Restoration of Kham River: Challenges and Strategies

YOGITA L. PADME [1] KSHAMA S. KHOBRAGADE[2]

[1]Dept. of Environmental Science, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad 431002 (M.S) India
[2]Dept. of Environmental Science, S.B. College of Science, Aurangabad431001 (MS) India.
Corresponding author e-mail: [1]Email:padmeyogita@rediffmail.com
[2]Email:kshama_khobragade@yahoo.com

Abstract

Water pollution is a biggest hazardous gift from urbanization, industrialization and modern agricultural practices. It leads to alteration of physical, chemical and biological properties of water bodies and affects the biota of the water body.

In present study the physico-chemical parameters of collected samples and wastewaters were analyzed. The analysis was carried out monthly for the duration from January 2013 to December 2013. The results were compared with the different standards. The impact of wastewater on river was studied. The study shows that the Kham river water quality is deteriorated due to the discharge of untreated domestic sewage and industrial effluent of Aurangabad city.

The present study reveals that the Kham River is heavily polluted at Station D (at Waluj) and then Station C as compared to Station A and B. The river water is contaminated due to continuous discharge of untreated domestic sewage and mixing of industrial wastewater.

Keywords: *Deterioration, Kham River, wastewater, water quality.*

Introduction

Almost all the rivers in India are polluted. There are 14 major rivers in India. Water, the universal solvent because of high dielectric constant has the property of dissolving most of the substances but the access of these substances leads to water pollution (Gautama, 1990).In the recent past, due to rapid progress in communications and commerce, there has been a swift increase in the urban areas along the rivers. The river is no longer only a source of water but is also a channel, receiving and transporting urban wastes away from the towns and the major problem of pollution from domestic municipal sewage. Most of the cities and towns have developed along the banks of rivers because of multipurpose use of river water. But unfortunately some rivers are being polluted by indiscriminate disposal of sewage and disposal of industrial wastes. Water quality provides current information about the concentration of various solutes at given place and time. It deals with the physical, chemical and biological characteristics in relation to other hydrological properties (Tiwari, 2004).The total area of Aurangabad city is about 138.5 sq.km containing about 9 lakhs population as per the 2001 census Aurangabad is situated on the Kham River. Its geographical location is latitude 19°50' north and longitude 75°20' east. Kham River flows 72 km towards the southeast and connects to the Godavari River. The Kham River flows through

Aurangabad city. The historic engineering marvel - city's water supply was developed by Malik Ambar which had canals and nahars running along the Kham River. This river flows with freshwater in monsoon only. Rest of the year it receives wastewater from the city. Kham River receives enormous amount of domestic sewage and industrial effluents. The Kham River receives sewage from the nallas flowing through densely populated areas of Aurangabad district.

According to the study of WQI; it is noted that Kham River Water comes in to Bad Quality of water and unsuitable for drinking and domestic purpose. (Kulkarni and Jain, 2014)

In present study the water samples were collected from different stations from the point where there is discharge of untreated wastewater into the river. The physico-chemical parameters of collected samples and wastewater were analyzed. The results were compared with the ISI standards. The impact of wastewater on river was studied.

Experimental Work

The water samples were collected from four different stations of Kham River flows in to the Aurangabad city, where is discharge of wastewater into Kham River.

Station A - Harsul area

Station B - Near Begampura

Station C - Padampura,

Station D - Waluj area.

Water samples were collected in plastic cans of five liters capacity in the morning session. The parameters like temperature, pH, DO were analyzed at the sampling sites and the samples were transferred to the laboratory for further analysis of the other parameters. The analysis was carried out monthly for the duration from January 2013 to December 2013. The parameters were analyzed by standard methods prescribed by APHA (1998), Trivedy and Goel (1984) and Kodarkar (2006).

Results and Discussions

The Physico-Chemical parameters of Kham River at station A, B, C, and D are given in below tables. The pH values of all the stations are within limit as compared to ISI standards. The pH value shows water is slightly alkaline due to presence of carbonates and bicarbonates. The maximum pH value was observed at Station D as compared to other Stations. The concentration of Total Solids, Total Dissolved Solids and Total Suspended Solids at all the stations are above the ISI standards. Total Solids level is maximum at Station D (**1447.6mg/l). S**imilar results were observed by Kulkarni *et al.* (2014). The maximum Total Dissolved Solids are at Station D (**1253.9mg/l**). The maximum Total Suspended Solids were observed at Station D (**193.7mg/l**). Total Dissolved Solids, Conductivity and Turbidity are related with each other (Tamlurkar and Ambhore 2006). The measurement of Total Solids can be useful as an indicator of the effect of domestic effluents or local sewage (Rai 2011).

Table no. 1.Average physico-chemical analysis of water samples at Kham River

Sr. no.	Parameters	Jan	Feb	March	June	July	Aug	Sept	Oct	Nov	Dec
	Temp (°C)	30.0	34.3	**38.0**	37.7	33.3	29	28.8	27.5	27.0	**23.7**
	Turbidity (NTU)	**76.5**	87.2	94	104	97.2	93	88	100	111	**111.5**
	TS(mg/l)	1112.5	1253	1407	**3190**	1498	982	765	725	887	**707.5**
	TDS (mg/l)	950	1080	1224	1273	**1317**	807	597	564	620	**534**
	TSS(mg/l)	162.5	173	183	**1917**	181	175	168	**161**	167	173.5
	Electrical Conductivity ($\mu mhos^{-1}$)	**542.7**	473	414	334	**259**	284	297	294	303	328
K	pH	**8.7**	**8.7**	8.6	7.8	**7.3**	7.6	7.5	7.7	7.9	7.9
	DO (ppm)	6.0	4.7	**3.9**	5.4	6.8	7.4	7.4	7.2	**8.0**	7.9
	BOD (ppm)	13.7	13.9	15.1	13.8	**13.5**	13.6	14.2	15.5	14.8	**16.1**
	COD (ppm)	21	21.8	22.5	**19.9**	30.9	36.6	35.5	26.9	34.7	**39.0**
	Alkalinity (mg/l)	501.7	479	463	454	495	484	**453**	490	470	**542**
	Total Hardness (mg/l)	341.7	325	**315**	324	333	333	360	366	362	**374**
	Nitrate (mg/l)	**2.5**	3.4	4.1	3.1	3.1	3.9	3.2	3.2	4.1	**6.0**
	Phosphate (mg/l)	1.07	**1.4**	**1.4**	0.93	1.1	1.0	0.89	0.87	**0.83**	1.02
	Sulphate (mg/l)	185	187	190	194.5	183	170	**163**	190	185	**213**
	Chlorides (mg/l)	434	439	**537**	**420**	461	454	488	472	490	497

Table no. 2.Mean values of parameters during January 2013 to December 2013

Sr. No.	Parameter	Station A	Station B	Station C	Station D
1	Temp (°C)	**30.4**	30.5	31.1	**31.7**
2	Turbidity	87.8	93.8	98.8	105.5
3	TS(mg/l)	**979.9**	999.9	1176.8	**1447.6**
4	TDS(mg/l)	**813.5**	841.9	999.4	**1253.9**
5	TSS(mg/l)	**158**	166.4	177.4	**193.7**
6	Electrical Conductivity ($\mu mhos^{-1}$)	**337.7**	343.8	358	**373.3**
7	pH	**7.81**	7.92	8.06	**8.2**
8	DO(ppm)	**7.02**	6.81	6.23	**5.9**
9	BOD(ppm)	**18.4**	19.72	21.4	**26.77**

10	COD (ppm)	**23.97**	27.74	30.54	**33.43**
11	Alkalinity(mg/l)	**432**	459.7	478.9	**563.3**
12	Total Hardness(mg/l)	**331.1**	339.8	346.4	**358.3**
13	Nitrate (mg/l)	**2.8**	3.2	3.69	**5.04**
14	Phosphate (mg/l)	**0.939**	1.07	1.10	**1.19**
15	Sulphate (mg/l)	**144.8**	168.8	209.7	**231.1**
16	Chlorides (mg/l)	**453.2**	464.8	473.2	**487.3**

Table no. 3.Average season wise physico-chemical parameters of Kham River
In the month of April 2013 and May 2013 Kham River was completely dried.

Sr. No.	Parameter	Winter	Summer	Monsoon
1	Temp (℃)	**27.05**	36.15	32.2
2	Turbidity	99.7	90.6	95.5
3	TS(mg/l)	**858**	1330	1608
4	TDS(mg/l)	**667**	1152	998
5	TSS(mg/l)	**166**	178	610
6	Electrical Conductivity ($\mu mhos^{-1}$)	**366**	443.5	293
7	pH	**8.05**	8.6	7.5
8	DO(ppm)	**7.2**	4.3	6.7
9	BOD(ppm)	**15.0**	14.5	13.7
10	COD (ppm)	**30.4**	22.15	30.72
11	Alkalinity(mg/l)	**500.9**	471	471
12	Total Hardness(mg/l)	**360.9**	320	337
13	Nitrate (mg/l)	**3.9**	3.7	3.3
14	Phosphate (mg/l)	**0.94**	1.4	0.98
15	Sulphate (mg/l)	**193.2**	188	177
16	Chlorides (mg/l)	**473.2**	488	455

Table no.4: Water Quality Standards

Sr. No.	**Parameters**	**USPH Standards**	**ISI Standards**	**BIS Standards**	**MPCB Standards**
	Temperature (℃)				
	pH	6.0-8.5	6.5-8.5	-	5.5-9.0

	Conductivity ($\mu mhos^{-1}$)	300	-	-	
	Turbidity NTU	< 5	10	-	
	TS mg/l		-		
	TDS mg/lit	500	-	-	2100
	TSS mg/l		50		100
	Alkalinity mg/ lit	-	200	-	
	Total Hardness mg / lit	-	300	-	
	Chlorides mg/lit	250	250	600	600
	Sulphates mg/lit	<0.3	150	1000	
	DO ppm	4-6	3.0	-	4-5
	BOD ppm	4.0	<4	-	30
	COD ppm	4.0	10	-	250
	Phosphate mg/lit	-	5.0	-	5.0
	Nitrate mg/lit	-	45	-	10

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The maximum value of Electrical Conductivity was recorded as **373.3** $\mu mhos^{-1}$ at Station D and minimum value **337.7** $\mu mhos^{-1}$ at Station A. the maximum level is observed in January and minimum level in the month of July. It represents the total concentration of soluble salts/mineral salts in water (Trivedy and Goyal 1984). The minimum DO level is recorded as 5.9 ppm at Station D. in summer season DO level was decreased by **3.9 ppm**. The introduction of oxygen demanding materials either organic or inorganic into water causes depletion of the DO. The DO levels recorded in the study area varied according to the rate of respiration and decomposition of the organic materials in the water. The similar results were observed by Shinde. *et al* 2011 and Ghorade *et al* 2012. The BOD values of all the stations were above the ISI standard, clearly indicates increasing load of pollution towards downstream of river. High BOD and COD indicate high degree of organic pollution. The high value of BOD was recorded at the Station D as 33.43 ppm as compared to Station A, B and C. Similar results were also observed by Shinde *et al* 2011 and Ghorade *et al* 2012 in Kham River. The high COD values is found at the Station D (26.77 ppm), which may be due to the mixing of domestic and industrial waste. All Stations having high value of COD as compared to the ISI standards. The level alkalinity was high at all the Stations as compared to ISI standard. The high alkalinity is recorded as **563.3** mg/l at Station D and minimum value was at Station A. The high alkalinity is because of addition of waste. Mishra and Saksena (1989), Pandey *et al*. (1993), Jesudass and Akia (1995) reported variation in the values of total alkalinity which interferes with the water quality. The high phosphate value is recoded at Station D as 1.19 mg/l. The maximum

level was observed in the month of February and March. The high Suphate value is recoded as 231 mg/l at Station D as compared to the Station A, B. and C. the increased level was observed in the month of December and decreased level in the month of September. The Nitrate, Phosphate and Sulphate increases towards downstream due to influx of domestic sewage, detergents, agricultural effluents and industrial effluents. Hynes (1979) also noticed an increase in phosphates and nitrate concentration in downstream direction of the Poluse River.

Conclusions

The present study reveals that the Kham River is heavily polluted at Station D (at Waluj) and then Station C as compared to Station A and B. The river water is contaminated due to continuous discharge of untreated domestic sewage and mixing of industrial wastewater. It necessary the constant monitoring of water disposal and to control the incoming industrial waste and wastewater from the city by redesigning the infrastructure to protect the river.

Strategies:

- To control the incoming industrial waste and wastewater from the city by redesigning the infrastructure to protect the Kham river.
- The constant monitoring of waste water disposal is essential.
- The industrial effluents should be treated before disposal to the any water body as they as posing serious risk for the health of people and water pollution.
- To avoid the disposal of municipal and domestic wastewater without treatment into any water body.
- Public should be made aware of the dangers of pollution. NGO'S academicians and local communities should be involved in extension programmes.
- The implementation of effective ecotechnologies such as, Bioremediation Technology, Root zone Technology, Green Bridge Technology, Green Lake Technology, and Stream Eco-System (SES) Technology to restore the quality of Kham River.
- There should be the development of models for management of Kham River water for sustainable utilization

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