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Impact of Biological Parameters on Water Quality in Himalayan and Upper Segments of River Yamuna

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ABSTRACT

Clean water is the necessity of every living being. Quality of water is linked to our cultural and economic existence too. We human beings have however neglected this primary and the most essential resource of ours. While there have been a lot of studies on analyzing the water quality of various water sources in relation to physical and chemical parameters, not much of importance is given to the biological parameters. Present work aims to analyze the variation in two of the most common biological parameters: Total Coliform and Thermotolerant (Fecal) Coliform in Himalayan and Upper Segment of Yamuna river.

Key words*: Biological Parameters, Water Quality, Yamuna River, Water Pollution.*

Introduction

'The amount of water on the planet does not change, only its quality'. This quote of Walter Munk, a renowned physical oceanographer, holds true when one sees the quality of water around us. Water is termed as one of the most valuable gifts available to the mankind. It is the most important resource for existence of mankind and also for all activities related to development around the world (Mohtar, 2019). Almost all living beings depend on water for life. Rivers have an important role to play in developing economic, cultural as well as natural characteristics of a country (Rafiq, 2016).

Human beings have developed a lot over the years, thanks to rapid industrialization and improved efficiencies in agriculture. Water has been a main source of this development. The situation now is totally different. Water quality is witnessing constant deterioration. While each one of us is aware of the significance of water and importance of water quality, not many even think once before contaminating it in some or the other way.

60+ million people in India depend on river water for their daily needs (CPCB, 2019). Rivers, which were a main source of fresh water, are reeling under tremendous pressure on water quality. About 70% of river water in India is contaminated and some of it is very poor for human consumption (Ramakrishnaiah, 2009; Jindal and Sharma, 2010). Industrial discharge, domestic waste and untreated sewerage has resulted in high contamination thereby impacting the water quality. This is not only affecting human life but also has a detrimental impact on aquatic life.

We all know that water is a natural resource. The way other natural resources are limited, water too is short. Although 70% of earth is covered with water, only 2.5% of it is clean. Water now appears to be a sparse commodity because of over-misuse (Patil and Tijare, 2001; Singh and Mathur, 2005; Gupta and Shukle, 2006). It is therefore high time that we think of improving the water quality of our main water source, i.e. the Rivers.

Water quality is a measure of water condition basis requirement of a species, human beings or for a purpose (Shah, 2017; Vasistha and Ganguly, 2020a). Water quality measures physical, chemical and biological characteristics of water. This is an extensive research because of the complexities involved in understanding the various sources impacting a parameter. While there are a lot many researches done on physical and chemical parameters to determine water quality, biological parameters are not given due importance. Some researchers give more importance to biological parameters (over physical and chemical parameters) while assessing impact on human health. As mentioned earlier, microbial contamination has the highest impact on human health. Main cause of concern for health authorities in most of developing countries are diseases caused by water (Ali, 2021). An estimate tells that 80% infections and one third deaths in developing nations are caused by polluted water intake (Sudip *et al.*, 2021)

To check if the water is safe for drinking, microbial indicators are measured, the most important being Total Coliform and Thermo tolerant (Fecal) Coliform. Coliform bacteria indicate presence of other pathogens too which in turn is one of the determinant of pollution levels.

Yamuna is polluted in North and highly polluted as it as Delhi (Sharma, 2015). There has been a lot of work on deteriorating water quality of river Yamuna and its impact on both, biodiversity and agriculture. These studies show the worrisome level of pollution because of wastewater, presence of heavy metals and its negative impacts on health of human beings (Malik, 2014; Toxic Link, 2014; Ramchandran, 2016; CPCB, 2019)

Study Area

Study area is river Yamuna spread in three states: Uttarakhand, Himachal Pradesh and Haryana.

Description of 7 sampling sites is given in Table 1 and Figure 1.

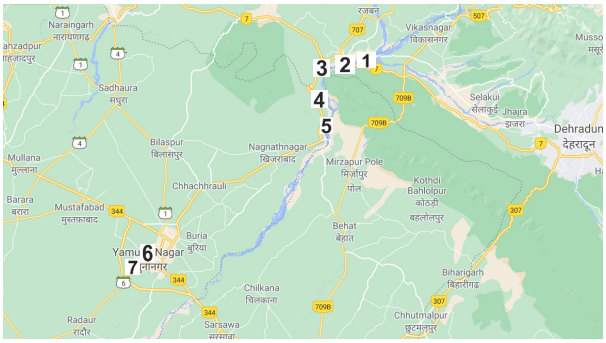

Fig. 1. Map of Study Area

Method and Methodology

Samples were taken from all above-mentioned sites in the Monsoon and Post-Monsoon season (September and December'20 respectively). All samples were taken below 50 cm depth. Pre-Cleaned and Deionized bottles were used to fill the water samples.

Total Coliforms and Thermo tolerant coliforms were analyzed by multiple tube fermentation technique method as described by APHA 23rd addition.

Results and Discussion

The desirable and permissible limits for coliforms (CPCB 2019) are show in below Table 2.

Water quality criteria for various designated best uses (CPCB 2019) is shown below in Table 3.

Table 4 below shows the values of Thermo tolerant (Fecal) Coliform and total Coliform for all 7 sites

Analyzing the Total Coliform levels during monsoon, we see that the count continues steadily increases as water moves from site 1-3. This is because water traverses from less dense populated areas to more populated sites. Site 4, 5 are show a drop in total coliform levels because as water moves outside

Table 1. Sampling Site Details

Site No.	Site Location	State
1	Dhalipur, Chakrata Road, Vikasnagar	Uttarakhand
2	Swarg Dham, Nr Telephone Exchange, Paonta Sahib	H.P
3	Timli Range, Bhuppur, Paonta Sahib	H.P
4	Bahral	H.P
5	Tajewala, Raiyanwala, Yamuna Nagar	Haryana
6	Vishwakarma Mohalla, Yamuna Nagar	Haryana
7	Old Hamida, Yamuna Nagar	Haryana

Table 2.

Coliform Type	Desirable Limit (MPN)/100 ml	Maximum Permissible Limit (MPN/100 ml)
Total Coliform	500	5000
Thermotolerant (Fecal) Coliform	500	2500

Table 3.

Class	Designated Best Use	Total Coliform Criteria
Class A	Drinking water source without conventional treatment but after disinfection	Dissolved Oxygen-6.0 mg/l or more Biochemical Oxygen Demand-2.0 mg/l or less Total Coliform- 50 MPN/100 ml.
Class B	Outdoor bathing	Dissolved Oxygen-5 mg/l or more Biochemical Oxygen Demand-3 mg/l or less. Total Coliform- 500 MPN/100 ml (desirable), 2500 MPN/100 ml (maximum permissible
Class C	Drinking water source with conventional treatment followed by disinfection	Dissolved Oxygen-4 mg/l or more Biochemical Oxygen Demand-3 mg/l or less Total Coliform- 5000 MPN/100 ml.
Class D	Breeding of wildlife and fisheries	Dissolved Oxygen-4 mg/l or more Free Ammonia (as N) 1.2 mg/l or less pH between 6.5 -8.5
Class E	Irrigation, Industrial Cooling	Sodium absorption ratio- 26 max. Boron- 2 mg/l max. Electrical conductivity at 25C micro mhos/cm- 2250 max.
	Below E	Not meeting A, B, C, D and E class

Table 4.

Sample Sites/ Parameters	Monsoon		Post-Monsoon	
	Thermotolerant (Fecal) Coliform (MPN/100 ml)	Total Coliform (MPN/100ml)	Thermotolerant (Fecal) Coliform (MNP/100 ml)	Total Coliform (MPN/100 ml)
Site 1	21	94	17	70
Site 2	26	110	21	84
Site 3	26	120	22	70
Site 4	32	94	22	79
Site 5	22	79	26	110
Site 6	32	280	21	94
Site 7	49	540	33	110

the city limits, it also mixes with smaller water channels. Site 6, 7 are again within the city limits and prone to high level of impurities.

Since post monsoon season witnesses lesser instances of rain water getting mixed in rivers, the count is lower. While total coliform levels at sites 1-4 are close to each other, sites 5-7 show higher total coliform levels. Site 5 is ahead of Hathnikund dam, because of which the water levels during post monsoon is low. Cattles can be seen bathing in this water which is the main reason of increase in total coliform. Sites 6, 7 are within the city limits and are prone to higher impurities, leading to higher total coliform levels.

Conclusion

Through the above readings we infer that water at all 7 sites is not fit for drinking as Total Coliform count is more than 50 MPN/100 ml. It needs to be

conventionally treated to make it worth drinking. Since the readings at all 7 sites (excluding site 7 during monsoon season) is below 500 MPN/100 ml, water there is fit for bathing. Reading at site 7 is also within the permissible limit of 2500 and is OK for bathing.

Total Coliform during monsoon season is high as compared to post monsoon season because of surface impurities that get mixed with water. During monsoon season rainwater from cities, forests also get mixed with river water, thereby increasing the total coliform levels.

References

Ali Khalaf Ahmed Albaggar, 2021 Investigation of some physical, chemical, and bacteriological parameters of water quality in some dams in Albaha region, Saudi Arabia.

CPCB, 2019. Water Quality Criteria https://cpcb.nic.in/water-quality-criteria/

Gupta, G.K. and Shukle, R. 2006. Physico-chemical and Bacteriological Quality in Various Sources of Drinking Water from Auriya District (U.P) Industrial Area. *Pollution Research*. 23(4): 205-209.

Jindal, R. and Sharma, C. 2010. Studies on water quality of Sutlej River around Ludhiana with reference to physicochemical parameters. *Environ. Monit. Assess.* 174: 417–425.

Link, Toxics, 2014. A report on Toxicity Load of Yamuna River in Delhi. http://toxicslink. org/docs/Yamuna-Report-Toxics-Link_12-12-2014.pdf.

Malik, D, Singh, S., Thakur, J., Kishore, R., Kapur, A. and Nijhawan, S. 2014. Microbial Fuel Cell: Harnessing Bioenergy from Yamuna Water. *Int. J. Sci. Res*. 3 (6): 1076-1081

Ministry of Environment and Forests https://cpcb.nic.in/wqm/Primary_Water_Quality_Criteria.pdf of Godchiroli Lake. Pollution Research, 20, Pp 257-259.

Patil, D.B. and Tijare, R.V. 2001. Study on Water Quality of Godchiroli Lake. *Pollution Research.* 20: 257-259.

Rafiq, F. 2016. Urban floods in India. *Int. J. Sci. Eng. Res*. 7: 721–734.

Ramachandran, Smriti Kak. 2016. The Yamuna is poisoned and so are your vegetables. 25, 2016 JULY. Accessed September 4, 2019. https://www.thehindu.com/news/cities/Delhi/ the-yamuna-is-poisoned-and-so-are-your-vegetables/article2891778.ece.

Ramakrishnaiah, C.R., Sadashivaiah, C. and Ranganna, G. 2009. Assessment of water quality Index for the groundwater in Tumkur Taluk, Karnataka State, India. *Electron. J. Chem.* 6 (2): 523–530.

Shah, C. 2017. Which Physical, Chemical and Biological Parameters of Water Determine Its Quality?

Sharma, Keshav, 2015. Pollution study of river Yamuna: The Delhi story. *International Journal of Science and Research.* 6(10): 1718-1622.

Singh, R.P. and Mathur, P. 2005. Investigation of Variation in Physico-Chemical Characteristics of a Fresh Water Reservoir of Ajmer City, Rajasthan. *Indian Journal of Environmental Science.* 9 : 57-61.

Sudip Some, Rittick Mondal, Debasis Mitra, Divya Jain, Devvret Verma and Samanwita Das, 2021. Microbial pollution of water with special reference to coliform bacteria and their nexus with environment.

Vasistha, P. and Ganguly, R. 2020a. Assessment of spatio-temporal variations in lake water body using indexing method. *Environ Sci Pollut Res.* 27: 41856–41875.

Vasistha, P. and Ganguly, R. 2020b. Water quality assessment of natural lakes and its importance: an overview.

Wan Mohtar, W. H. M., Abdul Maulud, K. N., Muhammad, N. S., Sharil, S. and Yaseen, Z. M. 2019. Spatial and temporal risk quotient based river assessment for water resources management. *Environmental Pollution.* 248 : 133–144.