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Status of Physico-Chemical Characteristics of River Ram Ganga at Bareilly, U.P. India

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ABSTRACT: The present study was carried out to assess the water quality of river Rāmgangā at Bareilly. The water quality of river is not as per norms and the main reason behind this is poor sewage, domestic waste and industrial effluent drainage system in the city Bareilly. In the present investigation water quality monitoring of river Ganga at Bareilly was studied during the period January 2019 to December 2019. The present study based on analysis of some physicochemical parameters from the river Ramganga. Parameters studied were Temperature, pH, free CO_2, DO, BOD, TDS, Acidity, Alkalinity, Hardness, Calcium, Chlorides and Conductivity. Statistical analysis of the analytical data was computed in the table 1. The temperature was 17.50°C to 22.00°C, pH of river water ranges from 7.10 to 7.60, Total dissolved solids were ranged from 115.20 mg/l to 256 mg/l, Free CO_2 ranging between 1.50 mg/l to 3.00 mg/l , Hardness of water was 84.00 to 125.00 mg/l, Alkalinity was 110 mg/l to 163 mg/l, organic pollution is mild as indicated by DO ranged from 8.16 mg/l to 10.25 mg/l and BOD was 1.00 mg/l to 3.50 mg/l.

Keywords: Physicochemical parameter**,** River Ganga, Water quality

INTRODUCTION

Water is one of the most vital natural resources. Compared with other resources, water is generally very utilizable resource. Hence we can say that Water is one of the most important components for survival of any kind of living organism. It covers nearly three fourth of the surface of the earth. Fresh water is the most precious resource on earth. Today, the easy availability of fresh water is a major problem as 80% rivers are getting polluted (Sharma and Walia, 2016).

There are many rivers in our India. But Ganga is one of the holiest river of India. The River Ganges, largest river of the Indian sub-continent with a total length of about 2525 km, originates from ice-cave '*Gaumukh*' (30°55′ N / 70°7′ E) in the Garhwal Himalaya at an altitude of 4100 m and discharges into Bay of Bengal. Ramganga river water is an important source of irrigation in major parts of the Bareilly region. Rapid industrialization, urbanization, and other developmental activities pollute rivers, which are important in the nation's development and sustenance of life. The Ramganga river receives most of the drainage from the Kumaun mountains. Ramganga west river emerges from Dudhatoli range in Pauri Garhwal district of uttarakhand. The length of Ramganga river is 155 km and catchment area of the basin is 30,641 km square. This river flows to the southwest from Kumaun Himalayas. Ramganga is a tributary of Ganga, which originates from the high altitude zone of 800m to 900m (Singh and Gaur, 2017). The water of river Ganga is pure due to presence of some micro-organism as a decade ago. Due to its religious importance million of people in India take holy dips in river Ganga especially on some auspicious occasions because it is believed that a holy dip in the same purges away all the sins. Day by day human's activities have polluted the river Ganga water. Due to unproportional growth of population and industries, water quality of river Ganga is degrading at a faster rate day by day therefore, regular monitoring of river Ganga is essential. With this aim, various studied have been conducted in the past on fresh waters related to various aspects. In the present investigation physicochemical parameter of river Ganga at Bareilly was done (Javed *et al*, 2020).

MATERIALS AND METHODS

Bareilly is one of the most famous cities of India well known as jhumka city and bans bareilly. It lies in the foothills of aravali range. The position of city on the globe is on latitude 29º58′N and longitude 78º 13′ E. Water samples were taken from different location of Ramganga river in Bareilly district. Monthly sampling was done from January-2019 to December 2019. Samples were collected between 7.00 a.m. to 9.00 a.m. in borosil glass bottles of 300 ml capacity and plastic containers from each sampling sites. The analysis of all the parameter was done according to the methods of APHA (1998), Khanna & Bhutiani (2004).

RESULTS & DISCUSSION

The monitoring of the river water is an essential step to mark the trend pattern of pollutants and their effect on living systems in today's developing life. On the basis of analysis average value of various physic-chemical parameters are given in table 1 of different location at Ramganga River. The results of physicochemical analysis are presented in Table 1 and correlation coefficients among the different parameters are presented in the Table 2.

Temperature: Temperature is an important parameter, which is directly related with the chemical reaction in water and biochemical reactions in the living organisms. During the present investigation the maximum temperature (22.00±0.26) was recorded in May while minimum temperature (17.50± 0.28) in December. Similar results regarding to temperature was also observed by Yadav and Kumar (2011); Sharma and Walia (2016) in the river Kosi at Rampur district.

pH: pH is one of the important tool to measure acidity or alkalinity in water. Aquatic organisms are sensitive for pH change due to any change in the pH cause change in the structure of aquatic system. In this study, pH observed maximum (7.60±0.03) in the month of July and minimum (7.10±0.28) in the month of February. This is due to dilution effect as suggested by several authors (Matta *et al*. 2017; Singh *et al*. 2016). Similar observation was also observed by Khanna *et al* (2007) in river Ganga.

Free CO_2: Free CO_2 comes in water due to activity of aquatic organism. In the present investigation the value of free CO_2 vary from (1.50±0.04) minimum in the month of January to (3.00±0.02) maximum value in the month of July. This is similar findings of Khanna and Bhutiani (2005) in river Ganga and in Nambol River, Manipur by Suma and Rajeshwari (2013).

Acidity: Acidity of water is quantitative capacity to react with a strong base to a designated pH. In the present study the concentration of acidity was found to be fluctuating between (13.00±0.40 to 6.87±0.04). This maximum (13.00±0.40) and minimum (6.87±0.04) concentration of Acidity was observed in the month of August and January respectively. A more or less similar trend has been observed by Rai *et al* (2010) in river Ganga at Varanasi.

Alkalinity: Alkalinity is due to presence of Carbonate and Bicarbonate ions. Alkalinity of water found to be maximum (163.00±0.39) in the month of August and minimum (110.00±0.32) in the month of December. Sarkar *et al* (2007); Javed *et al* (2020) observed similar trend for Alkalinity.

Hardness: Hardness indicates the concentration of calcium and magnesium ions. Hardness of water is due to the presence of chloride, Nitrate, sulphate and bicarbonate of calcium and magnesium. (Kumar *et al* 2010) The maximum (125.00±0.46) hardness of water observed in the month of May while minimum (83.00±0.57) in month of September. Mishra (2003) observed hardness in river Ganga at Bareilly and found more or less trend in their study.

Calcium: The concentration of Calcium was found to be maximum (38.48±0.06) in the month of November while minimum (21.78±0.12) in the month of August. Similar findings was observed by Khajuria and Dutta (2009) in the river Tawi, Jammu. Sharma and Walia, 2016 also observed similar results from their study.

Chloride: Chloride concentrations in excess amount can give rise to detectable taste in water, but the threshold depends upon the associated cations (singh *et al*. 2016). In natural water sometimes chloride may be due to leaching of rocks. In the present study the concentration of chloride was found to be fluctuating between (27.20±0.43 to7.18±0.34). This maximum (27.20±0.43) and minimum (7.18±0.34) concentration of chloride was observed in the month of July and December respectively. Similar observation was also observed by Vishnoi *et al* (2008) in river Ganga at Kangri village and at Kerwa Dam in Bhopal City by Gupta *et al*. (2011).

Dissolve oxygen (DO): DO is one of the most important factors, which depends on physical, chemical and biological activities of water body. In the present investigation maximum (10.25±0.02) value of DO was recorded in the month of December while minimum (8.90±0.11) in the month of August. Khanna *et al* (2009) reported the similar trend in river Panv Dhoi. Anushka and Deswal (2011) observed heigher value of DO at Rajghat bathing site in river Ganga.

Conductivity: Conductivity is the measure of the ability of an aqueous solution to carry electric current. Conductivity of Ganga river water fluctuates from (397.20±0.25 to 165.00±0.44). The concentration of Conductivity was found to be maximum (397.20±0.25) in the month of January while minimum (165.00±0.44) in the month of July. Khanna *et al* (2007) also reported the similar trend on Song river at Dehradun.

Table 1: Average value of physiochemical parameter of river Ganga from January to December 2019.

	Temp (˚C)	pH	CO_2 (mg/l)	Acidity (mg/l)	Alkanity (mg/l)	Hardness (mg/l)	Calcium (mg/l)	Chloride (mg/l)	DO (mg/l)	Conductivity (µmhos/cm)	Total Dissolved Solids (mg/l)	BOD (mg/l)
January	18.00 ±0.28	7.20 ±0.17	1.50 ±0.04	6.87 ±0.04	116.00 ±0.51	98.00 ±0.49	36.08 ±0.97	8.20 ±0.40	10.06 ±0.47	397.20 ±0.25	172.00 ±0.46	1.80 ±0.05
February	19.00 ±0.11	7.10 ±0.28	1.89 ±0.05	7.50 ±0.21	120.00 ±0.46	92.00 ±057	32.06 ±0.45	8.90 ±0.05	9.86 ±0.11	287.60 ±0.92	156.00 ±0.28	1.10 ±0.38
March	19.00 ±0.29	7.10 ±0.23	2.36 ±0.03	8.00 ±.40	119.00 ±0.49	84.00 ±0.56	24.04 ±0.50	7.85 ±0.02	9.68 ±0.21	187.20 ±0.40	115.20 ±0.51	1.90 ±0.05
April	21.00 ±0.32	7.30 ±0.04	2.45 ±0.02	8.00 ±0.40	133.00 ±0.34	120.00 ±0.46	28.05 ±0.51	11.50 ±0.19	8.98 ±0.15	387.00 ±0.34	192.00 ±0.11	2.60 ±0.04
May	22.00 ±0.26	7.20 ±0.01	2.40 ±0.04	9.00 ±0.46	148.00 ±0.56	125.00 ±0.46	30.06 ±0.51	17.00 ±0.44	8.16 ±0.36	248.90 ±0.51	256.30 ±0.11	1.40 ±0.05
June	21.50 ±0.28	7.60 ±0.04	2.96 ±0.03	10.00 ±0.40	150.00 ±0.51	96.00 ±0.49	34.48 ±0.27	19.00 ±0.48	8.68 ±0.39	178.00 ±0.55	162.00 ±0.40	3.50 ±0.04
July	21.10 ±0.50	7.60 ±0.03	3.00 ±0.02	10.50 ±0.17	150.50 ±0.28	98.00 ±0.53	36.08 ±0.45	27.20 ±0.43	8.96 ±0.10	165.00 ±0.44	178.00 ±0.48	2.20 ±0.04
August	21.00 ±0.40	7.20 ±0.01	2.90 ±0.03	13.00 ±0.40	163.00 ±0.39	87.00 ±0.01	21.78 ±0.12	23.00 ±0.55	8.90 ±0.11	190.80 ±0.48	147.00 ±0.29	1.20 ±0.43
September	20.50 ±0.26	7.20 ±0.02	2.76 ±0.06	11.00 ±0.51	116.00 ±0.54	83.00 ±0.57	22.09 ±0.49	17.60 ±0.18	9.45 ±0.16	247.60 ±0.32	152.90 ±0.46	1.00 ±0.02
October	20.00 ±0.40	7.10 ±0.00	2.45 ±0.13	8.00 ±0.51	133.00 ±0.49	90.00 ±0.08	33.05 ±0.81	9.80 ±0.05	9.65 ±0.11	186.00 ±0.28	159.50 ±0.57	1.70 ±0.04
November	19.00 ±0.25	7.20 ±0.01	2.10 ±0.05	7.80 ±0.04	128.00 ±0.49	110.00 ±0.51	38.48 ±0.06	8.40 ±0.11	9.99 ±0.06	392.00 ±0.28	186.00 ±0.48	1.44 ±0.02
December	17.50 ±0.28	7.10 ±0.06	1.98 ±0.04	6.90 ±0.04	110.00 ±0.32	89.00 ±0.11	33.38 ±0.11	7.18 ±0.34	10.25 ±0.02	348.00 ±0.55	168.00 ±0.38	1.33 ±0.04
Average	**19.96 ±1.44**	**7.24 ±0.17**	**2.35 ±0.46**	**8.88 ±1.87**	**132 ±17.08**	**97.66 ±13.75**	**30.80 ±5.66**	**13.80 ±6.74**	**9.38 ±0.64**	**267.94 ±91.31**	**170.40 ±33.64**	**1.76 ±0.71**

Table 2: Correlation between physicochemical parameters during January- December 2019.

	Temp	pH	CO_2	Acidity	Alkalinity	Hardness	Calcium	Chloride	DO	Conductivity	TDS	BOD
Temp	1	0.5676	0.7995	0.6814	0.8085	0.3882	-0.2831	0.7623	-0.9529	-0.5349	0.3999	0.3595
pH		1	0.6156	0.4132	0.5733	0.1953	0.3041	0.7073	-0.5424	-0.3294	0.1535	0.7480
CO_2			1	0.8345	0.7127	-0.1060	-0.3768	0.8307	-0.6924	-0.7469	-0.0762	0.3507
Acidity				1	0.7152	-0.2217	-0.5341	0.8732	-0.6038	-0.6218	-0.1102	-0.0055
Alkalinity					1	0.2760	-0.0826	0.7915	-0.8136	-0.5460	0.2822	0.3363
Hardness						1	0.3268	0.0065	-0.4717	0.4250	0.8809	0.2329
Calcium							1	-0.2029	0.2659	0.3364	0.3351	0.2919
Chloride								1	-0.7234	-0.6167	0.1468	0.2024
DO									1	0.4864	-0.4992	-0.3773
Conductivity										1	0.2984	-0.1723
TDS											1	0.0033
BOD												1

Total Dissolved Solid: Total dissolved solids or filterable residue are those solids, which left after evaporation of the filterable sample. TDS indicate the total amount of inorganic chemicals in the solution. In the present study the concentration of Total dissolved solids was found to be fluctuating between (256.30±0.11 to 147.00±0.29). This maximum (256.30±0.11) and minimum (147.00±0.29) concentration of TDS was observed in the month of May and August respectively. Khanna (1993) also observed similar trend for total dissolved solid.

Biochemical Oxygen Demand: The biochemical oxygen demand is the amount of oxygen required to degrade the organic compound biologically. The concentration of BOD increases with the increase in chemical pollution of the water body. In the present investigation maximum (3.50±0.04) value of BOD was recorded in the month of July while minimum (1.00±0.02) in the month of September. The similar conclusion was supported by Khanna and Bhutiani (2005); Meena *et al.* (2016) and Gupta *et al*. (2009).

The correlation coefficients among the different parameters are presented in the Table 2. The analysis shows high degree positive correlation between temperature and alkalinity, temperature and CO_2, temperature and chloride, temperature and acidity, temperature and pH, temperature and hardness, temperature and TDS, temperature and BOD. pH and BOD, pH and chloride, pH and CO_2, pH and alkalinity, pH and acidity, pH and calcium, pH and hardness, pH and TDS. CO_2 and acidity, CO_2 and chloride, CO_2 and alkalinity, CO_2 and BOD. Acidity and chloride, Acidity and alkalinity. Alkalinity and chloride, Alkalinity and BOD, Alkalinity and TDS, Alkalinity and hardness. Hardness and TDS, Hardness and conductivity, Hardness and calcium, Hardness and BOD, Hardness and chloride. Calcium and conductivity, Calcium and TDS, Calcium and DO, Calcium and BOD. Chloride and BOD, Chloride and TDS. DO and conductivity. Conductivity and TDS. TDS and BOD. (Singh and Gaur, 2017).

The analysis shows the high degree negative correlation between temperature and DO, temperature and conductivity, temperature and calcium. pH and DO, pH and conductivity. CO_2 and conductivity, CO_2 and Do, CO_2 and calcium, CO_2 and hardness, CO_2 and TDS. Acidity and conductivity, Acidity and Do, Acidity and calcium, Acidity and hardness, Acidity and TDS, Acidity and BOD. Alkalinity and DO, Alkalinity and conductivity, Alkalinity and calcium. Hardness and DO. Calcium and chloride. Chloride and conductivity. Do and TDS, DO and BOD. Conductivity and BOD.

Figs. 1-12 showing monthly fluctuation in physiochemical parameters of river Ganga.

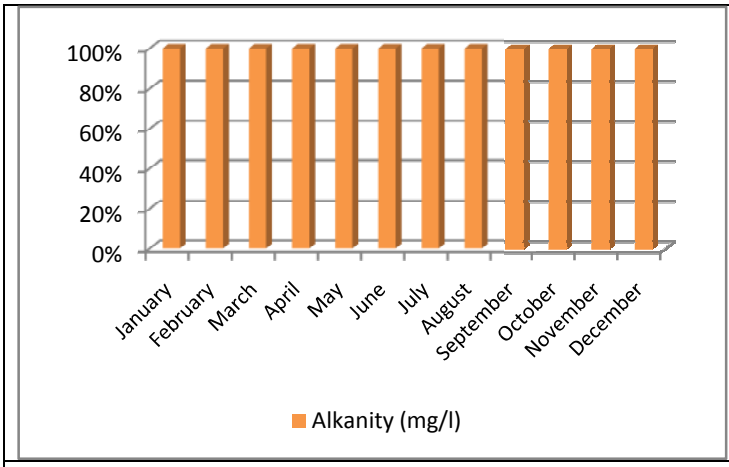


Fig. 1

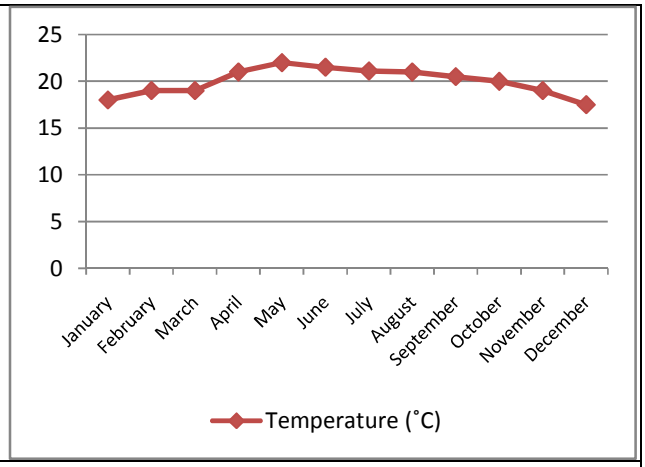


Fig. 2

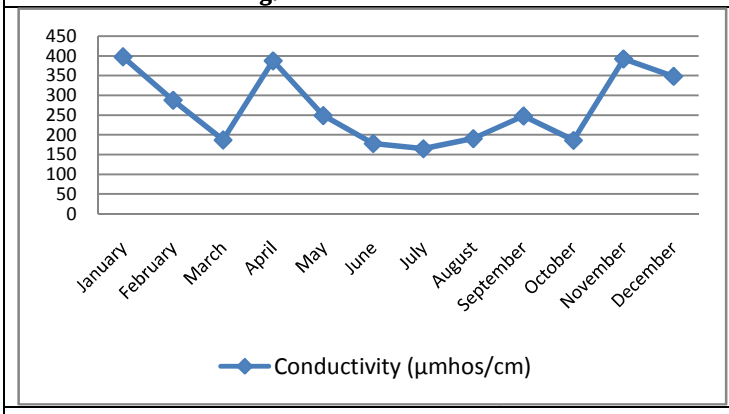
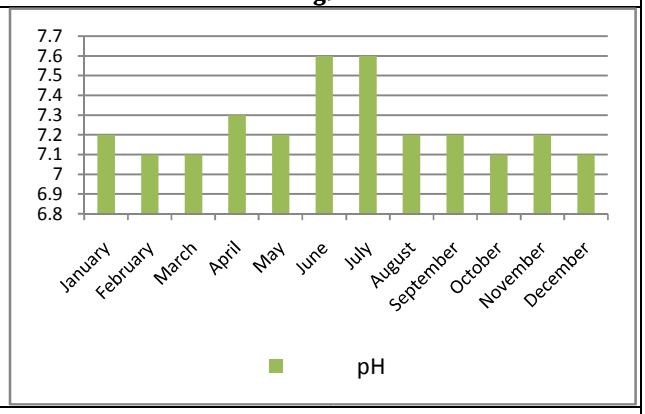


Fig. 3



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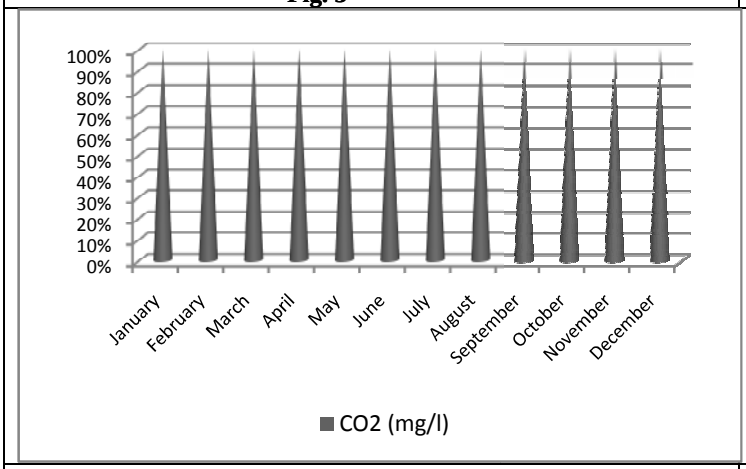

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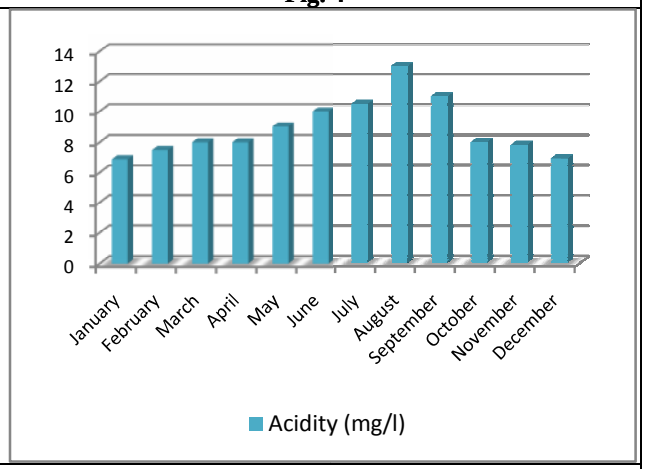

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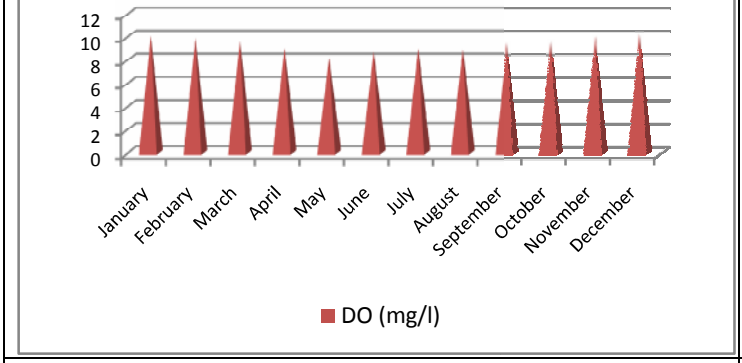

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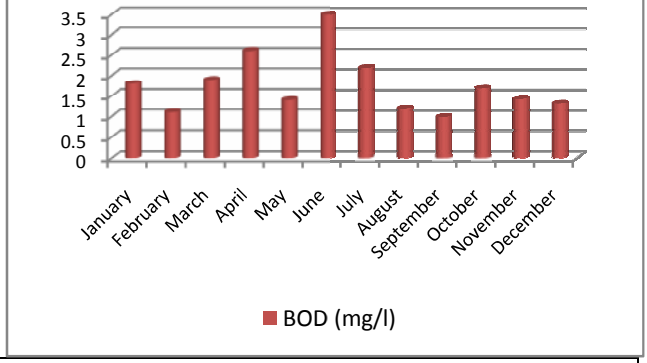

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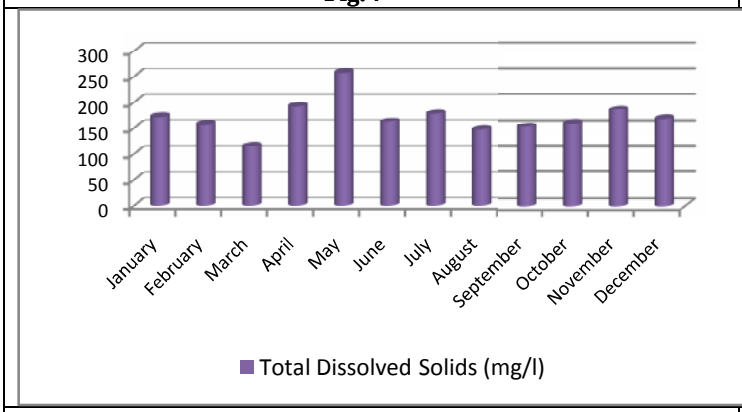

Fig. 9

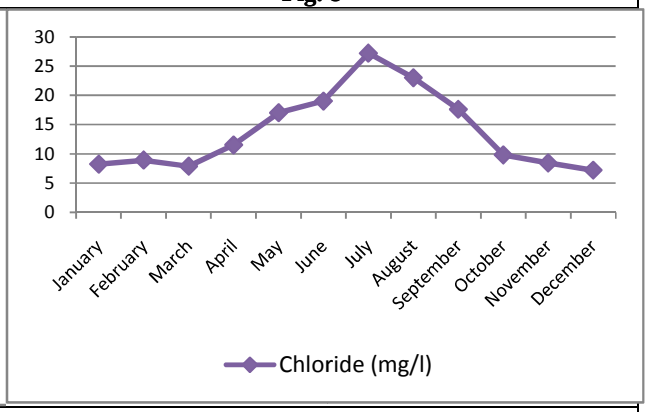

Fig. 10

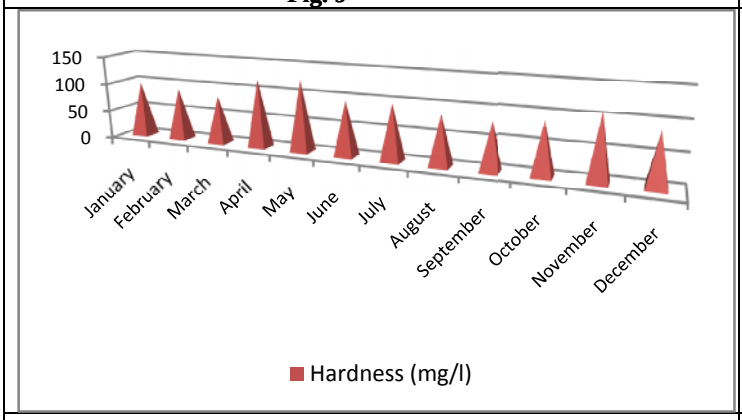

Fig. 11

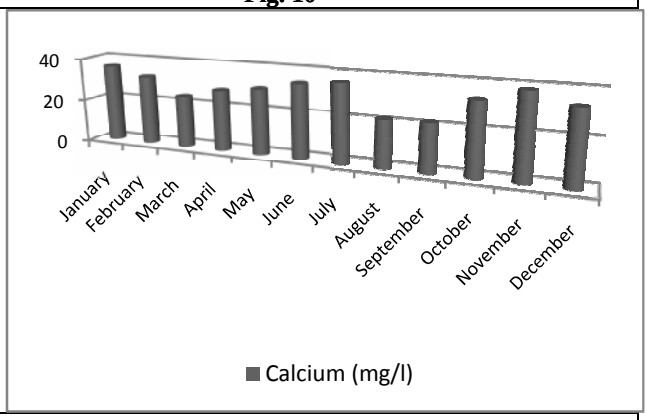

Fig. 12

CONCLUSION

This study provides information about the present condition of river Ramganga. A large number of factors directly or indirectly influence the water quality of the river Ramganga. Based on various parameters studied it was concluded that the water quality of River Ramganga is not good.

REFERENCES

Agarwal, M. and Agarwal, A. (2013). Linear regression and correlation analysis of water quality parameters: A case study of river Kosi at district Rampur, India. *International Journal of Innovative Research and Science, Engineering and Technology*, **2**(12): 7273-7279.

APHA (Standard methods for examination of water and wastewater), (1998). American Public Health Association, AWWA, WPCF, Washington, D.C. (U.S.A.), pp: 1-1193.

Anushka and Deswal, S. (2017). Assessing the Impact of a few Anthropogenic Activities on Water Quality of River Ganga. *International Journal on Emerging Technologies*, **8**(1): 251-255.

Kumar, Bhupander and Gupta, Vikas (2015). Assessment of water quality of Ramganga river in Moradabad district, Uttar Pradesh, india.

International conference of advance research and innovation. ISBN: 978-93-5156-328-0.

Gupta, P., Vishwakarma, M and. Rawtani, P.M. (2009). Assessment of water quality parameters of Kerwa Dam for drinking suitability *International Journal of Theoretical & Applied Sciences*, **1**(2): 53-55.

Gupta, P., Rawtani, P.M. and Vishwakarma, M. (2011). Study and Interpretation of Physico-Chemical Characteristic of Kerwa Dam Water Quality in Bhopal City (India). *International Journal of Theoretical and Applied Science*, **3**(1): 28-34

Javed, N., Prajapati, D.K., Singh, J., Gangwar R.K. and Deval, R. (2020). Assessment of physico-chemical properties of river Ramganga water quality in Moradabad and Bareilly region of Uttar Pradesh, India. *International Journal of Pharmaceutical Science & Research*, **11**(11): 5741-46.

Khajuria, M. and Dutta, S.P.S. (2009). Physico-chemical characteristics of raw water of river Tawi, near Sitlee water treatment plant, Jammu. *Environment Conservation Journal.* **10**(3): 45-52.

Khanna, D.R. and Bhutiani, R., (2004). *Water analysis at a glance*. ASEA Publication, pp: 1-115.

Khanna, D.R., Bhutiani, R., Matta, Gagan., Kumar, Dheeraj., Singh, V., and Ashraf, J. (2009). A study of zooplankton diversity with special reference to their concentration in river Ganga at Bareilly. *Environment Conservation Journal*, **10**(3): 15-20.

Khanna, D.R., (1993). *Ecology and pollution of Ganga river*. Ashish Publication House, New Delhi. pp: 1-241.

Khanna, D.R., Ashraf, J., Chauhan, B., Bhutiani, R., Matta, Gagan and Singh, V. (2009). Water quality analysis of River Panv Dhoi in reference to its physico-chemical parameters and heavy metals. *Environment Conservation Journal*, **10**(1&2): 159-169.

Khanna, D.R., Sarkar, P., Gautam, A., and Bhutaini, R. (2007). Fish scales as indicator of water quality of River Ganga. *Environmental Monitoring and Assessment*, **134**: 153-160.

Khanna, D.R., Singh, V., Bhutiani, R., Kumar, Satish Chandra, Matta, G. and Kumar, D. (2007). A study of Biotic and abiotic factors of Song river at Dehradun, Utttrakhand. *Environment Conservation Journal.*, **8**(3): 117-126.

Kumar, A., Bisht, B. S., Talwar, A., and Chandel, D. (2010). Physicochemical and microbial analysis of Ground water from different regions of Doon valley. *International Journal of Applied and Environmental Science*, **5**(3): 433-440.

Matta, G., Srivastava, S., Pandey, R. R., Saini, K. K. (2017). Assessment of physicochemical characteristics of Ganga Canal water quality in Uttarakhand. *Environment Development and Sustainability*, **19**: 419-431.

Meena R., Gaur, A., and Gupta, S. (2016). Hydrobiology of river ram ganga. *International Journal of Current Research and Review*, **8**(14): 23-32.

Mishra, S., and Joshi, B.D. (2003). Assessment of water quality with few selected parameters of river Ganga at Bareilly. *Himalayan Journal of Environmental Zoology*, **17**(2): 113-122.

Rai, P.K., Mishra, A., and Tripathi, B.D., (2010). Heavy metal and microbial pollution of the river Ganga: A case study of water quality at Varanasi. *Aquatic Ecology, Health and management*, **13**(4): 352-361.

Sarkar, S.K., Saha, M., Takada, H., Bhattacharya, A.K., Mishra, P. and Bhattacharya, B. (2007). Water quality management in the lower stretch of the river Ganges, east coast of India; an approach through environmental education. *Journal of Cleaner Production*, **15**: 1559-1561.

Sharma, V. and Walia, Y.K. (2016). Water quality assessment of Gobind Sagar Lake during rainy season in Himachal Pradesh, India. *Biological Forum-An International Journal*, **8**(1): 559-564.

Singh, P. and Gaur, A. (2017). Physico-Chemical and Biological Characteristics of River Ramganga at Bareilly. *International Journal of Current Research*, **9**(12): 62249-62252.

Singh, P. and Gaur, A. (2018). Physico-Chemical and Biological Characteristics of River Ramganga at Bareilly", *International Journal of Development Research*, **8**(03): 19198-19201.

Singh, S., Ali, A., Upadhyay, K.K. and Wani, K.A. (2016). An Investigation on Physical, Chemical and Bacteriological Quality of Drinking Waters and Health Issues of the Rural Areas in Uttar Pradesh, India. *Biological Forum-An International Journal*, **8**(2): 350-355.

Suma, S and Rajeshwari, R.K. (2013) Assessment of Water Quality and Pollution Status of Nambol River, Manipur, *International Journal of Theoretical & Applied Sciences*, **5**(1): 67-74 .

Vishnoi, U., Kaur, J. and Pathak, S.K., (2008). Water quality of river Ganga in respect of physicochemical characteristics at Kangri Village, District Bareilly. *Environment Conservation Journal*, **9**(1&2): 145-147.

Yadav, S.S., and Kumar, R. (2011). Monitoring water quality of Kosi river in Rampur District, U.P., India. *Applied Science and Research*, **2**(2): 197-201.

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