Al-Kufa University Journal for Biology / VOL.8 / NO.1 / Year: 2016
Print ISSN: 2073-8854 Online ISSN: 2311-6544

Impact of Rustumiya Station for Sewage Water Treatment on Bacterial Pollution of Diyala River

Ayad Gh. Hashim

The General Directorate for Education in the province of Baghdad - Rusafa / 2
E-Mail:ayad_bio@yahoo.com

Abstract

The bacterial pollution of Diyala River (Iraq) was studied, especially the impact of Rustumiya station for sewage treatment. Surface water samples from Diyala River at Baghdad city of Iraq were collected in four seasons; summer, winter, spring and autumn of 2016, to examine the following parameters (Fecal Coliform Bacteria (FC), *Escherichia coli* (*E. coli*) and Fecal Streptococci (FS). It observed by the results that the proportions of the microbial pollution has exceeded the prescribed system maintenance Iraqi rivers, especially at the third station as the Diyala River has been affected greatly as posed streams Rustumiya station to the river, which negatively affects aquatic life on one hand and on the farmland on both sides the river on the other hand, where the river water used for irrigation.
Keywords: Diyala River, bacterial pollution, Rustumiya station.

Introduction

Wastewater discharge to rivers without treatment or inefficient treatment by water treatment plants causes significant damage to the aquatic environment because heavy water contains high concentrations of harmful environmental determinants, a general situation in Iraq where most of the city's canals are located along river banks , Damage caused by disturbance of the ecological balance and the occurrence of food enrichment (Eutrophicion) in rivers, which is the growth of undesirable organisms at the expense of the life of other important life, such as fish, the spread of microbes and the growth of other concentrations of determinants such as phenol compounds, carcinogenic wastes consumed Oxygen and other pollution determinants (1,2,3). The sharp decline in river levels and the decline in their flow rate exacerbate these damages. (4)

Reducing the risk of this water lies in efficient and efficient treatment of the removal and cracking of pollutants and their transformation into low risk compounds by sedimentation, ventilation, filtration, chlorination and other processes carried out by treatment plants such as Al-Rustamiya sewage Treatment Plant (RSTP). Some studies have shown that, by evaluating the efficiency of the heavy water treatment plants (5) and the water from the plants (4), they have higher pollution limits than those permitted by the Iraqi standard for river pollutants.

Study Area

The Diyala River is an important tributary of the Tigris River that flow through Iran and Iraq which drains an area of 32,600 km2 (6). The Diyala River arises near Sanandaj in the Zagros Mountains in Iran, forming the Iran- Iraq border for over 30 km. With a total length of 574 km (7), the river has a drainage area of 32,600 km2, of which 25% are located in Iran and 75% in Iraq (8). The Diyala joins the Tigris 15 km south of Baghdad (7). The most important branches of the river are Tangro, Sarawan and Wand. It passes Hemreen mountain series and divided into several streams such as the north Diyala, Al-Khalis, Rose, Haronia, Shahraban, Mahrute and Khraisan. Three dams were established on the river, namely Darbandekhan (3 × 109 m3), Diyala (regulated dam) and Hemreen (4 × 109 m3). where station 1(st.1) was located 1.8km north Rustamiya wastewater plant, while st.2 at new Diyala bridge after the

outflow north Rustamiya in Diyala River where it away from the first station 2.8km, st.3 located at AL_Rasool bridge after the outflow south Rustamiya in Diyala River where it away from the second station about 9.6km, the fourth station it's located at the meeting point of Diyala tributary with the Tigris River. (fig.1).

Fig.1 study area showing the sampling stations

Procedures and Methods

Thermo tolerant (Fecal) Coliform Bacteria (FC) by using MaCckonkey broth (HIMEDIA, India), *Escherichia coli* (*E. coli*) by using MaCckonkey Agar (HIMEDIA, India) and Fecal Streptococci (FS) by using Glucose Azide medium were determined according to(9). The Statistical Analysis System- SAS 2012(10) program was used to effect of difference factors (Station and Season) in study parameters. Least significant difference –LSD test was used to significant compare between means in this study.

Results and Discussion.

The results indicate a high seasonal rate of fecal coliform bacteria (FC) during the winter season, where the highest rate was recorded at the third station, which was (6600000 CFU/100 ml), while it remained during the summer, where it registered (4200 CFU/100 ml) at the first station (fig. 2). High value of (FC) in Diyala river were recorded during the winter that may be due to the high level of suspended solid and nutrients in the drainage water affecting the survival of aquatic micro flora (11), also may be due to the high numbers of bacteria discharge by AL-Rustamiya sewage treatment plant and also to increased agricultural activities (12). *On the other hand,* low number of bacteria during *summer may be due to high temperature* that

encourage the growth of Primitive organisms, which is one of the predators of bacteria *which kills of large number of the of bacteria (13,14). the statistical analysis showed that there was a significant difference in (FC) among seasons and there were significant differences among stations* (Table, 1). These results agreed with previous studies (15, 16 and 17) on the same River

Table 1. Effect of station and season in F.C. (CFU/100 ml)

Station	Season				LSD value
	Winter	Spring	Summer	Autumn	
St 1	740000	240000	4266.67	300000	1463.92 *
St 2	4333333	310000	99333.33	2600000	1766.24 *
St 3	6566667	356666.7	173333.3	3333333	1274.02 *
St 4	4166667	320000	116666.7	3033333	1458.94 *
LSD value	894.34 *	1384.59 *	1207.44 *	983.26 *	---
* (P<0.05).					

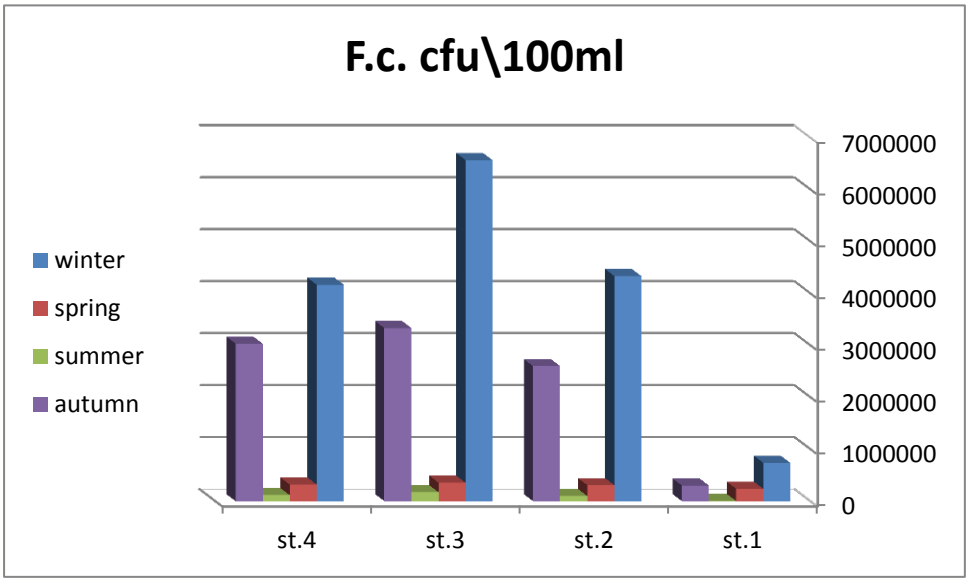

Figure (2): Seasonal variation of fecal coliform in Diyala River during study period

Seasonal rates of (*E. coli*) increased during the winter season (3600000 CFU/100 ml) at st. 3, while in the spring and summer they decreased (4000 CFU/100 ml) at st. 1. These results confirm the role of low temperatures in increasing the number of bacteria. Temperature is not the only factor in determining the numbers of (*E. coli*) bacteria, as the current can be washed with large numbers of bacteria (18). The land passing through the river, as well as the effect of the sediments from the (RSTP), have an impact on the content of these bacteria (fig. 3). *The statistical analysis showed that there was a significant difference in (E. coli) among seasons and there were significant differences among stations* (Table, 2)

Table 2. Effect of station and season in *E. coli* (CFU/100 ml)

Station	Season				LSD value
	Winter	Spring	Summer	Autumn	

St 1	690000	30000	4233.33	236666.6	1269.45 *
St 2	203333	246666.7	99333.33	316666.7	1783.07 *
St 3	3166667	340000	173333.3	663333.3	1662.91 *
St 4	2533333	296666.7	150000	546666.7	2036.84 *
LSD value	1873.59 *	1634.09 *	1085.42 *	1689.63 *	---
* (P<0.05).					

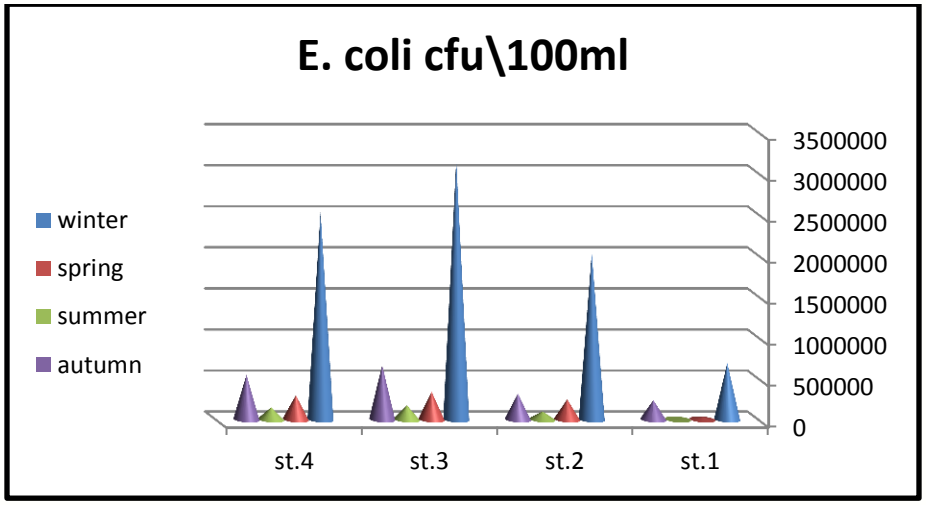

Figure (3): Seasonal variation of *E. coli* in Diyala River during study period.

While the highest rates of feacal streptococci bacteria were recorded during the winter at the third station (560000 CFU/100 ml) where it was decreased during the spring at the first station where it was (210 CFU/100 ml) (fig. 4). *The statistical analysis showed that there was a significant difference in (*FS*) among seasons and there were significant differences among stations* (Table, 3) The observed variation in the results may not be due to differences in environmental conditions affecting the growth of bacteria in water, such as current movement and gas rates, but also to the environmental relations between different bacterial species such as predators and competition. As well as the amount of depositions from the station Rustumiya streams of waste and synchronized time with the time of sampling have a role in the different results (15).

Table 3. Effect of station and season in F.S. (CFU/100 ml)

Station	Season				LSD value
	Winter	Spring	Summer	Autumn	
St 1	7266.67	215	233.33	350	862.50 *
St 2	290000	480	1600	57000	1235.84 *
St 3	513333.3	630	2066.67	92000	1673.59 *
St 4	320000	520	1800	71666.67	1366.02 *
LSD value	1349.52 *	287.66 *	973.07 *	1148.63 *	---
* (P<0.05).					

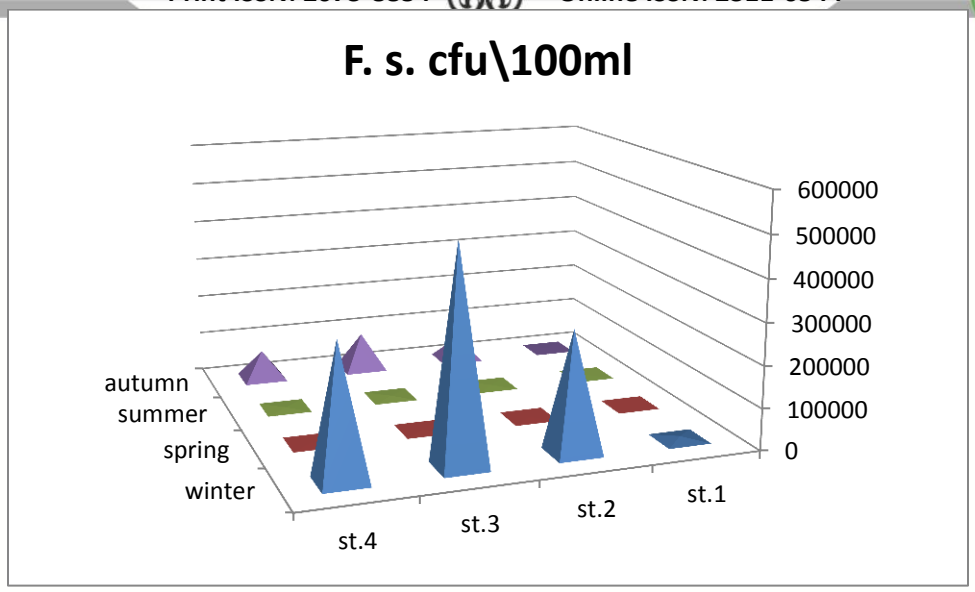

Figure (4): Seasonal variation of (fs) in Diyala River during study period.

The results of the study showed a significant increase in the determinants of pollution in the water coming to the station as shown in the expected result of heavy water untreated and reflect the danger of discharge of this water to the river Diyala without treatment and exacerbate the problem with the low level of the river and the lack of flow as a result of circumstances Drought and water scarcity.

Conclusions:

1. From results of study, faecal coliform, feacal streptococci and *E. coli* bacteria were not in compliance with WHO standards.
2. Presence of faecal coliform bacteria, feacal streptococci and E. coli was found in all the water samples which indicated severity of contamination for human health in Diyala River.

References.

1. Ali, L. H. **(1991)**. "Industrial Pollution", Mosul University. *(In Arabic).*
2. Hughes, L. **(1989)**. "Environmental pollution". Translated by Mohammed Ammar Al - Rawi and Abdul Rahim Asheer. Baghdad University.
3. Hammer. M. J. **(2008)**.Water and Wastewater Technology 6th Ed.
4. Al-Fahdawi, H. J. **(1999)**. Master Thesis, Faculty of Education, University of Basra. *(In Arabic).*
5. Hammadi, A. H., Khaled R. and Ahmad R. **(2005).** Journal of Science Mustansiriya 23, 16 (4). *(In Arabic).*
6. Haitham A. H. **(2010)**. Dependable discharges of the upper and middle Diyala basins.Vol. 2 (16) Journal of Engineering.
7. UN-ESCWA and BGR (United Nations Economic and Social Commission for Western Asia; Bundesanstalt für Geowissenschaften und Rohstoffe) **(2013)**. Inven(UN-ESCWA and BGR, 2013) tory of Shared Water Resources in Western Asia. Beirut. Shared Tributaries of the Tigris River Chapter 4. http://waterinventory.org/sites/waterinventory.org/files/chapters/Chapter-04-Shared-Tributaries-of-the-Tigris-web_1.pdf.

8. Shahin, M. **(2007)**. Water Resources and Hydrometeorology of the Arab Region. In Water Science and Technology.
9. *APHA, AWWA and WFF **(2005)**. Standard Methods for the Examination of Water and wastewater, 21th ed., edited by Eaton, A. D American Water Work Association and Water Environment Federation, USA.*
10. SAS. **(2012)**. Statistical Analysis System, User's Guide. Statistical. Version 9.1th ed. SAS. Inst. Inc. Cary. N.C. USA.
11. *Hader, D.P.; Kumar, H.D.; Smith, R.C. and Dobler, W.I. **(1998)**. Effects on aquatic ecosystems. J. Photochem. And Photobiol.Vol.46: 53-68.*
12. *Adams, S. B. and Kolo, R. J. **(2006)**. Public health implications of Gurara River around Izam Environs, Niger State, Nigeria. Fisheries Society of Nigeria (FISON). Conference Proceedings.*
13. *Davies, C. R. J.; Donnison, A. M.; Speed, D. J.; Ross, C. M. and Nagels, J. W. **(1999)**. Inactivation of fecal indicator microorganisms in waste stabilization ponds interactions of environmental factors with sun light. Water Res.Vol.33: 1220 – 1230.*
14. *Abdo, M. H.; Sabae, S. Z.; Haroon, B. M.; Refaat, B.M. and Mohammed, A. S. **(2010)**. Physico-chemical characteristics, microbial assessment and antibiotic susceptibility of pathogenic bacteria of Ismailia Canal Water, River Nile, Egypt. J. American Sci. Vol. 6(5) pp: 243-250. http://www.americanscience.org.*
15. *Al-Mayaly, I.K.; B.H. Maroof and H.A.AL-Saadi. **(2000)**. Limnological characters of Diyala River and their effect on Tigris River. The first scientific* National in environmental pollution and protection, 5-6 dec.2000. *(In Arabic).*
16. Hashim, A. G. and Rabee, A. M. **(2014)**. Impact of Diyala Tributary on the Quality of Tigris River Water.Vol. 9(4) pp: 493-504.
17. AL-Khaledy, S. H. H. **(2003)**. Ecological and Bacteriological Study in the South Part of Diyala River. *MSc Thesis, College of Science for Women, University of Baghdad, Iraq. (In Arabic).*
18. *Chapman, D. **(1996)**. Water Quality Assessments: A Guide to the Use of Biota, Sediments and Water.Environmental monitoring, 2 ed. UNESCO, WHO and UNEP. E & FN Spon, London UK.*