WATER QUALITY ANALYSIS OF YAMUNA RIVER IN FEW SELECTED SITES OF YAMUNANAGAR, HARYANA

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ABSTRACT

Yamuna River is the fifth longest river and is one of the major rivers of north India. The river flows through the states of Uttarakhand, Haryana, Delhi and Uttar Pradesh. It has been exposed to anthropogenic pollution, such as industrialization, deforestation and urbanization for many decades, and has become so polluted that it exceeds the permissible limit. The study was carried out at two different sites (Shiv Temple and Near Old Bridge) of Saraswati Sugar Mill, (Rampura Colony Yamuna Nagar) and other two different sites (Old Bridge Midstream and Below Old Bridge, Kalanaur) of Dheen Bandhu Chhotu Ram Thermal Power Plant, the places covered in Yamuna Nagar, Haryana, dealing with various physico – chemical parameters such as pH, biochemical oxygen demand (BOD), chemical oxygen demand (COD), dissolved oxygen (DO) and microbial population levels by following the standard method. It was found that the pH values of river water were recorded as minimum of 6.7 at Old Bridge Midstream, Kalanaur 1 KM upstream of Dheen Bandhu Chhotu Ram Thermal Power Plant and maximum of 7.6 at Near Old bridge of Saraswati Sugar Mill, Rampura Colony, Yamuna Nagar. All the selected sites show increased values of BOD and COD ranging from 80 to 120 ppm and 180 to 300 ppm respectively, which are above the permissible limits and ensures the presence of wastewater sewage. The purpose of the study is to create general awareness to control further pollution and make water fit for domestic and agricultural use to some extent in the future.

Keywords: River Yamuna, Yamuna Nagar, physico-chemical parameters, pH, DO, BOD, COD.

Abbreviations: *DO: Dissolved Oxygen; COD: Chemical Oxygen Demand; BOD: Biochemical Oxygen Demand; mg L-1: milligrams per Litre; ppm: Parts per million; WHO: World Health Organization, CPCB: Central Pollution Control Board, CFU ml/l: Colony -forming units, Org/l: Organisms per litre.*

INTRODUCTION

The rapid growing population and economic development is leading to a number of environmental issues in India because of the uncontrolled growth of urbanization and industrialization, expansion and massive intensification of agriculture, and the destruction of forests (Khanduri, 2020). Water, the natural resource is the essential component of our life. Nearly 72% of earth's surface is covered with water. Nowadays the supply of fresh water has become a limiting factor because of various reasons. The shortfall of rain, poor water management and abundant use of water for household and agricultural purposes have led to the over-exploitation of surface water sources especially from the river bodies. Many rivers become short lived and even dried up. In recent years, with everyday development of human activities around the Yamuna River the probability of the ecosystem has changed due to domestic waste, sewage, industrial waste, agricultural, and religious activities.

Numerous sources of pollutants can deteriorate the quality of water resources. 70 to 80 % of the river pollution is the result of raw sewage, industrial runoff, and garbage thrown into the Yamuna River every day (**Fig. 1**). Yamuna, the lifeline of several cities like Yamuna Nagar, Karnal, Panipat, Delhi, Agra etc. its water is used for both domestic and agricultural purposes. Therefore, appropriate analysis is required for the effective maintenance of water quality. Physico- chemical, microbiological characteristics are several parameters that may describe the quality of water. Water pollution levels are higher by multiples than the limit prescribed by the

pollution control authorities for irrigation, washing and domestic purposes. Physico – chemical analysis of Yamuna River water at Agra, Uttar Pradesh showed high values of DO, BOD and COD Mishra (2020). The assessment of several water quality parameters to check the suitability of water is crucially very important for making the water suitable for drinking and agricultural purpose. (Ritabrata, 2018; Bhat et al., 2018). Seasonally the average concentration of dissolved oxygen in Yamuna water was found 2.31 to 1.09 mg/l and the BOD concentration was found between 12 to 50 mg/l (Sharma et al., 2017). Even the contaminants present in the Yamuna River water have toxic effect on the embryo (Bhasin et al., 2016). The comparative analysis of the trends in Yamuna River water quality parameters like pH, DO, BOD, COD have been found to reach very high levels due to anthropogenic activities, industrial and commercial activities (Naithani, 2015).

Fig: 1: Water pollution of Yamuna River (Depicting the motto of the study)

The present study deals with analysis of water samples of river Yamuna for various physico – chemical parameters such as pH, biochemical oxygen demand (BOD), chemical oxygen demand (COD), dissolved oxygen (DO) and microbial population levels by following the standard method. The purpose of the study is to create general awareness to control further pollution and make water fit for domestic as well as agricultural use to some extent in the future.
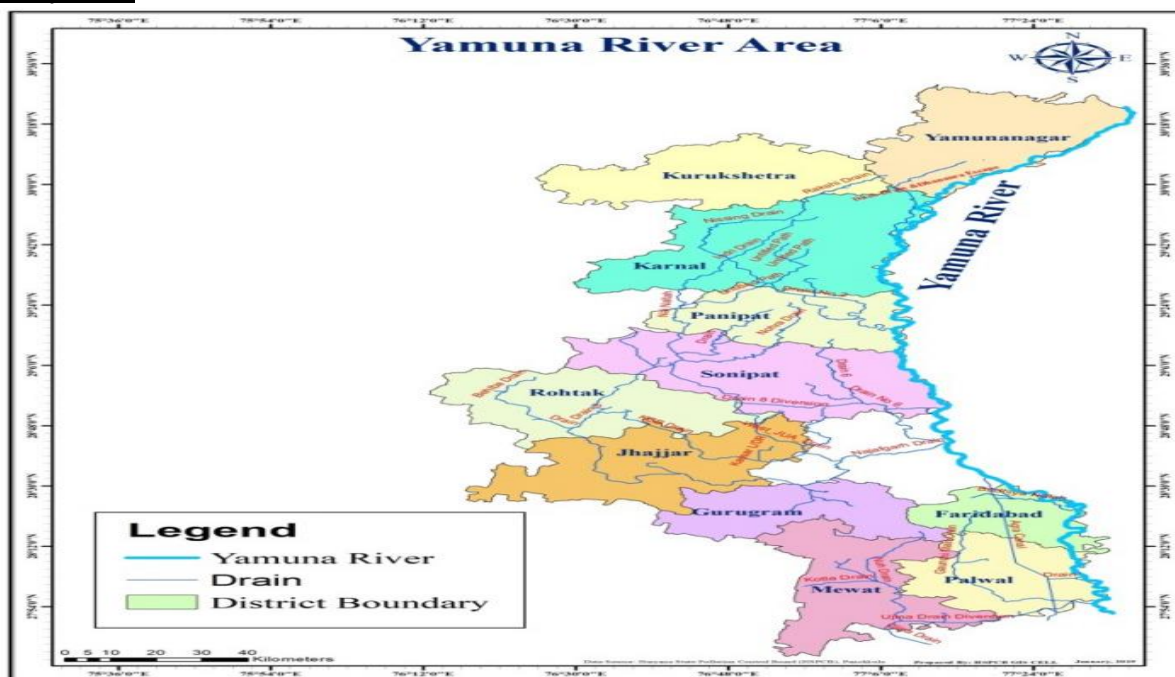
Study Area:

Fig: 2: Showing map of the selected area.

Yamuna River is the fifth longest river and is one of the major rivers of the north India. It is the largest branch of the river Ganga with 1370 km of length. The coverage area of the Yamuna River is 366,223 square km, around 40.2%of Ganga. It originates from Yamunotri which is located in the Himalayas and flows along the borders of Uttar Pradesh and Haryana to the west side. After crossing Mathura and Agra, Yamuna reaches Allahabad and joins Ganga. Yamuna flows through the states of Uttarakhand, Haryana, Delhi and Uttar Pradesh. The famous cities Agra, Mathura and Allahabad are located on the banks of Yamuna.

The study was carried out at two different sites (Shiv Temple and Near Old Bridge) of Saraswati Sugar Mill, (Rampura Colony Yamuna Nagar) and other two different sites (Old Bridge Midstream and Below Old Bridge, Kalanaur) of Dheen Bandhu Chhotu Ram Thermal Power Plant, the places covered in Yamuna Nagar **(Fig. 2).**

MATERIALS AND METHODS

Water samples have been collected from the above sites to carry out the analysis of various physico – chemical and microbial parameters. Samples were collected in the sampling bottles from the northern and southern side of the Saraswati Sugar Mill, (Rampura Colony) Yamuna Nagar, western and midstream of the waste water drain of the Dheen Bandhu Chhotu Ram Thermal Power Plant, (Near Kalanaur Village). The water quality monitoring was done to obtain quantitative information on the physical, chemical and biological characteristics of water via statistical sampling. Physical parameters were detectable by the senses, chemical tests would determine the amount of chemicals that affect water quality and biological tests determining the microbial activity. Testing procedures and parameters were grouped into three categories: For the analysis of physical parameters of water samples, the samples were immediately taken to the laboratory and tested. Chemical parameters like DO, BOD and COD etc. were estimated by using titration. The presence of microbial content was reported based on locomotion of microbes through compound microscope.

Fig: 3: Sample collection from two different sides of Kalanaur (Old Bridge Yamuna Nagar)

Fig: 4: Sample collection from Sugar Mill Colony Near Bridge, Rampura Colony

Fig. 5: Sample collection from Shiv Temple, Rampura Colony (Yamuna Nagar)
(@All photographs are captured by Balvinder Singh from the selected sites).

Different methods have been employed for the physical, chemical and biological analysis of Yamuna River water sample, given in **Table 1** below.

Table No. 1: Different Methods applied for water sample analysis.

S. No.	Parameters	Analytical Method	Instrument/Equipment
1	pH	Electrometer	pH Meter
2	DO	Titration by sodium thiosulphate	Titration
3	BOD	Titration by sodium thiosulphate	Titration
4	COD	Titration by sodium thiosulphate	Titration
5	Microbial Content Bacterial	Membrane filtration colony form	Compound Microscope
6	Microbial Content Protozoa	Study by Locomotion	Compound Microscope

RESULTS AND DISCUSSIONS

The water quality testing of River Yamuna was carried out in the year 2023. The details of sampling locations are presented in **Table 2** and photographs are presented in **Figures 3, 4 and 5.**

Table No. 2: Observed values of water quality of the samples collected from four different sites.

S.No	Location	Sub-Location	Chemical Parameters				Biological parameters	
			pH	DO ppm	BOD ppm	COD ppm	Bacteria CFU ml/l	Protozoa Org./l
1.	Saraswati Sugar Mill, Rampura Colony, Yamuna Nagar	Shiv Temple	7.4	8.5	100	200	2.60	12
		Near Old bridge	7.6	8.0	120	180	3.06	13
2.	Dheen Bandhu Chhotu Ram Thermal Power Plant, Yamuna Nagar	Old Bridge Midstream, Kalanaur 1 KM upstream	6.7	8.0	80	250	1.90	9.0
		Below Old Bridge, Kalanaur	6.9	8.2	95	300	1.90	7.0

Sources: Alkom Synergy Pvt. Limited Secter 63, Block- C, Noida and Khalsa College, Botany Lab, Yamuna Nagar.
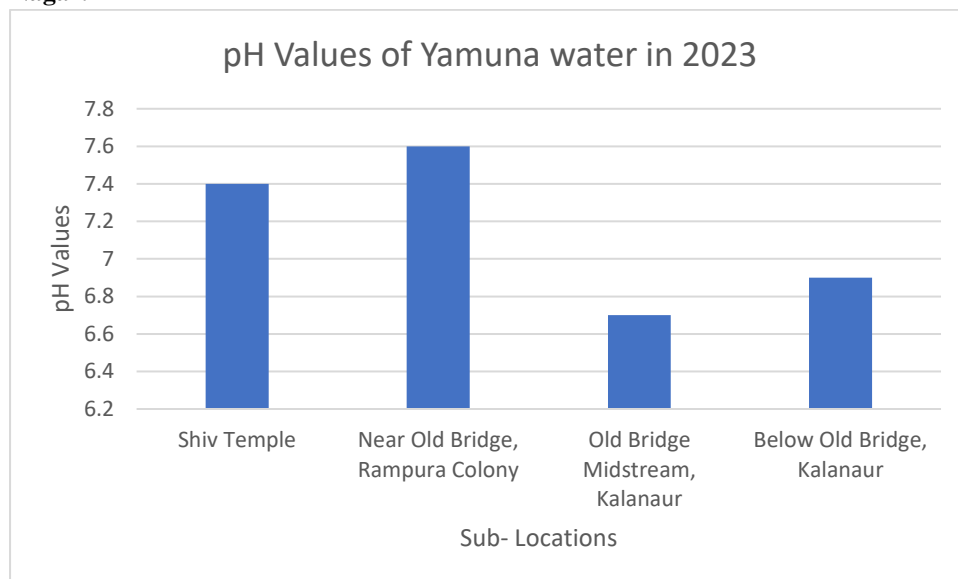

Fig. 6: Graphical representation of pH of Yamuna River water samples.

The pH values of river water were recorded as minimum of 6.7 at Old Bridge Midstream, Kalanaur 1 KM upstream of Dheen Bandhu Chhotu Ram Thermal Power Plant, Yamuna Nagar and maximum of 7.6 at Near Old bridge of Saraswati Sugar Mill, Rampura Colony, Yamuna Nagar. According to CPCB (1999 - 2000), the permissible pH value of drinking water lies between 6.5 to 8.5 and of DO is 6.0. The results show that the pH values of selected sites are within the permissible limits.
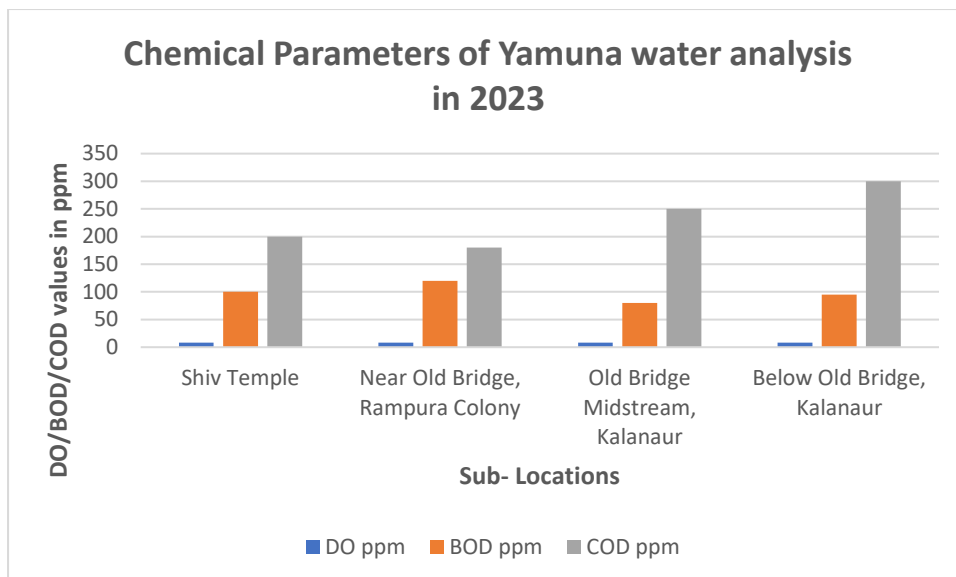
Fig. 7: Graphical representation of DO, BOD and COD of Yamuna River water samples.

According to WHO (2024), for drinking water BOD limit is less than < 5.0 mg/l, at this limit BOD will not cause any harmful impacts on human body while the wastewater sewage must have BOD around 80 ppm and COD 200 ppm. The results reflect that all the selected sites showed increased values of BOD and COD ranging from 80 to 120 ppm and 180 to 300 ppm respectively which shows the presence of untreated sewage waste by the above-mentioned Sugar Mill and Thermal Power Plant which needs to be properly managed. SWM (Solid Waste Management) is an essential service if not efficiently performed by the municipal bodies will result in health problems of sanitation and environmental degradation (Dumka and Khanduri, 2019).

The values of Coliform bacteria varied between 1.9 to 3.06 CFU ml/l and that of protozoa from 7.0 to 13.0 organisms/litre in the selected sites of the study. It was observed that the BOD and COD levels are high and DO levels are low because the oxygen in the water is consumed by the bacteria, thereby making it unfit for domestic, irrigation, or any industrial purpose. Similar results were recorded by Vyas et. al., (2022) while analysing the water quality of Yamuna River and Nallahs situated in the catchment area of the river flowing in Delhi where very high values of BOD and very low values of DO indicate high organic pollution and poor health of the river. Similar findings were reported by Singh et al., (2018) regarding low values of DO of River Yamuna traversing through different locations of Delhi categorising it as dead water quality which might be due to the heavy load of organic pollution from surroundings.

CONCLUSION

Rivers are an indispensable part of our biosphere and are essential for the development of the present civilization. River Yamuna is among holy rivers according to Hindu Mythology, which is becoming polluted day by day with the increase in anthropogenic activities. Despite the above scenario, the people of Yamuna Nagar extensively use the water of river Yamuna for various purposes. The results of the study have revealed the need for planning and implementation of various pollution abatement measures for improvement in the river water quality as per requirement of designated best use (DBU). The water quality map may serve as a useful tool for policy makers, decision makers and environmentalists to suggest and implement appropriate conservation measures to improve the health of the water body.

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