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Research Article

Impact of Domestic Effluents on Various Water Bodies of Kota Region

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ABSTRACT

The addition of any substance to water or changing of water's physical and chemical properties in any way which interferes with it's use for legitimate purpose is called water pollution. Most of the rivers of India are highly polluted due to domestic and industrial effluents. Water pollution adversely effects not only human being but also plants and animals. Chambal river of Kota region is also highly polluted by the domestic effluents of different untreated nallah's. Among these 4 are causing major changes in water quality. Quantitative estimation of different parameters reveals that Alkalinity, Salinity, Total Hardness, Turbidity, amount of chlorides, Total dissolved solids, Coliforms and BOD is very high in all the studied sites. Dadabari nallah is highly polluted among all the sites. Treatment of these water bodies is highly essential for the life of Chambal river.

Key words*: Domestic effluents, Physico- chemical, Biological parameters, Pollution, Treatment.*

INTRODUCTION

Water is one of the most unique molecules known to man and also one of the most important to biological systems. Water exist in nature in all three states of matter (solid, liquid, gas), it also covers 75 percent of the earth and composes roughly 78 percent of the human body. Water pollution is any chemical, physical or biological change in the quality of water that has a harmful effect on any living thing that drinks or uses or lives in it. India has 14 major river each having catchment area of 20,000 sq.km.

The Ganga River is one of the largest river's on the Indian Sub-continent. There are all 48 big cities and 66 small towns situated on it's bank, which produce major part of sewage, untreated industrial waste effluents, wanton discarding of corpses which fall into the Ganga river.

Over 100 million gallons per day of untreated sewage and over 5 million liters of industrial waste effluents degrades Yamuna river's quality (Agarwal et al, 1986).

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In March 1981 and 1983, mass death of fish in the Gomti river water at Lucknow was reported caused by discharge of untreated sewage. The waste discharge from Rohtas industries, Dalmia nagar, Bihar, have made a 22 km stretch of the Son river devoid of fish. The upper stretch of Damodar river in Eastern India, Between Bakora and Panchet are highly polluted due to discharge of waste effluents.

Rajasthan is a semi arid desert state. The Arawali Range of Hills, cuts it into two halves. The eastern part of Rajasthan drained by several integrated drainage system and wastern part opens out into the great desert - The Thar, which has only one major river basin - The Luni.

The textile industries in Pali produces industrial waste which is finally enter into the Bandi and Luni river. Bhilwara and the adjoining areas are well known for the textile industries which produce poisonous industrial effluents with concentration of Cr, Pb, Fe, Zn, Na which are flowing in the nalah that joins the in the Kothari and Banas river.

In context of above the present study focus on the studies on the domestic effluents in various water bodies of Kota city. It was undertaken in the view to assess the water quality deteriorated by the domestic effluents.

STUDY AREA

Kota is located along eastern bank of the Chambal river in the southern part of Rajasthan. It is the 3rd largest city of Rajasthan after Jaipur. and Jodhpur. Kota once belonged to the princely state of Bundi under the rule of the Chauhans. Kota is well known for its ancient palaces, havelis or mansions and castles. In the 17th century, Emperor Jahangir declared Kota a separate state and it was ruled by Rao Madho Singh the heir apparent to the throne of Kota. The city is a modern settlement now and is known for its natural and man made marvels.)

The exact cartographic coordinates are 25°11'N 75°50'E25.18°N 75.83°E. It covers an area of approximately 12,436 km² (3.63 per cent of the Rajasthan state). It has an average elevation of 271 meters (889 ft). The district is bound on the north and north west by Sawai Madhopur, Tonk and Bundi districts. The Chambal river separates these districts from Kota district, forming the natural boundary

River Chambal originates near the Janapao temple at about 24 km. south west away from Mhow in Madhaypradesh at an elevation of 854.35 m. The Chambal is a perennial river. It is 135 km. in length in Rajasthan. It's total length is 966 km. This river forms the boundary between Rajasthan and M.P. (Agarwal, 1986).

MATERIALS AND METHODS

Water from different sources was collected and analyzed for various parameters i.e. Physical color, odour and temperature, Chemical - pH, turbidity, total alkanity, total hardness, magnesium hardness, calcium hardness, chloride, sulphate, nitrate, T.D.S. and M.P.N. value and B.O.D. For determination of these parameters, method is given by APHA (2005).

1. **pH DETERMINATION :-** The pH of a solution can be taken as the logarithm to the base 10 of the reciprocal of the hydrogen ion concentration.
   $pH = -\log_{10}(H)$
2. **TURBIDITY DETERMINATION (N.T.U.)** - Due to presence of these undissolved materials water becomes turbid. The turbidity of water is directly related to light penetration and visibility or transparency. To determine turbidity we used Nephelometer.
3. **ALKALINITY DETERMINATION** :- The major portion of alkalinity in natural water is caused by hydroxide, carbonates and bicarbonates.
   Methyl orange alkanity (M) as mg/l $CaCO_3 = \frac{\text{ml of titrant (M) X 1000}}{\text{ml of sample}}$

4. **TOTAL HARDNESS DETERMINATION (mg/l)** :- Hardness is defined as characteristics of water representing the total concentration of calcium and magnesium ions expressed as milligrams of $CaCO_3$ per liter.

   Total hardness as, $\frac{\text{Volume of 0.01 M EDTA(ml) X 1000}}{\text{Volume of sample(ml)}}$ mg/l

5. **CALCIUM HARDNESS as CaCO3 (mg/l)**=$\frac{\text{Volume of 0.01 M EDTA (ml) X 1000}}{\text{Volume of sample (ml)}}$

6. **MAGNESIUM HARDNESS DETERMINATION**:-

   Magnesium hardness = Total hardness - Calcium hardness

7. **CHLORIDE ESTIMATION (mg/l)** :- Chloride is one of the major anions in water and sewage. A high chloride contents also exerts effect on metallic pipes and structure as well as on agriculture plants.

   mg/l Cr = $\frac{\text{(A-B)X1000}}{\text{ml of sample}}$

8. **SULPHATE DETERMINATION (mg/l)** :- It is done with the help of Spectrophotometer, Nessller cylinder

9. **NITRATE DETERMINATION (mg/l)** :-

   Measured with the help of Spectrophotometer or colorimeter, Nessller tubes.

10. **TOTAL DISSOLVED SOLIDS (mg/l)** :- Firstly conductivity of water is determined with the help of conductivity meter. Now if we know conductivity, dissolved solid concentration and correlation factor than the total dissolved solids can be found out by direct multiplying conductivity with the correlation factor. According to Indian Standard max. permissible limit of total dissolved solids range is up to 2000 mg / l. for potable water.

11. **BIOLOGICAL OXYGEN DEMAND** :- The B.O.D. is the measure of the amount of organic pollution and is of great value for understanding the quality of sewage, sewage effluents, industrial waste and grossly polluted water. According to Indian Standard max. permissible limit of biological oxygen demand range is up to 3 mg/1. for potable water.

    B.O.D. (mg/l) at 35 deg.C = Initial D.O. (mg/l) - 5 Days D.O.

12. **BACTERIOLOGICAL EXAMINATION (MPN):-**

    If the coliform group of bacteria has been widely used in water. Water testing to indicate the pollution of water with sewage and waste. For bacteriological examination we use generally Multiple Tube Dilution Method.

OBSERVATIONS AND RESULT

The present study was aimed to assess the exciting biological status and physiochemical parameter of water of various water bodies which fall into Chambal river. Investigation carried out from October 2010 to September 2011.~ The physiochemical parameter of water determine it's suitability for any intended use. Different water bodies and chambal river water was analyzed for it's various physicochemical characteristics. The results are presented in Table No. 1; Fig.1 and 2.

pH:- pH factor is important factor of water quality and survival of biological agent depends on it. The values of "pH" was minimum (6.8) in "Santoshi Nagar Nalah" and maximum (8.2) in "Dadabari Nalah" which concludes that water is alkaline in nature of all the studied sites.

TURBIDITY:- Turbidity is the measurement of cleaning of water. In most of the sites is turbid due to colloidal and extremely fine dispersions. Suspended matter such as clay, silt finally divided organic and inorganic matter plankton and other microscopic organism also contribute to turbidity. The values of "Turbidity" was minimum (1.0 N.T.U.) in "Santoshi Nagar Nalah" and maximum (35.0 N.T.U.) in "Dadabari Nalah".

The value is exceeding in all the cases that means the water is highly turbid.

TOTAL ALKALINITY :- The determination of alkalinity provides an idea of the nature of salt present. The values of "Alkalinity" was minimum (60.0 Mg./L.) in "Bheetariya Kund Nalah" and maximum (200.0 Mg./L.) in "Dadabari Nalah". The value is exceeding in all cases that means that the water is Alkaline in nature.

HARDNESS :- Hardness is defined as characteristics of water representing the total concentration of calcium and magnesium ions. The values of "Total Hardness" was minimum (80.0 Mg./L.) in "Bheetariya Kund Nalah" and maximum (350.0 Mg./L.) in "Dadabari Nalah" (Table No. 4, Fig. No.12). The values of "Calcium Hardness" was minimum (40.0 Mg./L.) in "Bheetariya Kund Nalah" and maximum (250.0 Mg./L.) in "Dadabari Nalah". The values of "Magnicium Hardness" was minimum (35.0 Mg./L.) in "Bheetariya Kund Nalah" and maximum (230.0 Mg./L.) in "Sajidehra Nalah". It is concluded that the water is unpotable.

CHLORIDE :- Chloride is one of the measure anion in water and sewage. The values of "Chloride" was minimum (15.0 Mg./L.) in "Bheetariya Kund Nalah" and maximum (220.0 Mg./L.) in "Sajidehra Nalah". It is concluded that the water is unpotable.

TOTAL SULPHATE :- The values of "Total Sulphate" was minimum (5.0 Mg./L.) in "Bheetariya Kund Nalah" and maximum (70.0 Mg./L.) in "Dadabari Nalah".

NITRATE:- Nitrate is an excellent parameter to judge organic pollution in water bodies. The values of "Nitrate" was minimum (0.0 Mg./L.) in "Bheetariya Kund Nalah" and maximum (12.0 Mg./L.) in "Sajidehra Nalah".

T.D.S. :- All aquatic bodies in nature contain both inorganic and organic dissolved solids. In the present study the values of "T.D.S." was minimum (182.0 Mg./L.) in "Bheetariya Kund Nalah" and maximum (1000.0 Mg./L.) in "Santoshi Nagar Nalah".

The value is exceeding in all cases that means that the water is Unpotable.

COLIFORM ORGANISM:- The values of "Coliform Organism" was minimum (9.0 M.P.N.) in "Bheetariya Kund Nalah" and maximum (2400.0 M.P.N.) in "Santoshi Nagar Nalah". The value is exceeding in all cases that means that the water is Unpotable.

B. O.D. - The B.O.D. is the measure of the amount of organic pollution and is of great value for understanding the quality of sewage, sewage effluents, industrial waste and grossly polluted water. The values of "B.O.D." was minimum (0.0 Mg./L.) in "Bheetariya Kund Nalah" and maximum (2.5 Mg./L.) in "Dadabari Nalah" (Fig 1). The value is exceeding in all cases that means that the water is Unpotable.

DISCUSSION

Present study highlight on the studies of the domestic effluents in various water bodies of Kota city. The principal focus of study is to check the quality of water entering into the various water bodies of the Kota region. Water has been analysed to find out the level of pollution in water. The water from these water bodies in turn flows into the Chambal river.

From the present study, it is revealed that water is polluted in many ways such as in industrial effluents, untreated domestic sewage etc. From different sources they enter the nearby nalah and make entry into river. The large number of chemicals that either existed naturally or added due to human activities dissolved in water thereby contaminating leading to various problems.

Anthropogenic nutrient enrichment causes serious attraction in the aquatic eco system (Khan and Ansari, 2005). The physicochemical properties are governed by rain evaporation, adjoining water and intensities of pollution (Handa, 1983).

The physical and chemical characteristics of water determine suitability of water for use. The microbial examination of water is direct indicator of faecal contamination and it's extent of risk to human health.

Table 1- Physio-chemical parameters on selected sites

Parameters	Santoshi Nagar Nallah		Dadabari Nallah		Bheetariya Kund		Sajidehra Nallah	
	Max	Min	Max	Min	Max	Min	Max	Min
pH	7.5	6.8	8.2	7.0	8.1	7.0	7.9	7.0
Turbidity (NTU)	10	1	35	3	12	2	10	2
Alkalinity (Mg/L)	170	75	200	80	200	60	180	80
Total Hardness (Mg/L)	300	130	350	100	270	80	330	90
Calcium Hardness (Mg/L)	190	70	250	40	150	40	200	50
Magnicium Hardness (Mg/L)	230	55	200	40	150	35	230	40
Chloride (Mg/L)	150	40	190	30	130	15	220	35
Total Sulphate (Mg/L)	60	7	70	15	45	5	50	15
Nitrate (Mg/L)	10	2	10	2	12	0	12	1
TDS (Mg/L)	1000	216	900	380	500	182	700	184
Coliorm (MPN)	2400	460	2400	460	75	9	2400	460
BOD (Mg/L)	1.9	0.0	2.5	0.0	1.5	0.0	2.5	0.2

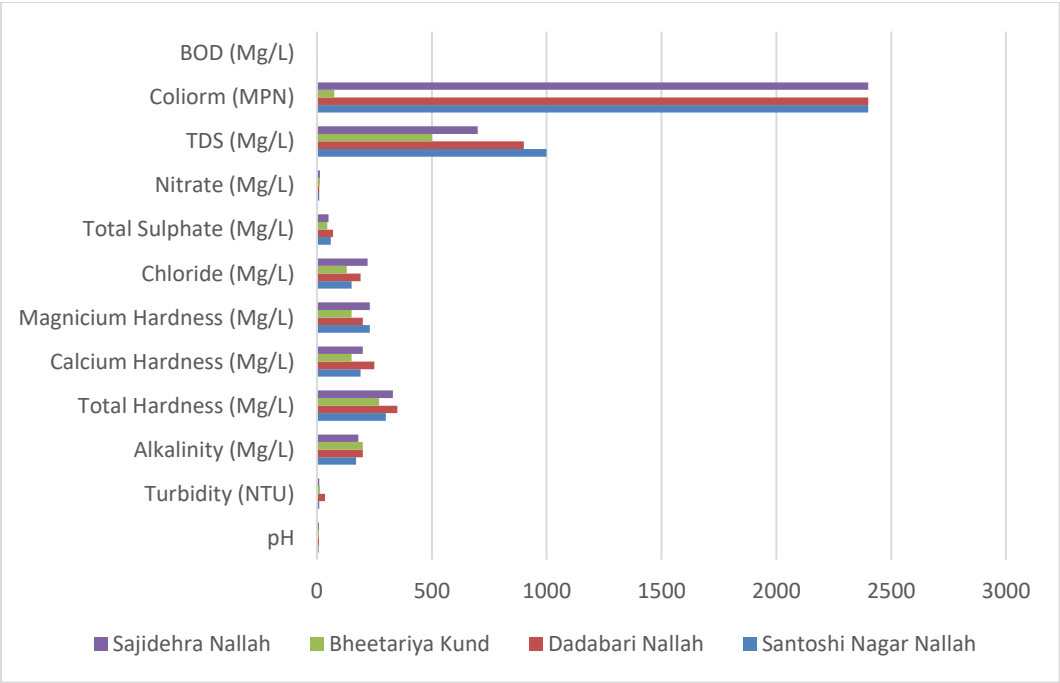

Fig. 1: Maximum Values of Physico-Chemical Parameters

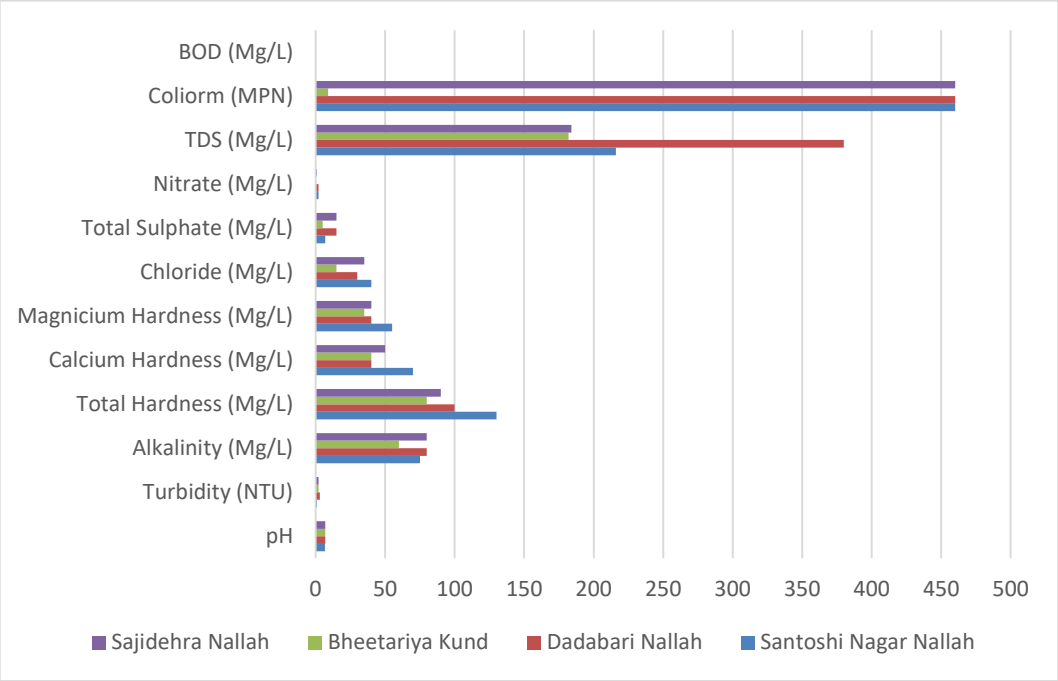

Fig. 2: Minimum Values of Physico-Chemical Parameters

CONCLUSION

The quality of water is concerned according to classification of irrigation, water quality, pH value between 7.4 - 8.6 is said to be safe. According to W.H.O. the highest desirable limit of pH is 7.0-8.5 permissible limit is 6.8 8.2. Therefore water collected from all sites is safe all plants species can be grown. Higher range of pH indicates higher productivity of water (Rafeeq et al, 2002).

Higher alkalinity cause many problems like cloudy water, second scale formation on the pool, walls, floor, plumbing and equipment.

The values of hardness at all sites proves that the water is very hard. Due to hardness of water many major problems create that when it is heated in a kettle washing machine or hot water pipes.

Raina (1984) reported that chloride concentration above 60 p.p.m. indicates heavy pollution, The chloride concentration at all sites indicates heavy pollution.

The values of sulphate at all sites indicate the water is polluted. Sulphate gives a bitter or medicinal taste to water if it exceeds a concentration of 250 mg. /1. high sulphide level may also be corrosive or plumbing.

The value of nitrate at all sites indicates that the water is more eutrophic and the growth of *Nymphaea alva*, *Nelumbo nucifera*, *Ceratophyllum demersun*, *Ipomoea aquatica* indicates that the water is highly polluted (Saxena, et al, 2008).

The M.P.N. value of water at all sites is very high. Analytical microbiological and parametric variation reflected various condition specifying the water related disease in the study area. Analytical consideration above also point out the suffering of population due to pollution of water in drinking water sources creating the risk of water related disease in the area.

Decomposition of sewage and other waste is largely an aerobic process, accumulation of these in water increases it's oxygen requirement (B.O.D.). The oxygen level is depleted. The no. of microbes as Escherichia Coli also increases and they also consume most of the oxygen.

It is concluded that the "Dadabari Nalah" is very much polluted due to different types of anthropogenic activities and on the contrary "Bheetariya Kund Nalah" is comparatively less polluted as there were no such activities seen. But it is suggested that

water entering into the river must be checked properly so that it should not pollute the whole system.

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