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Analysis of Yamuna Water Quality using Physicochemical Parameter

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Abstract: ***Water is the basic necessity for the functioning of all life forms that exist on earth. It is safe to say that water is the reason behind earth being the only planet to support life. It is vital for the survival of living organisms, major ecosystems as wall as for human health, food production and economic development. It is universal fact that the life first arose in aquatic environment. Even today water is major consideration for technological, industrial, cultural, social-economic development to Hindu Mythodology river Yamuna is considered as one of the most sacred rivers.In this study water quality of river Yamuna was assessed from different points with regular intervals in every month during June 2019 to May 2020. The different physico-chemical parameters like temperature, pH, turbidity, DO, COD, BOD,TDS, total hardness, Cr, Fe, Cd, Pb, Ni, Mn, Zn, and Cu, were analysed from the Yamuna Water sample. During the course of analysis it was observed that there was marked variation in different parameters at different sample collection points. On the bases of this study we conclude that Yamuna river water is highly polluted and its quality is not good for irrigation as well as for aquatic life of organisms.***

Keywords: Physico-Chemical analysis, electrical conductivity, biochemical oxygen demand, total dissolved solids, combined oxygen demand, drainage system, effluents.

1. Introduction

The quality of water is of vital concern for mankind since it is directly linked with human welfare. Water is a vital natural sources for a multiplicity of purpose such as drinking, domestic use, industrial cooling, power generation, agriculture, transportation and waste disposal. Rivers in general are considered tobe one of the most important resource for man. India has a rich river system, but rivers are exploited by every use. The monitoring data of the central pollution board show that most of the Indian river are contaminated by coliform bacteria and can be potential risk for health (Aranzo R.M, 1989) due to fast industrialization, urbanization and other developmental activities most of our rivers have been found to highly polluted. Even presence of heavy metals in water also have great impact on the enzymatic activity of Yamuna river soil (RanjuSharma et.al. 2020). Survey reveals that many river receive millions of litre of sewage, domestic waste, industrial effluents, land and agricultural drainage etc. These effluents cause degradation of water quality (Rao et.al. 1999)

The study of water quality of different rivers in India by Gill et.al. (1993), Sanjay et.al. (1990), Athappanet.al. (1992), Madhysthaet.al. (1996), Sreenivasa Rao et.al. (1999), Doctor et.al. (1998), Jain p (2009), Anil Kumar Mishra (2010), Maninder Kaur Dhillon (2013), C. Sharma et.al. (2017), Anima Upadhyayet.al. (2014), J. Pandayet.al. (2017), E. Siddiqui (2019) have shown remarkable pollution level. The discharge of untreated domestic and industrial effluents have severely affected the quality of river Yamuna Chadetrik Rout (2017).

Quantitative study of physico chemical condition of river Yamuna at Mathura is quite essential Dhillonet.al. (2013), Fulekor and Dave (1983), Bilal Bhat et.al. (2018) Rachanaet.al. (2015), A Yadav et.al. (2019).

As it is well known that waste water effluents have so many pollutants and they show very harmful impact on river water Akporet.al. (2014). For physico chemical Analysis water samples were collected from different sites of river Yamuna.

2. Material and Method

Water samples were collected every month from specific locations during June 2019 to May 2020. The collected samples were analysed for various physico Chemical treatment as recommended by APHA (1995). Temperature and dissolved oxygen (DO) were measured at the sampling spot, BDH/AR grade reagents, double distilled water and borosilglass wares were used throughout the work. Temperature was measured by Celsius thermometer. pH and turbidity were measured by digital pH meter (type-325) and digital Nephelo-turbidity meter (type-132) respectively. Dissolved Oxygen (DO) was measured by digital DO meter (Model METZ192M). Chemical Oxygen demand (COD) was measured by dichromate reflux method. BOD was estimated by incubating the sample at 20^0 C for few days. TDS was estimated by digital TDS meter (METZ-701), Total hardness was determined by volumetric titration (E DTA method). Metal were estimated by atomic absorption spectrophotometer (AAS) with a Perkin-Elmer model-2380 instrument using Perkinelmer hollow cathode lamp as light sources sulphates was estimated by UV-VIS Spectrophotometer (type-118), chloride was estimated by volumetric titration with $AgNO_3$. Alkalinity was determined by volumetric titration preliminary. Digestion of the water samples were necessary to release the metal associated with suspended matter and colloidal organic matter (chakrabortyet.al. 1987), (Subramanian and Meranger 1979)

3. Result and Discussion

The range of results of various physico-Chemical parameters obtained during the analysis has been given in table-1.

Table 1: Range of results of various parameters at different specific sites of river Yamuna

S.No.	Parameters	Range
1-	Temperature (^{0}C)	10-24
2-	pH	6.8-7.6
3-	Electrical conductivity (mhos/cm)	1050-1600
4-	Dissolved Oxygen (mg/L)	1.15-2.30
5-	Chemical Oxygen demand (mg/L)	25-63
6-	Biochemical Oxygen demand (mg/L)	15-28
7-	Chlorides (mg/L)	546-604
8-	Sulphates (mg/L)	262-450
9-	Total alkalinity (mg/L)	150-250
10-	Total hardeness (mg/L)	790-1500
11-	Total dissolved solids (mg/l)	1300-2500

The range of concentration of various heavy metals obtained during the analysis has been given in table (2).

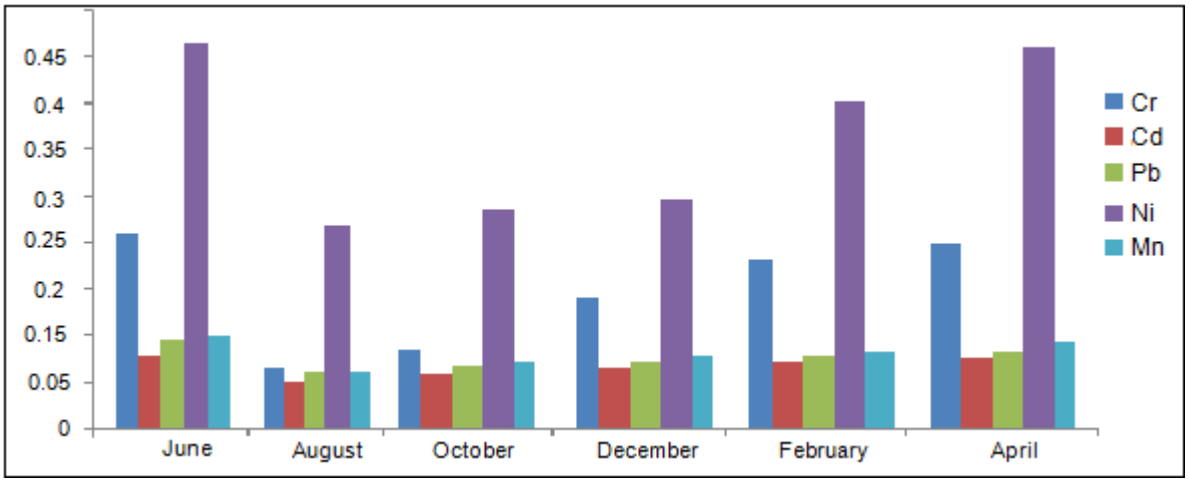
Table 2: Range of Concentration of Various Heavy Metals

S. No	Heavy metals (mg/L)	Range
1-	Cr	0.065 - 0.210
2-	Fe	1.004 - 1.079
3-	Cd	0.050 - 0.079
4-	Pb	0.061 - 0.095
5-	Ni	0.219 - 0.415
6-	Mn	0.062 - 0.100
7-	Zn	2.899 – 5.452
8-	Cu	1.501-1.900

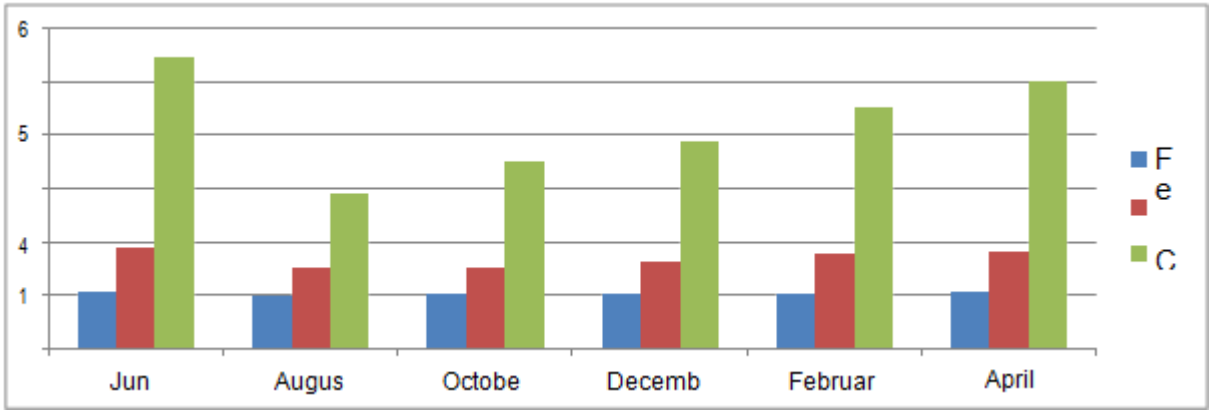
The comparison of concentration of various heavy metals at the intervals of month is given in figure 1 and 2.

Value of concentration of heavy metals shown in fig 1

Value of Concentration of Heavy Metals shown in Fig 1						
Metals	June	August	October	December	February	April
Cr	0.21	0.065	0.085	0.14	0.181	0.198
Cd	0.079	0.05	0.06	0.065	0.071	0.076
Pb	0.095	0.061	0.068	0.072	0.078	0.083
Ni	0.415	0.219	0.235	0.246	0.352	0.41
Mn	0.1	0.062	0.073	0.078	0.082	0.093



Values of Concentration of Heavy Metals shown in Fig 2						
Metals	June	August	October	December	February	April
Fe	1.079	1.004	1.012	1.022	1.035	1.056
Cu	1.9	1.501	1.522	1.623	1.789	1.812
Zn	5.452	2.899	3.486	3.893	4.521	5.021



The concentration of Cr, Cd, Ni, Pb and Mn were recorded beyond the permissible limit. The higher concentration of chromium metal in river water was due to the supply of effluents chromplating work, which is running on large scale in Mathura City. Some parameter like pH, DO and concentration of same metals like Fe, Mn, Ni, were found

under tolerance limit. The chromium metal is carcinogenic, tetratogenic, and mutagenic element. The higher concentration of heavy metal like Cr, Cu is harmful for aquatic orgnisms. On the other hand Mn is very important micronutrient for aquatic environment.

4. Conclusion

On the basis of above given information and analysis we can conclude that the pollution creating parameters have variable value due to ecological conditions as well as due to qualities and quantity of small scale industries and large scale of domestic waters. Almost all the parameters, except few were found to be beyond permissible limits. The significant pollution observed in Yamuna river water due to dropping of huge quantity of domestic sewage and industrial effluents discharge through nallahs into river Yamuna. There are approximate 50 nallahs which drop sewage and industrial waste into river Yamuna from different part of the city.

The high level of conductivity, turbidity, sulphates, chlorides, TDS, Hardness, Ni, Zn, Pb Cd values at different sampling sites are definitely harmful to aquatic life of organisms as well as for irrigation and domestic purpose. A continuous monitoring at the river water for various parameters would be done (Sarma. D. 2011, CPCB 2006).

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