent with respect to time. The test failed for the station ST1 with respect of space.

Figures Numbers (1, 2, 3, 4 & 5) shows ANOVA test two ways for BOD, Cl, SO_4, NO_3 & PO_4, respectively for the years (2010, 2011 & 2012).

Table (2): Result of ANOVA test for BOD values 2010

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Std	Sy	F	F1	F2	
ST1	2.0	2.5	2.0	2.6	4.4	2.5	3.0	6.0	4.0	3.2	4.5	5.0	1.29	1.81	0.91	2.69	0.37	
ST2	1.5	2.0	2.5	3.0	3.5	2.0	5.0	5.0	3.5	1.1	3.0	4.4	1.35	1.98	/	/	/	
Std	0.4	0.4	0.4	0.3	0.6	0.4	1.4	0.7	0.4	1.5	1.1	0.4	/	/	/	/	/	
Sx	0.3	0.3	0.3	0.2	0.8	0.3	4.0	1.0	0.3	4.4	2.3	0.4	/	/	/	/	/	
F	1.0	1.0	1.6	0.2	3.2	0.1	4.0	4.0	0.1	2.0	6.3	/	/	/	/	/	/	
F1	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	/	/	/	/	/	/	
F2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	/	/	/	/	/	/	
	F2<F<F1	F2<F<F1	F2<F<F1	F2>F<F1	F2<F>F1	F2>F<F1	F2<F>F1	F2<F>F1	F2>F<F1	F2<F<F1	F2<F>F1	/	/	/	/	/	/	

Table (3): Result of ANOVA test for BOD values 2011

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Std	Sy	F	F1	F2	
ST1	4.0	4.5	3.0	2.6	3.5	6.0	6.4	5.5	3.5	2.5	3.0	5.0	1.34	1.96	1.00	2.69	0.37	
ST2	3.0	4.0	2.6	2.2	3.3	5.5	6.0	5.2	3.3	2.4	2.0	4.0	1.34	1.96	/	/	/	
Std	0.7	0.4	0.3	0.3	0.1	0.4	0.3	0.2	0.1	0.1	0.7	0.7	/	/	/	/	/	
Sx	1.0	0.3	0.2	0.2	0.0	0.3	0.2	0.1	0.0	0.0	1.0	1.0	/	/	/	/	/	
F	4.0	1.6	1.0	4.0	0.2	1.6	1.8	2.3	4.0	0.0	1.0	/	/	/	/	/	/	
F1	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	/	/	/	/	/	/	
F2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	/	/	/	/	/	/	
	F2<F>F1	F2<F<F1	F2<F<F1	F2<F>F1	F2>F<F1	F2<F<F1	F2<F<F1	F2<F<F1	F2<F>F1	F2>F<F1	F2<F<F1	/	/	/	/	/	/	

Table (4): Result of ANOVA test for BOD values 2012

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Std	Sy	F	F1	F2	
ST1	4.0	4.2	4.0	4.0	2.2	3.4	5.0	3.0	1.5	8.0	5.0	2.0	1.72	3.24	1.25	2.69	0.37	
ST2	3.8	5.0	3.7	3.8	3.5	4.5	4.0	3.5	1.0	7.0	6.0	2.5	1.54	2.59	/	/	/	
Std	0.1	0.6	0.2	0.1	0.9	0.8	0.7	0.4	0.4	0.7	0.7	0.4	/	/	/	/	/	
Sx	0.0	0.6	0.1	0.0	1.7	1.2	1.0	0.3	0.3	1.0	1.0	0.3	/	/	/	/	/	
F	0.1	7.1	2.2	0.0	1.4	1.2	4.0	1.0	0.3	1.0	4.0	/	/	/	/	/	/	
F1	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	/	/	/	/	/	/	
F2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	/	/	/	/	/	/	
	F2>F<F1	F2<F>F1	F2<F<F1	F2>F<F1	F2<F<F1	F2<F<F1	F2<F>F1	F2<F<F1	F2>F<F1	F2<F<F1	F2<F>F1	/	/	/	/	/	/	

Table (5): Result of ANOVA test for Po4 values 2010

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Std	Sy	F	F1	F2	
ST1	0.50	0.40	0.25	0.30	0.25	0.50	0.45	0.80	0.10	0.60	0.80	0.70	0.2	0.1	1.02	2.69	0.37	

ST2	0.40	0.30	0.30	0.35	0.30	0.45	0.50	1.00	0.20	0.70	0.60	0.60	0.2	0.1	/	/	/
Std	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	/	/	/	/	/
Sx	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	/	/	/	/	/
F	1.0	4.0	1.0	1.0	1.0	1.0	0.1	4.0	1.0	0.3	4.0	/	/	/	/	/	/
F1	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	/	/	/	/	/	/
F2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	/	/	/	/	/	/
	F2<F<F1	F2<F>F1	F2<F<F1	F2<F<F1	F2<F<F1	F2<F<F1	F2>F<F1	F2<F>F1	F2<F<F1	F2<F<F1	F2<F>F1	/	/	/	/	/	/

Table (6): Result of ANOVA test for Po4 values 2011

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Std	Sy	F	F1	F2
ST1	0.40	0.50	0.50	0.50	0.25	0.80	0.50	0.65	0.58	0.30	0.40	0.50	0.1	0.0	1.39	2.69	0.37
ST2	0.50	0.60	0.40	0.60	0.30	0.70	0.45	0.70	0.60	0.40	0.50	0.60	0.1	0.0	/	/	/
Std	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.1	/	/	/	/	/
Sx	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	/	/	/	/	/
F	1.0	1.0	1.0	4.0	0.2	4.0	1.0	6.3	0.0	1.0	1.0	/	/	/	/	/	/
F1	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	/	/	/	/	/	/
F2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	/	/	/	/	/	/
	F2<F<F1	F2<F<F1	F2<F<F1	F2<F>F1	F2>F<F1	F2<F>F1	F2<F<F1	F2<F>F1	F2>F<F1	F2<F<F1	F2<F<F1	/	/	/	/	/	/

Table (7): Result of ANOVA test for Po4 values 2012

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Std	Sy	F	F1	F2
ST1	0.60	0.40	0.50	0.50	0.20	0.60	0.30	0.70	0.30	0.30	0.50	0.80	0.2	0.0	0.66	2.69	0.37
ST2	0.40	0.50	0.60	0.40	0.30	0.80	0.20	0.80	0.20	0.20	0.40	0.70	0.2	0.1	/	/	/
Std	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	/	/	/	/	/
Sx	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	/	/	/	/	/
F	4.0	1.0	1.0	1.0	0.2	4.0	1.0	1.0	1.0	1.0	1.0	/	/	/	/	/	/
F1	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	/	/	/	/	/	/
F2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	/	/	/	/	/	/
	F2<F>F1	F2<F<F1	F2<F<F1	F2<F<F1	F2>F<F1	F2<F>F1	F2<F<F1	F2<F<F1	F2<F<F1	F2<F<F1	F2<F<F1	/	/	/	/	/	/

Table (8): Result of ANOVA test for No3 values 2010

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Std	Sy	F	F1	F2
ST1	16.0	3.5	2.7	4.3	4.5	7.3	3.6	3.1	3.5	3.2	6.0	6.0	3.6	14.5	0.92	2.69	0.37
ST2	15.0	3.8	2.0	3.5	5.1	7.5	6.4	4.8	2.4	2.0	9.8	7.8	3.8	15.8	/	/	/
Std	0.7	0.2	0.5	0.6	0.4	0.1	2.0	1.2	0.8	0.8	2.7	1.3	/	/	/	/	/
Sx	1.0	0.1	0.5	0.6	0.4	0.0	7.8	2.9	1.2	1.4	14.4	3.2	/	/	/	/	/

F	11.1	0.2	0.8	1.8	9.0	0.0	2.7	2.4	0.8	0.1	4.5	/	/	/	/	/	/
F1	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	/	/	/	/	/	/
F2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	/	/	/	/	/	/
	F2<F>F1	F2>F<F1	F2<F<F1	F2<F<F1	F2<F>F1	F2>F<F1	F2<F<F1	F2<F<F1	F2<F<F1	F2>F<F1	F2<F>F1	/	/	/	/	/	/

Table (9): Result of ANOVA test for No3 values 2011

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Std	Sy	F	F1	F2	
ST1	6.5	5.7	6.6	3.4	7.2	4.4	8.8	7.8	6.4	6.0	7.0	5.4	1.5	2.3	1.09	2.69	0.37	
ST2	7.6	5.0	6.0	4.0	7.6	4.2	8.2	7.4	6.2	5.7	6.5	5.0	1.4	2.1	/	/	/	
Std	0.8	0.5	0.4	0.4	0.3	0.1	0.4	0.3	0.1	0.2	0.4	0.3	/	/	/	/	/	
Sx	1.2	0.5	0.4	0.4	0.2	0.0	0.4	0.2	0.0	0.1	0.3	0.2	/	/	/	/	/	
F	2.5	1.4	1.0	2.3	4.0	0.1	2.3	4.0	0	0.4	1.6	/	/	/	/	/	/	
F1	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	/	/	/	/	/	/	
F2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	/	/	/	/	/	/	
	F2<F<F1	F2<F<F1	F2<F<F1	F2<F<F1	F2<F>F1	F2>F<F1	F2<F<F1	F2<F>F1	F2>F<F1	F2<F<F1	F2<F<F1	/	/	/	/	/	/	

Table (10): Result of ANOVA test for No3 values 2012

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Std	Sy	F	F1	F2	
ST1	4.3	5.0	6.0	5.7	3.7	4.5	5.0	4.8	3.8	5.0	6.2	4.0	0.8	0.7	1.41	2.69	0.37	
ST2	5.4	4.5	5.7	5.5	3.6	4.2	5.7	4.5	4.4	5.3	4.3	5.3	0.7	0.5	/	/	/	
Std	0.8	0.4	0.2	0.1	0.1	0.2	0.5	0.2	0.4	0.2	1.3	0.9	/	/	/	/	/	
Sx	1.2	0.3	0.1	0.0	0.0	0.1	0.5	0.1	0.4	0.1	3.6	1.7	/	/	/	/	/	
F	4.8	2.8	2.2	4.0	0.1	0.2	5.4	0.2	4.0	0.0	2.1	/	/	/	/	/	/	
F1	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	/	/	/	/	/	/	
F2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	/	/	/	/	/	/	
	F2<F>F1	F2<F<F1	F2<F<F1	F2<F>F1	F2>F<F1	F2>F<F1	F2<F>F1	F2>F<F1	F2<F>F1	F2>F<F1	F2<F<F1	/	/	/	/	/	/	

Table (11): Result of ANOVA test for So4 values 2010

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Std	Sy	F	F1	F2	
ST1	1230.0	1680.0	1281.0	1400.0	1425.0	2100.0	2440.0	1388.0	975.0	1731.0	1500.0	1500	395	170460	0.36	2.69	0.37	F2>F<F1
ST2	1200.0	1600.0	1200.0	1250.0	1500.0	2040.0	2389.0	1100.0	400.0	261.0	782.0	400	654	467288	/	/	/	/
Std	21.2	56.6	57.3	106.1	53.0	42.4	36.1	203.6	406.6	1039.4	507.7	777.8	/	/	/	/	/	/
Sx	900	6400	6561	22500	5625	3600	2601	82944	330625	2160900	515524	1210000	/	/	/	/	/	/
F	0.1	1.0	0.3	4.0	1.6	1.4	0.0	0.3	0.2	4.2	0.4	/	/	/	/	/	/	/
F1	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	/	/	/	/	/	/	/

F2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	/	/	/	/	/	/	/
	F2>F<F1	F2<F<F1	F2<F<F1	F2<F>F1	F2<F<F1	F2<F<F1	F2>F<F1	F2<F<F1	F2>F<F1	F2<F>F1	F2<F<F1	/	/	/	/	/	/	/

Table (12): Result of ANOVA test for So4 values 2011

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Std	Sy	F	F1	F2
ST1	1230.0	1320.0	1020.0	980.0	967.0	1587.0	1680.0	1457.0	1650.0	1546.0	1465.0	1320	257	72080	1.04	2.69	0.37
ST2	1200.0	1300.0	1000.0	988.0	976.0	1548.0	1430.0	1546.0	1765.0	1500.0	1420.0	1300	252	69448	/	/	/
Std	21.2	14.1	14.1	5.7	6.4	27.6	176.8	62.9	81.3	32.5	31.8	14.1	/	/	/	/	/
Sx	900	400	400	64	81	1521	62500	7921	13225	2116	2025	400	/	/	/	/	/
F	2.3	1.0	6.3	0.8	0.1	0.0	7.9	0.6	6	1.0	5.1	/	/	/	/	/	/
F1	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	/	/	/	/	/	/
F2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	/	/	/	/	/	/
	F2<F<F1	F2<F<F1	F2<F>F1	F2<F<F1	F2>F<F1	F2>F<F1	F2<F>F1	F2>F<F1	F2<F>F1	F2<F<F1	F2<F>F1	/	/	/	/	/	/

Table (13): Result of ANOVA test for So4 values 2012

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Std	Sy	F	F1	F2
ST1	1230.0	1210.0	1350.0	1200.0	1700.0	1510.0	1170.0	900.0	1350.0	1200.0	1060.0	1080	211	48681	0.96	2.69	0.37
ST2	1228.0	1205.0	1345.0	1205.0	1715.0	1540.0	1160.0	870.0	1200.0	1150.0	1080.0	1170	216	50849	/	/	/
Std	1.4	3.5	3.5	3.5	10.6	21.2	7.1	21.2	106.1	35.4	14.1	63.6	/	/	/	/	/
Sx	4	25	25	25	225	900	100	900	22500	2500	400	8100	/	/	/	/	/
F	0.2	1.0	1.0	0.1	0.3	9.0	0.1	0.0	9.0	6.3	0.0	/	/	/	/	/	/
F1	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	/	/	/	/	/	/
F2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	/	/	/	/	/	/
	F2>F<F1	F2<F<F1	F2<F<F1	F2>F<F1	F2<F<F1	F2<F>F1	F2>F<F1	F2>F<F1	F2<F>F1	F2<F>F1	F2>F<F1	/	/	/	/	/	/

Table (14): Result of ANOVA test for Cl values 2010

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Std	Sy	F	F1	F2
ST1	624.0	826.0	798.0	646.0	566.0	700.0	746.0	650.0	550.0	600.0	644.0	600	88	8480	1.55	2.69	0.37
ST2	634.0	503.0	660.0	600.0	550.0	689.0	721.0	625.0	540.0	530.0	540.0	540	71	5471	/	/	/
Std	7.1	228.4	97.6	32.5	11.3	7.8	17.7	17.7	7.1	49.5	73.5	42.4	/	/	/	/	/
Sx	100.0	104329.0	19044.0	2116.0	256.0	121.0	625.0	625.0	100.0	4900.0	10816.0	3600	/	/	/	/	/
F	0.0	5.5	9.0	8.3	2.1	0.2	1.0	6.3	0.0	0.5	3.0	/	/	/	/	/	/
F1	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	/	/	/	/	/	/
F2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	/	/	/	/	/	/
	F2>F<F1	F2<F>F1	F2<F>F1	F2<F>F1	F2<F<F1	F2>F<F1	F2<F<F1	F2<F>F1	F2>F<F1	F2<F<F1	F2<F<F1	/	/	/	/	/	/

Table (15): Result of ANOVA test for Cl values 2011

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Std	Sy	F	F1	F2	
ST1	705.0	710.0	660.0	754.0	710.0	659.0	650.0	712.0	700.0	650.0	587.0	710	44	2115	0.84	2.69	0.37	F2<F< F1
ST2	730.0	746.0	678.0	700.0	680.0	650.0	665.0	750.0	755.0	678.0	598.0	650	48	2513	/	/	/	/
Std	17.7	25.5	12.7	38.2	21.2	6.4	10.6	26.9	38.9	19.8	7.8	42.4	/	/	/	/	/	/
Sx	625	1296	324	2916	900	81	225	1444	3025	784	121	3600	/	/	/	/	/	/
F	0.5	4.0	0.1	3.2	11.1	0.4	0.2	0.5	3.9	6.5	0.0	/	/	/	/	/	/	/
F1	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	/	/	/	/	/	/	/
F2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	/	/	/	/	/	/	/
	F2<F< F1	F2<F> F1	F2>F< F1	F2<F< F1	F2<F> F1	F2<F< F1	F2>F< F1	F2<F< F1	F2<F> F1	F2<F> F1	F2>F< F1	/	/	/	/	/	/	/

Table (16): Result of ANOVA test for Cl values 2012

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Std	Sy	F	F1	F2	
ST1	598	643	650	564	658	620	620	603	725	595	744	668	53	3073	0.31	2.69	0.37	F2>F< F1
ST2	620	630	645	550	645	615	625	600	710	600	740	350	96	10065	/	/	/	/
Std	15.6	9.2	3.5	9.9	9.2	3.5	3.5	2.1	10.6	3.5	2.8	224.9	/	/	/	/	/	/
Sx	484	169	25	196	169	25	25	9	225	25	16	101124	/	/	/	/	/	/
F	2.9	6.8	0.1	1.2	6.8	1.0	2.8	0.0	9.0	1.6	0.0	/	/	/	/	/	/	/
F1	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	/	/	/	/	/	/	/
F2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	/	/	/	/	/	/	/
	F2<F< F1	F2<F> F1	F2>F< F1	F2<F< F1	F2<F> F1	F2<F< F1	F2<F< F1	F2>F< F1	F2<F> F1	F2<F< F1	F2>F< F1	/	/	/	/	/	/	/

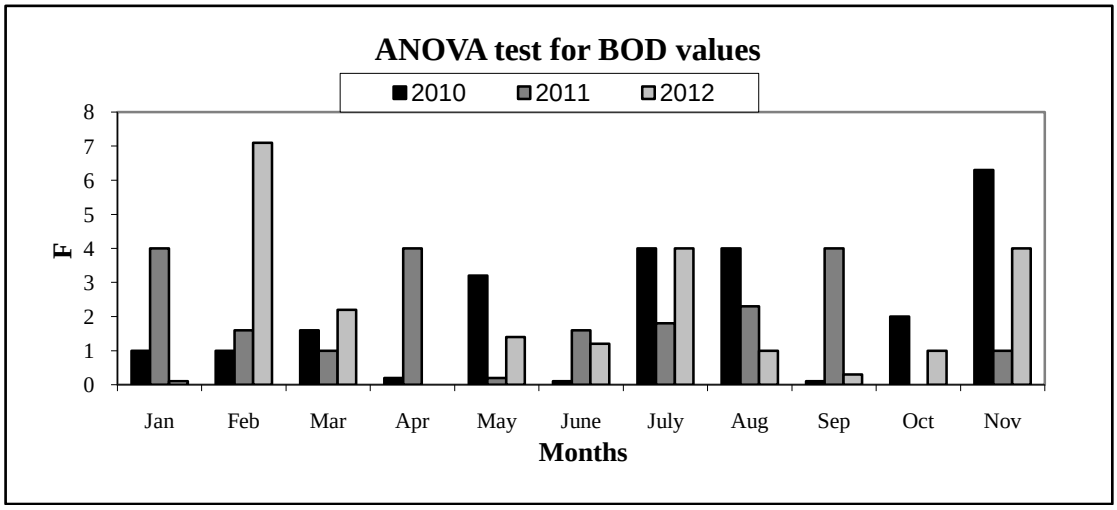

Fig (1) ANOVA test for BOD values for the years (2010, 2011 & 2012)

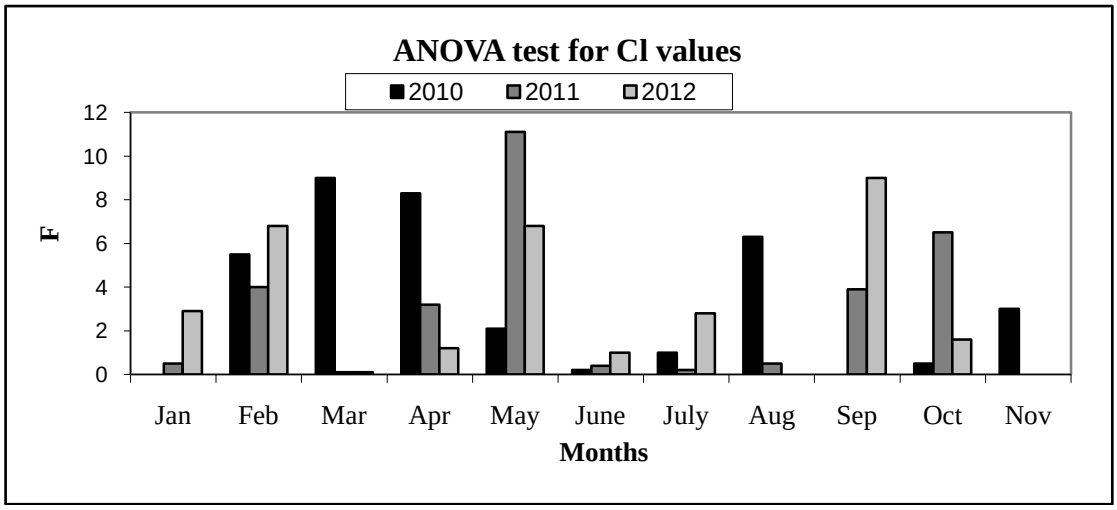

Fig (2) ANOVA test for Cl values for the years (2010, 2011 & 2012)

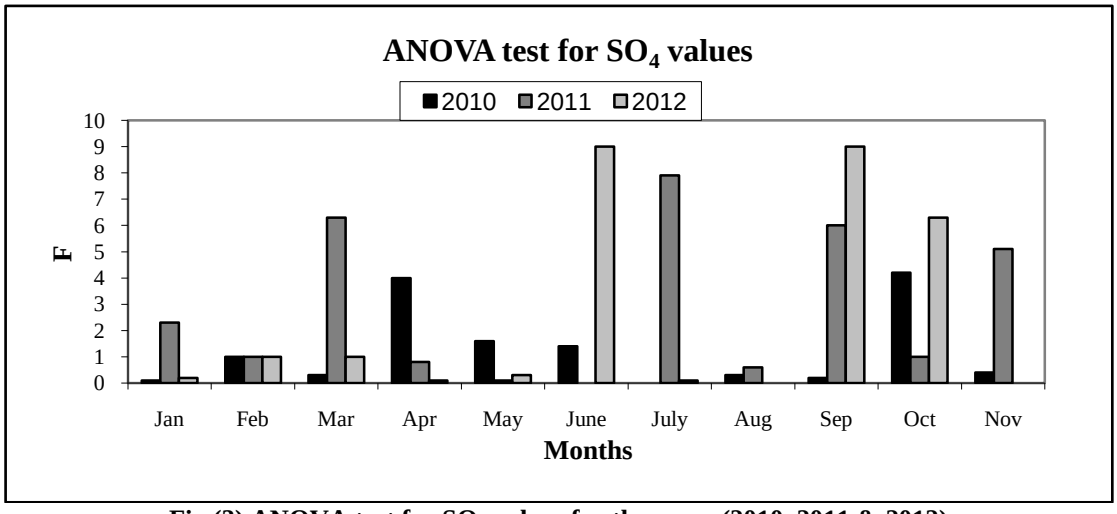

Fig (3) ANOVA test for SO_4 values for the years (2010, 2011 & 2012)

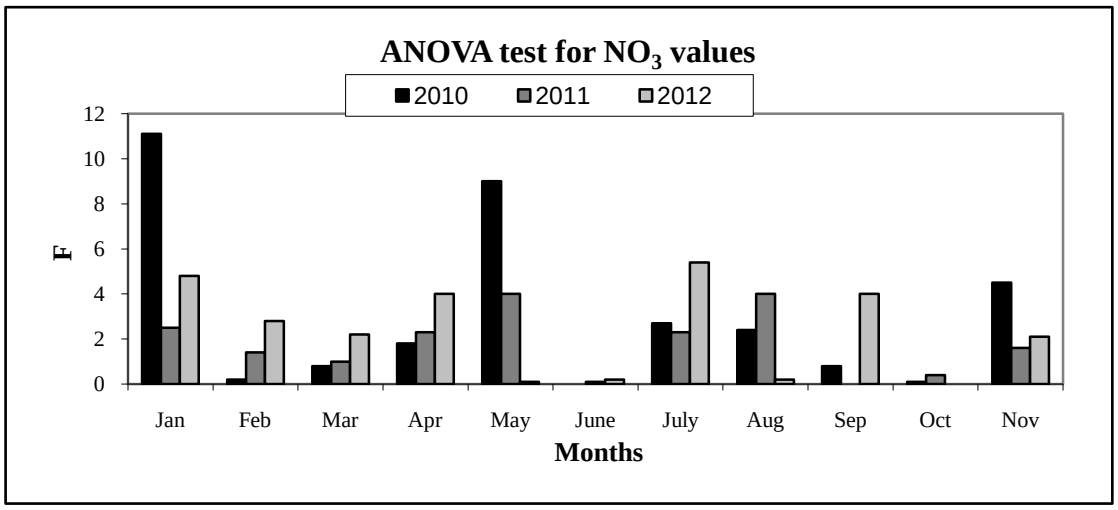

Fig (4) ANOVA test for NO_3 values for the years (2010, 2011 & 2012)

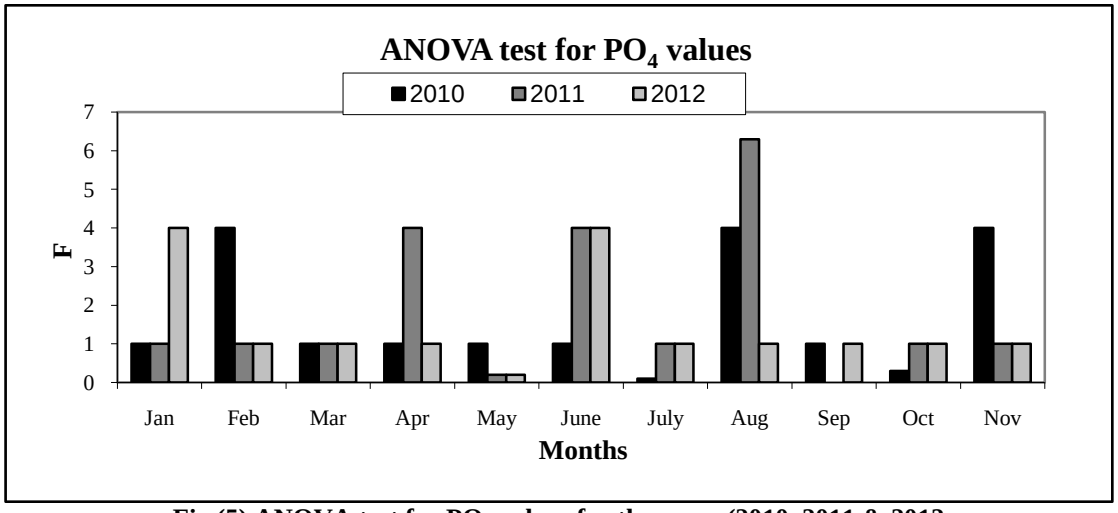

Fig (5) ANOVA test for PO_4 values for the years (2010, 2011 & 2012

6. Conclusions

This study deals with the critical assessment of Al-Masab Al-Aam River water quality in Baghdad. The PO_4, SO_4, Cl, BOD_5 and NO_3 concentrations in Al-Masab Al-Aam River were found to be high or out of the limit of WHO and national standard.

Abu Ghraib and Al-Mahmodiyah Cities are two of four cities outskirts of Baghdad, were found in poor condition in terms of water supply and sewerage because of inaccessibility, lack of proper attention, and insecure war conditions.

References

1. Kamil Kadhum Fahad, 2005. SOME PHYSICO - CHEMICAL CHARACTERISTICS OF AL-Masab AL-Aam-River AT AL-NASIRIYIA CITY
2. Ministry of Water Resource, 2013, History of Al-Masab Al-Aam River in Iraq
3. Gupta S. and Kapoor V., 2000. Fundamentals of Mathematical Statistics. Tenth revised edition: August 2000. Publisher: Sultan Chand. Address: house no 4859/24, 24 darya ganj, New delhi, New Delhi, 110002.
4. Allaa M. Aenab, S. K. Singh, Ali Jabir Lafta, 2013. Critical Assessment of Air Pollution by ANOVA Test and Human Health Effects. Journal of Atmospheric Environment. Published online 04 Feb. 2013 @ ELSEVIER. Volume 71, June 2013, Pages 84–91.