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Physico-Chemical Study of Ramganga River at Moradabad

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***Abstract*: In the present investigation physico-chemical parameters of Ramganga river at Moradabad, India were analyzed for a period of one year from Sep 2013 to Aug 2014. About 12 parameters were taken in consideration for analysis of river water quality viz. temp., pH, turbidity, transparency, total solids, total dissolved solids, total suspended solids, velocity, total hardness, chlorides, D.O., B.O.D at three selected sites.**

***Keywords*: Physico-chemical, Ramganga river, Moradabad**

1. Introduction

Our earth is also known as the water planet because it is present only on earth. Thus water is the characteristic feature of our Earth. The fresh water is a limited and finite resource (Bouwer, 2000). This water is available first in the form of surface water through rivers and Lakes. Thus the journey of water on our planet starts in the form of surface runoff. This surface water forms the lifeline of almost all the human activities as also most of nature's activities. It is the surface water which percolates down and recharges the life of living organism's dependent on water and becomes part of Ground Water. Therefore, contamination of surface water has a cascading effect and has far reaching implications throughout the reach of the river, Ground water aquifers, flora and fauna, and human activities. Fresh water is available only about 3% of the total water present on the earth (Pani, 1986). Although the surface of our planet is nearly 71% water, only 3% of it is fresh. Out of this 3% fresh water about 75% is tied up in glaciers and ponds suitable for human consumption (Dugan, 1972). The Indian subcontinent is rich in its water resources (Rao, 1975) as there are 14 major rivers in India. According to the National Environmental Engineering Research Institute, Nagpur, India, about 70 % of the available water in India is polluted (Pani, 1986). The water bodies are heavily affected by the Polluted discharge of Paper and Sugar mills. A number of workers such as Beg et al. (2001), Dandge (2001), and Hopetti et al. (1995), have done a considerable amount of work to study about the change in water quality and quality of Rivers.

Ramganga River is a tributary of very important and Holy River Ganga. Moradabad is first major city in the way of flow of Ramganga River. The Ramganga River has a total drainage area of 500km^2. A dam for irrigation and power generation purpose is made on this river at Kalagarh, Uttrakhand. It is being experienced that Ramganga River losing its water quality due to urbanization and industrialization therefore it is necessary to know the present status of Ramganga water quality within Moradabad City. The city is full of brass, steel & glass cottage industries. A paper industry, some electroplating plants and other small-scale industries situated in Moradabad. All these industries are in unorganized sector and thus have unplanned growth leaving to high degree of air, water and soil pollution. The most of the industries are dumping their waists in two major rivers of the city Ramganga River and Gagan River. The effluent containing heavy metals is largely the waste by product of industrial processes. In the present study an attempt has made to find the current status of Ramganga river and impact of urbanization and industrialization upon its water quality.

2. Study area

Moradabad is a city is situated at the bank of River Ramganga in Uttar Pradesh state of India.

Its altitude from sea level is about 670 feet and is at 28^{o}20', 29^{o}15'N and 78^{o}4',79^{o}E. Three sampling stations were selected i.e. M.D.A. Colony (S-I), Manokamna mandir (S-II) and Kamri village (S-III). These sites were placed from where the reach Upto River was very easy.

3. Materials and methods

As per the norms of the APHA, wide mouthed plastic bottles of one liter size was used for collecting the samples and preserved till the parameters were analyzed in laboratory. All the parameters were estimated by the standard methods of APHA (1995) and Trivedi & Goel (1986), Khanna and Bhutiani (2005).

Parameters Studied:

Water quality parameter: The study was carried out by systematic collection of water samples from three spots namely Site-I, Site-II and Site-III.

Physical Parameters

1. Temperature (^{o}C).
2. Velocity (m/sec).
3. Total Solids (T.S.) mg/l.
4. Total Dissolved Solids (T.D.S.) mg/l.
5. Total Suspended Solids (T.S.S.) mg/l.
6. Turbidity (NTU).

7. Transparency (cm).

A. Chemical parameters

1. P^H.
2. Dissolved Oxygen (DO) mg/l
3. Biological Oxygen Demand (BOD) mg/l.
4. Total Hardness (mg/l).
5. Chlorides (mg/l).

4. Result and discussion

The present investigation was carried out for a period of one year from September 2013 to August 2014 at three sampling sites namely, Site-I, Site-II and Site-III. A total of 12 physico-chemical parameters were monitored. Findings of water quality assessment are represented in table1-table-3 and described below.

As our observations the values obtained for temperature showed some noticeable variation in the mean value for each sampling sites and during the different months. The minimum value of temperature was recorded at site-I as compared to other sites. The rising values of temperature at site –II and III is mainly due to the entry of sewage and industrial effluents. Temperature exerts a strong influence on many physic-chemical parameters of water including the solubility of oxygen and other gases, chemical reaction rates and toxicity, and microbial activity (Dallas and Day, 2004).

High velocity of Ramganga River was observed during the month of September and August in all three study site. It is mainly due to high flood in the hilly area of Uttarakhand. Velocity is also responsible for soil erosion in the riparian area of the Ramganga River. Similar observations were also found by Bhadula and Joshi (2011). During the course of study it was observed that minimum mean value of velocity was 0.35 m/s at site-II and maximum 0.69 m/s August at Site-III was 0.46 m/s.

The total solids are a measurement of dissolved and suspended impurities of water. In present study highest values of total solids was observed as 1298.82 mg/l and 1147.95 mg/l during the months of August at site-I M.D.A. Colony and Site-II Manokamna Mandir, respectively. These variations in Total solids mainly due to high rain fall in hilly region which ultimately leads in to soil erosion and adding of domestic sewage and industrial effluent in the river.

Total dissolves solids (TDS) are naturally present in water or are the result of mining or some industrial treatment of water. In the present study the overall lowest and highest mean value of total dissolved solids were observed 155.9 mg/l and 1599.6 mg/l in the month of January and August at the Site-III and Site-I, respectively. Lowest and highest values of total suspended solids were observed as 103.5 mg/l and 968.5 mg/l at Site-1 M.D.A.Colony, Moradabad, (U.P), during the months of November and March, respectively. Similar results were observed by Rani and Kumar (2014).

Lowest and highest range values of turbidity for the year of study i.e. 2013-14 were observed as 6.0NTU and 165.00 NTU at Site-II i.e. Manokamna Mata Mandir and Site-1 i.e. M.D.A. Colony, Moradabad (U.P), during the months of January and September, respectively. Similar results was also found by Verma (2013) who has studied on physico-chemical characteristics and biological factor of Ramganga River and find out that high turbidity (92.2 NTU) during the monsoon period and minimum value of turbidity was during the winter months which supports our observations and drifts on turbidity in Himalayan rivers.

During study period, the overall lowest and highest mean values of transparency was observed as 0.5 cm and 46.5 cm at Site-II i.e. Manokamna Mandir, Moradabad, (U.P), during the months of August and January, respectively. In Present study 7.0 was lowest mean value of pH at Site-II i.e. Manokamna Mandir, Moradabad (U.P) and 8.4 at Site-III i.e. Kamri village during the months of January and June, respectively. Transparency shows negative correlation with turbidity. (Graph A, C and F).

Higher DO suggesting the abundant growth of phytoplankton (De et al., 1991) and related to plankton leading to higher biological activity in winter season. The overall lowest and highest mean values of dissolved oxygen were observed as 1.5 mg/l and 6.9 mg/l at Site-II and Site-III during the months of June and January, respectively. Similar results were observed by Singh et al. (1989b) for all the water samples of river Ganga ranged from 7.1 to 8.7 mg/l they illustrated that dissolved oxygen has low values due to anthropogenic activities in the river ecosystem. DO shows negative correlation with temp at all selected sampling sites (graph B, D and E respectively)

The overall lowest and highest mean values of bio-chemical oxygen demand were observed as 2.0 mg/l and 12.8 mg/l at Site-III and Site-II during the months of January and June, respectively. Similarly, Saxena et.al., (2008) showed similar results and described that BOD was certainly rise in the River water due to various anthropogenic activities in which BOD was 3.24 mg/l during the month of June.

In present study the overall lowest and highest mean values of total hardness was observed as 82.7mg/l and 130 mg/l at Site-III and Site-2, during the months of June and February, respectively. The biannual average of total hardness was computed 99.42 mg/l. During investigation, the overall lowest and highest mean values of chlorides were observed as 22.0 mg/l and 58.1 mg/l at Site-I and Site-II during the months of May and September, respectively. During this study the maximum values of chloride was recorded in monsoon season; it is mainly due to the seasonal impacts and other anthropogenic activities mainly due to human discharge. Similar results were found by the Semwal and Akolkar (2006) in which chlorides were 126.12% higher in the polluted site in comparison to non-polluted site.

Table 1
Physical Parameters of Ramganga River water at Site-II M.D.A. Colony, Moradabad) during 2013-14

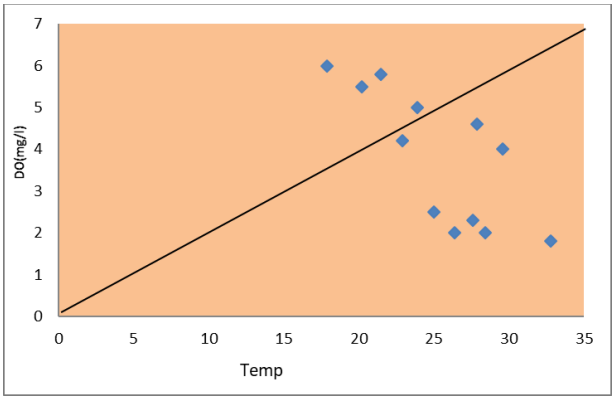
	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	March	Apr.	May	June	July	Aug
Temp. (^{0}C)	26.4	25.0	22.9	20.2	17.9	21.5	23.9	27.9	29.6	32.8	28.4	27.6
Vel. (m/s)	0.44	0.35	0.30	0.28	0.22	0.20	0.27	0.35	0.47	0.49	0.68	0.59
TS (mg/l)	1787.8	1738.6	1678.6	1265.7	898.2	952.9	1223.8	1263.2	862.7	809.1	1697.2	1852.2
TDS (mg/l)	1474.3	1587.3	1309.7	539.1	228.3	405.3	255.3	373.8	663.1	705.8	1420.8	1599.6
TSS (mg/l)	313.5	151.3	368.9	726.6	669.9	547.6	968.5	889.4	199.6	103.3	276.4	252.6
Turb.(NTU)	165.0	106.0	22.0	8.0	7.0	16.0	29.0	39.0	46.0	62.0	83.0	153.0
Trans.(cm)	12.7	34.2	42.6	44.2	47.1	38.4	30.3	15.2	7.8	4.6	1.4	1.1
pH	7.3	7.2	7.5	7.8	8.3	8.2	7.9	7.6	7.7	7.2	7.1	7.3
DO (mg/l)	2.0	2.5	4.2	5.5	6.0	5.8	5.0	4.6	4.0	1.8	2.0	2.3
BOD (mg/l)	4.64	3.86	2.92	2.57	2.80	3.80	4.28	7.39	7.89	10.50	9.20	6.30
T.H (mg/l)	96.0	103.0	109.0	121.0	126.0	130.0	121.0	112.0	101.0	100.0	91.0	88.0
Chl. (mg/l)	58.1	49.6	48.8	45.1	39.5	37.1	35.0	38.0	22.0	41.5	42.9	50.0

Table 2
Physical Parameters of Ramganga River water at Site-II (ManokamnaMandir, Moradabad) during 2013-14

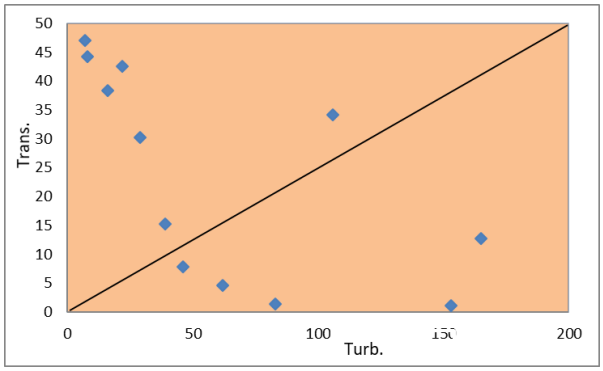
	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	March	Apr.	May	June	July	Aug
Temp.(^{0}C)	26.1	27.2	27.1	23.0	21.2	24.5	28.2	28.6	30	33.2	28.5	27.2
Vel. (m/s)	0.65	0.24	0.28	0.25	0.20	0.14	0.27	0.32	0.36	0.47	0.59	0.53
TS (mg/l)	1590.7	1509.6	1445.4	1134.8	765.9	948.1	1036.8	1144.3	717.1	762.6	1378.2	1651.9
TDS(mg/l)	1309.3	1215.8	1060.3	390.9	178.5	347.9	227.3	284.8	558.7	636.9	1056.4	1224.3
TSS(mg/l)	281.4	293.8	385.1	744.1	226.1	600.2	809.5	859.5	158.4	125.7	321.8	427.6
Turb.(NTU)	153.0	107.0	24.0	10.0	6.0	14.0	30.0	41.0	46.0	70.0	85.0	160.0
Trans. (cm)	12.90	33.10	43.8	45.5	49.8	35.4	22.2	14.9	7.8	2.8	1.7	0.5
pH	7.1	7.3	7.4	7.6	7.8	7.7	7.5	7.3	7.1	7.0	7.3	7.3
DO (mg/l)	2.2	2.4	4.0	5.1	6.2	5.8	5.2	4.7	4.3	1.5	2.3	2.5
BOD (mg/l)	4.5	3.7	3.0	2.8	2.9	3.6	3.8	7.5	7.9	12.8	11.5	9.3
T.H (mg/l)	92.6	98.8	99.3	110.6	115.4	102.3	100.7	98.3	94.8	84.2	87.8	89.8
Cl(mg/l)	50.52	41.57	46.20	34.89	32.52	33.80	35.70	37.10	39.34	39.90	40.13	41.98

Table 3
Physical Parameters of Ramganga River water at Site-III (Kamri Village, Moradabad) during 2013-14

	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	March	Apr.	May	June	July	Aug
Temp.(^{0}C)	25.9	24.1	23.5	21.3	21.0	24.2	28.4	27.5	29.0	30.6	28.7	27.5
Vel. (m/s)	0.95	0.35	0.39	0.28	0.22	0.27	0.24	0.29	0.37	0.49	0.75	0.86
TS (mg/l)	1518.5	1407.3	1298.6	1021.9	670.2	824.9	956.7	1014.7	657.8	558.6	1208.3	1521.2
TDS(mg/l)	1225.7	1101.9	910.3	490.1	195.7	248.7	155.9	233.7	461.6	389.9	905.9	1164.8
TSS(mg/l)	292.8	305.4	388.3	531.8	474.5	576.2	800.8	781.0	196.2	168.7	302.4	356.4
Turb.(NTU)	138.0	108.0	22.0	10.0	6.0	11.0	30.0	41.0	40.0	77.0	89.0	151.0
Trans. (cm)	5.80	30.30	40.0	44.2	46.5	24.1	20.4	14.1	10.8	4.2	3.7	1.9
pH	7.5	7.7	7.8	8.0	8.4	8.3	7.8	7.6	7.3	7.0	7.3	7.3
DO (mg/l)	3.0	3.5	4.8	6.4	6.9	6.6	6.2	5.0	4.4	3.2	3.6	3.4
BOD (mg/l)	3.4	2.9	2.6	2.3	2.0	2.8	3.7	4.8	5.7	7.4	5.7	4.9
T.H (mg/l)	87.6	89.9	91.5	99.3	101.3	120.1	107.3	100.2	96.1	82.7	85.1	85.9
Cl. (mg/l)	47.60	40.3	40.1	31.8	28.7	29.8	34.51	36.39	30.96	35.18	38.57	40.93

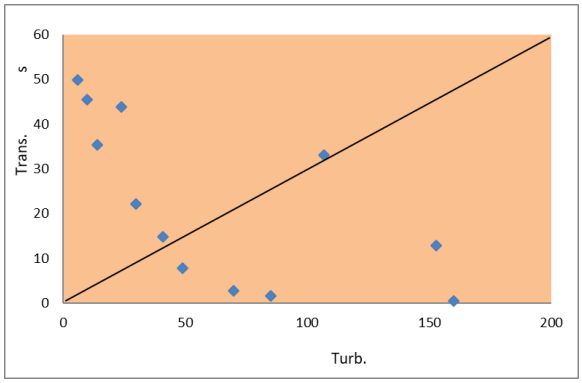


(a)

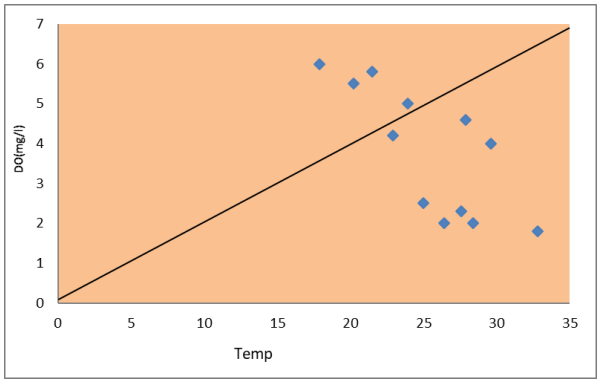


(b)

Fig. 1. Graphs (a) & (b) Showing Negative correlation between Temperature vs. Dissolved Oxygen and Turbidity vs. Transparency, respectively at Site-I.

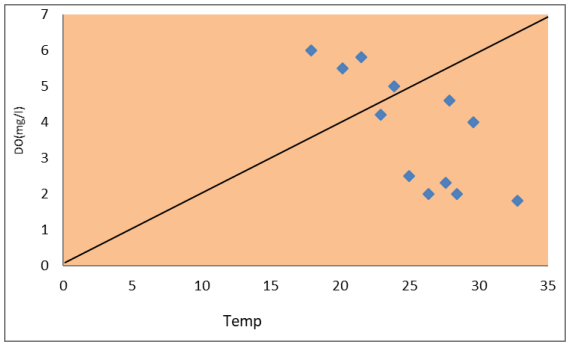


(c)

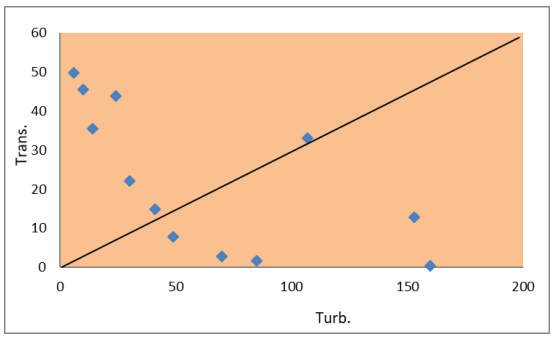


(d)

Fig. 2. Graphs (c) & (d) Showing Negative correlation between Turbidity vs. Transparency and Temperature vs. Dissolved Oxygen, respectively at Site-II

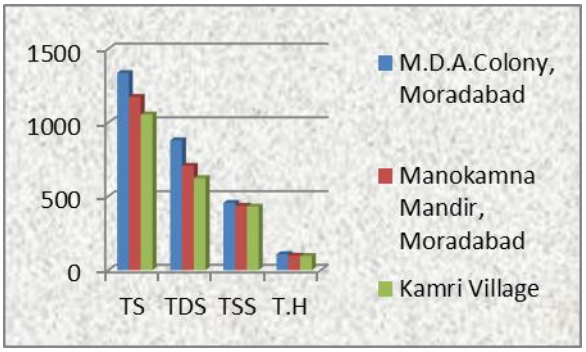


(e)

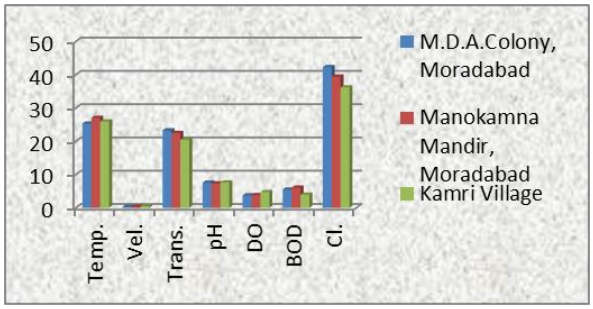


(f)

Fig. 3. Graphs (e) & (f) Showing Negative correlation between Temperature vs. Dissolved Oxygen and Turbidity vs. Transparency, respectively at Site-III



(g)



(h)

Fig. 4. Comparative graphs (g) & (h) of Annual Mean Values of Physico-chemical parameters in three selected sites at River Ramganga

5. Conclusion

The results and discussion of this study is clearly depicted that Ramganga river ecosystem is not good for drinking purpose and also for fisheries particularly at Moradabad. However, environmental variables show diversity at specific points and sampling stations. Some anthropogenic activities such as industrial effluents, domestic sewage, dumping of solid waste, illegal fishing, indigenous methods of fishing, lake of awareness are major threats for the biological diversity degradation. It was also observed that there is a need of proper attention and Government should protect this river which is socio-economically very important for this area.

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