

# Effect on Water Quality of Chambal River due to Discharge of Open Drains in Kota City

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**Abstract** – The undeveloped sewerage system and unavailability of sewerage lines in Kota city are affecting the water quality of Chambal River by falling of untreated sewage water through the open drains. Looking to the severe condition of the sewerage system, it was decided to carry out a study to analyze the effect of open drainage system on water quality of Chambal River. To do this work, initially samples of wastewater were collected from different open drains as well as from Chambal river of Kota city and then samples were tested for various physico-chemical and biological parameters. The observed results were compared with permissible limits prescribed by the Indian Standards. From comparison, it is concluded that the parameters are beyond the permissible limits. The direct discharging of open drains in the river is creating an alarming situation to the quality of the water of Chambal River, which is the main source of drinking water for Kota city and other districts of Rajasthan.

**Key Words:** Physico-chemical parameters, biological parameters, wastewater, sewerage system, Chambal River, open drains

## 1. INTRODUCTION

The only perennial river of Rajasthan 'The Chambal' is the main source of Kota city as well as the district for the purpose of drinking water, agriculture, and various other uses. The river Chambal flows through the Kota city, an educational and industrial city of Rajasthan. Water of Chambal River is getting contaminated in the area because of various polluted activities and population increase.

There are 26 open drains situated in Kota city which are directly falling in the Chambal River due to reason that the sewerage system of Kota city is at present not developed to handle and treat the wastewater generated daily. The sewage treatment plants installed in the city have a capacity of only 50 MLD against the requirement of 312 MLD for present population. So the objective of this study is to carry out an analysis of sewerage system of Kota and to know about the effect of wastewater from open drains on the water quality of Chambal River.

## 1.1 Aims and Objectives

The aims and objectives of the study are as follows:

1. To study the parameters of wastewater of open drains.
2. To evaluate the effect on the quality river water due to the falling of open drains.
3. To know about the sewerage system of Kota.
4. To study that whether the demand of STPs in Kota is fulfilled or not.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

The city of Kota is situated along the eastern bank of river Chambal in southern part of Rajasthan. It is the third largest city of Rajasthan after Jaipur and Jodhpur respectively. The geographical coordinates of Kota are 25.18° N 75.83°E. It extends over an area of 12,436 km<sup>2</sup> which amounts to about 3.63 % of the total land covered by Rajasthan. The average elevation of Kota is 271 meters. The district is bound by Sawai Madhopur, Tonk and the Bundi districts, to its north and North West. The river Chambal separates these districts from Kota, and forms a natural border line. The district of Kota is famous for sand stone, Kota stone, Kota Sarees, delicious kachori, and famous coaching centers.

### 2.2 Plan, Sampling and Collection

It is known from newspapers and electronic media that the quality of river water is getting deteriorated continuously by discharging of untreated water. Also in the study of researchers, it is explained that the quality of river water is adversely affected by direct discharging of waste water and also it is affected by lack of sewerage system. On this basis different theories from different research papers have been studied in the first two months of the study period.

Based on these theories, it is decided to study and analysis of sewerage system and water quality of open drains falling in Chambal River. To carry out this task, first of all, proper information was collected be require about the existing system of sewerage, sewage treatment plants and open

drains. For this, sites of different sewerage systems and treatment plants have been visited in next two months with the permission of different functional bodies like Nagar Nigam, UIT, Pollution control board, RUIDP etc.

For the purpose of study, we identified the locations of sample collection along the river Chambal where open drains are directly discharging their wastewater into it. The major locations from where we collected the samples are given in table 1.

**Table -1:** Sample Locations and their Coding

S. No.	SAMPLE LOCATION	SAMPLE CODE
1.	Godawari Dham drain	S1
2.	Chambal river at Chambal garden	S2
3.	Dadabari circle drain	S3
4.	Jawahar nagar petrol pump drain	S4
5.	Drain Infront of RAC office	S5
6.	Chambal river at Bhitriya Kund	S6
7.	Drain near by St. Paul School	S7
8.	Sajidhera drain	S8
9.	Drain near Ram Dass Circle (Station Side)	S9
10.	Kala talab	S10
11.	Drain near Bhitriya Kund	S11
12.	Chambal River at Karai ke balaji	S12
13.	Chambal river at Station	S13
14.	STP Sajidhera	S14
15.	STP Dhakerkhedi	S15

### 2.3 Sampling of Wastewater

The sampling of wastewater has been carried out from various open drains and Chambal river of Kota city. The sampling and experimental work has been done during the months June 2017 to August 2017. We used plastic buckets and plastic bottles of 1 and 1.5 liters to collect samples. Bottles and bucket were sterilized and rinsed properly. Samples were collect from different open drains and some location of Chambal River.

### 2.4 Physico-chemical Parameter Analysis

The wastewater samples were collected from all the targeted stations at for physico-chemical analysis, methods of collection and handling were adopted based the standard procedures. Various physico-chemical tests like DO, BOD, COD, pH, Temperature and TDS were performed in the laboratory of Environmental Engineering in the department of Civil Engineering, RTU, Kota. pH test was performed with digital pH meter and DO, BOD, COD, and TDS were performed using DO meter, BOD meter, COD meter and TDS meter respectively.

## 3. RESULTS AND ANALYSIS

### 3.1 Physico-chemical Parameters

The table 2 and 3 shows the prescribed limits of different parameters for discharge of sewage/domestic and industrial wastewater into inland surface sources of water after proper treatment as per the Indian Standards.

**Table 2:** Tolerance Limits for Sewage Effluents discharged into Inland Surface Water (IS: 4764-1973)

S. No.	Characteristics	Tolerance limits
1.	Total suspended solids	Max. 30 mg /l
2.	BOD (5 day at 20°C)	Max. 20mg/l

**Table 3:** Tolerance limits for Industrial Effluents discharged into Inland Surface Water (IS: 2490-1981)

S. No.	Characteristics	Tolerance limit
1.	Total suspended solids	Max. 100 mg/l
2.	pH	5.5 to 9.0
3.	Temperature	Temperature of wastewater should not exceed 40° C in any section of the river within 15 meters downstream from the effluent outlet
4.	BOD (5 day at 20°C)	Max. 30 mg/l
5.	Oil and grease	Max. 10 mg/l
6.	Sulphides (as S)	Max. 2.0 mg/l
7.	Total residual chlorine	1.0 mg/l
8.	COD	Max. 250 mg/l

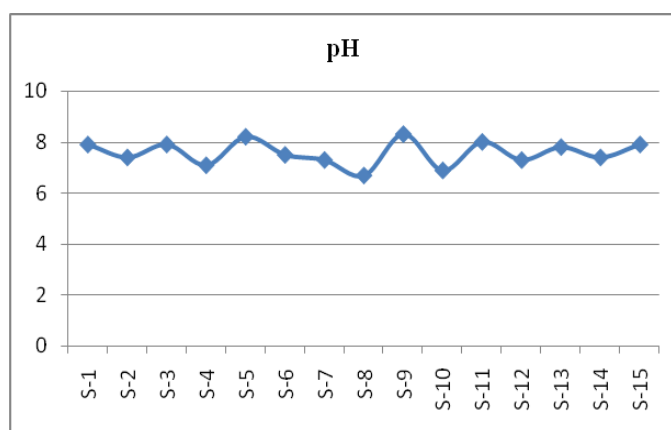
Samples were collected for three months and tests were done. The average results and analysis are shown in the following table 4. The important parameters which were analysed are pH, temperature, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand and total dissolved solids for the wastewater samples collected from locations mentioned as above in table 1:

**Table 4:** Physico-Chemical Parameters of Wastewater Samples

Sample Code	Parameters (in mg/l, except pH and temperature)					
	pH	Temperature	DO	BOD	COD	TDS
S-1	7.9	22.4	2.97	314	813.26	1500
S-2*	7.4	26.3	5.51	25	59	300
S-3	7.9	30.1	0.31	502	1340.34	1715
S-4	7.1	30.4	0.21	319	749.65	1500
S-5	8.2	32.5	2.37	328	1049.6	1610
S-6*	7.5	30.7	6.7	28	63	312
S-7	7.3	27.4	1.8	412	1054.7	1690
S-8	6.7	28.2	2.17	325	763.75	1611
S-9	8.3	22.4	2.9	110	262.9	590
S-10	6.9	30.9	3.7	150	363	612
S-11	8.0	31.4	3.42	146	421.94	530
S-12*	7.3	30.8	6.2	27	65	328
S-13*	7.8	32.2	3.7	80	191.2	523
S-14	7.4	30.7	3.1	105	327.6	711
S-15	7.9	31.1	2.97	110	285	810

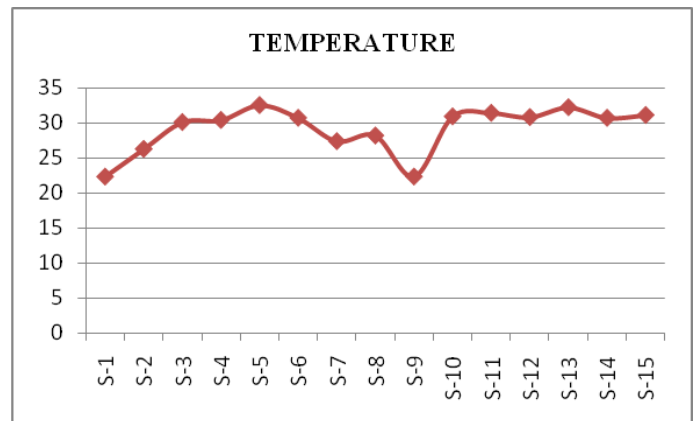
Note: \* shows the samples of water collected from Chambal River along its path in Kota city

The results obtained as above are being presented in the form of graphs for different parameters, as follows:



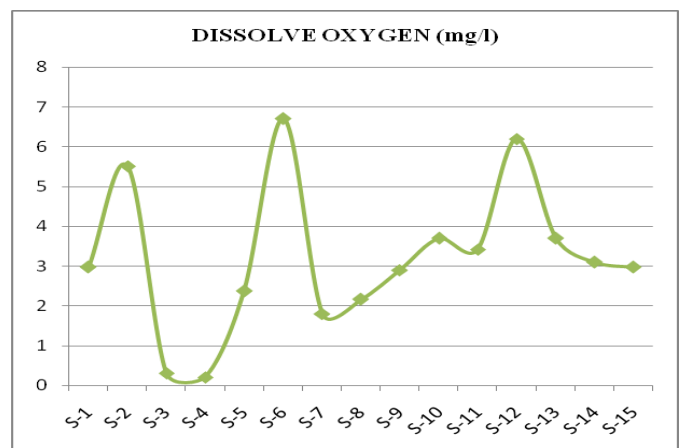
Graph 1: pH values for wastewater samples

It is observed that pH of all the samples are in limits as per IS standards (pH should be between 5.5 to 9.0) and there is not much necessity to control the pH of waste water before discharging into river.

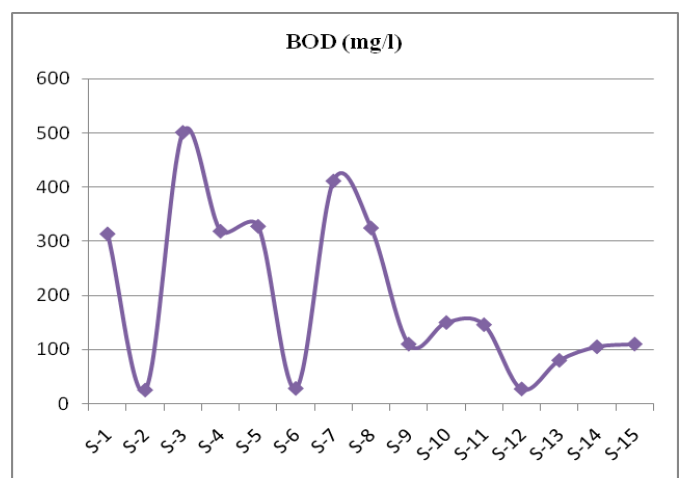


Graph 2: Temperature values for wastewater samples

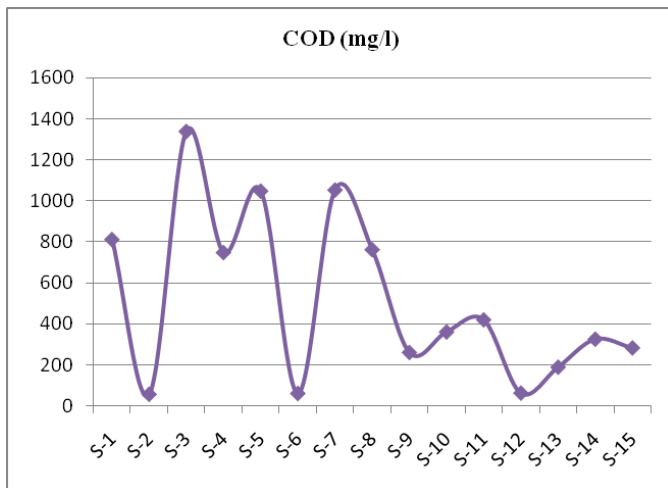
As per norms, the temperature of wastewater should not exceed 40° C in any section of the river within 15 meters downstream from the effluent outlet and our results show that temperature of all samples are within limits.



Graph 3: DO values for wastewater samples

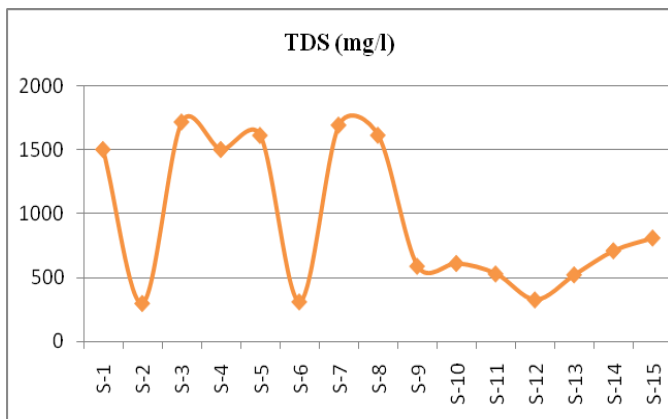


Graph 4: BOD values for wastewater samples



Graph 5: COD values for wastewater samples

DO, BOD and COD of all the collected samples are beyond the limits. Lowest DO was found in the drain near Dadabari circle, drain near Jawahar Nagar, drain near St. Paul School and Sajidhera drain. In these locations highest BOD and COD was also found.



Graph 6: TDS values for wastewater samples

TDS of all the samples were also found beyond the limits as per IS standards limit. Therefore it is suggested to ensure that proper waste water treatment is carried out before allowing the waste water to enter into river Chambal through open drains. Also it is desired that sufficient capacity of sewage treatment plants is built up and no open drain should be permitted to discharge its waste water directly into river Chambal.

### 3.2 Bacteriological Parameters

The wastewater samples were tested for microbiological parameters, total coliforms and fecal coliforms in the microbiological laboratory. It was found that all the samples were having these coliforms in some amount and hence were

declared positive. So it is very alarming that river water is getting polluted through the discharge of wastewater from open drains and since the river water is the main source of drinking water for Kota city, so it is even more critical because of the harmful pathogens getting their entry into drinking water. This creates unnecessary load on water treatment plants of Kota city to remove these pathogens from water.

### 4. CONCLUSIONS

This study shows that Kota city lacks proper system for treatment and drainage of wastewater, consequently leading the wastewater from household, industries etc. to the lifeline of the city, Chambal River. There is high need for connecting the sewer lines throughout the sewers of the city so that the wastewater can be easily transported to the Sewage Treatment Plant (STP) for its treatment before dumping it into the river.

This study also highlights the fact that parameters viz., BOD, COD and TDS of all samples from various locations are alarmingly higher than the prescribed limits by IS 4764:1973 and IS 2490:1981. These values exceeding above their respective limits may cause heavy damage to aquatic plants and animals.

Approximately 312 MLD of wastewater is produced by the city, out of which only 50 MLD is treated daily through 2 STP's running in the city. Rest 262 MLD is dumped directly into the Chambal River through open drains. Hence there is a urgent need for a few new STP's in the city. Also there is a need of public and media participation in spreading awareness about it and it could also be included in government initiatives like Swachh Bharat Mission.

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