WATER QUALITY ASSESSMENT OF RIVER YAMUNA, WITH RESPECT TO ITS PHYSICO-CHEMICAL ANALYSIS

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ABSTRACT **-**The water quality of Yamuna river, an important domestic, irrigation and potable water source of North India, has been assessed. Along the river, from different points, water sample were collected and analysed for various physico chemical quality parameters during winter. Effect of Agricultural runoff, industrial waste and municipality sewage on the river water were investigated. The study was conducted by selecting sites in such a way that nearly all Yamuna river is covered under the study area. The study involved determination of physical and chemical parameter of surface water. The various parameters analyzed were water temperature, Total Dissolved Solids (TDS), Electrical Conductivity (EC), Dissolved Oxygen (DO), Total Alkalinity, Chloride, Total Hardness (TH), pH, Chloride, Calcium and Magnesium.

KEYWORDS**-Physiochemical, Yamuna river, pollution, water quality**

INTRODUCTION

For all the forms of life the essential components is water. Although nearly 75% of Earth's surface is covered with water, the supply of fresh water has increasingly become a limiting factor because of various reasons. The expansion of industrialization and exploding population are the major ones. Acute shortfall of heavy rains, poor water shed management, abundant use of water for household and Agriculture purpose is have led to the over exploitation of the surface water sources especially from the river bodies. Many perpetual rivers became short lived and even dried up. [1] Water quality characteristics of aquatic environments arise from a massive amount of physical, chemical and biological interaction. In recent years, with everyday development of human activities in the countries around Yamuna river the probability of ecosystem changes is not an odd idea.[2] . Most of freshwater bodies all over the world are getting populated due to domestic waste, sewage, Industrial waste, agricultural and religious activities like idol immersion. [3]

Quality of water is now a great concern for environment as well as common public in all the part of the world. There are numerous sources of pollutants that could deteriorate the quality of water resources [4, 5]. According to the Centre of Science and Environment, approximately 75 to 80 percent of the river pollution is result of raw sewage, Industrial runoff and the garbage thrown into the river Yamuna and it totals over 3 billion liter of waste per day. [6] The other side shows that the surface water bodies are becoming the dumping sources for the industrial and domestic wastes. As a result, the existing dynamic equilibrium among the environmental segments get affected leading to the state of polluted rivers [7,8]. According to UN surveyed Report, India is expected to the face critical level of water stress by 2025 and there will be serious water shortage. [9]

Drying up of various water bodies and disappearing has resulted in the lack of availability of surface water [10]. River Yamuna, the main source of water supply to national capital-Delhi, plays a crucial role in its growth. [11,12]. In India, river water resources are under the risk of getting reduced to carry water of extremely poor quality in several stretches, particularly along the major cities where in excessive volumes of domestic and industrial waste water enters to them [13]. It is a fact that good water quality produces healthier human then one with poor water quality. [14-18].

Table 1. Sampling Location Description

Location Name	Location Number	Description
Shiv Temple, Bhimawala	01	To study River's natural conditions
Ponta Sahib	02	
Lapra	03	Various domestic , agricultural runoff and maximum textile industry waste
Budanpur	04	
Shyam Ghat	05	Industrial belt throwing effluents directly without treatment via drains
Nigam Bodh Ghat	06	
Darrul Hizrah	07	
Gandholi Puram	08	Sewage and various industries related to leather and also unauthorized slaughter houses.
Nangal Paimana	09	
Bateshwar	10	

Yamuna is the lifeline of Delhi and its water is used for the domestic and agricultural purposes. Therefore, appropriate measurements are required for the effective maintenance of water quality. Physico-chemical and microbiological characteristics may describe the quality of water [19-26]. With increasing number of industries and stakeholders of the river, the concern over the quality has also grown up and hence warranted for the present investigation.

In the present study, various physico-chemical parameters of water sample taken from different ten sites along the river Yamuna were collected in such a way that nearly whole Yamuna river is covered and analyzed.

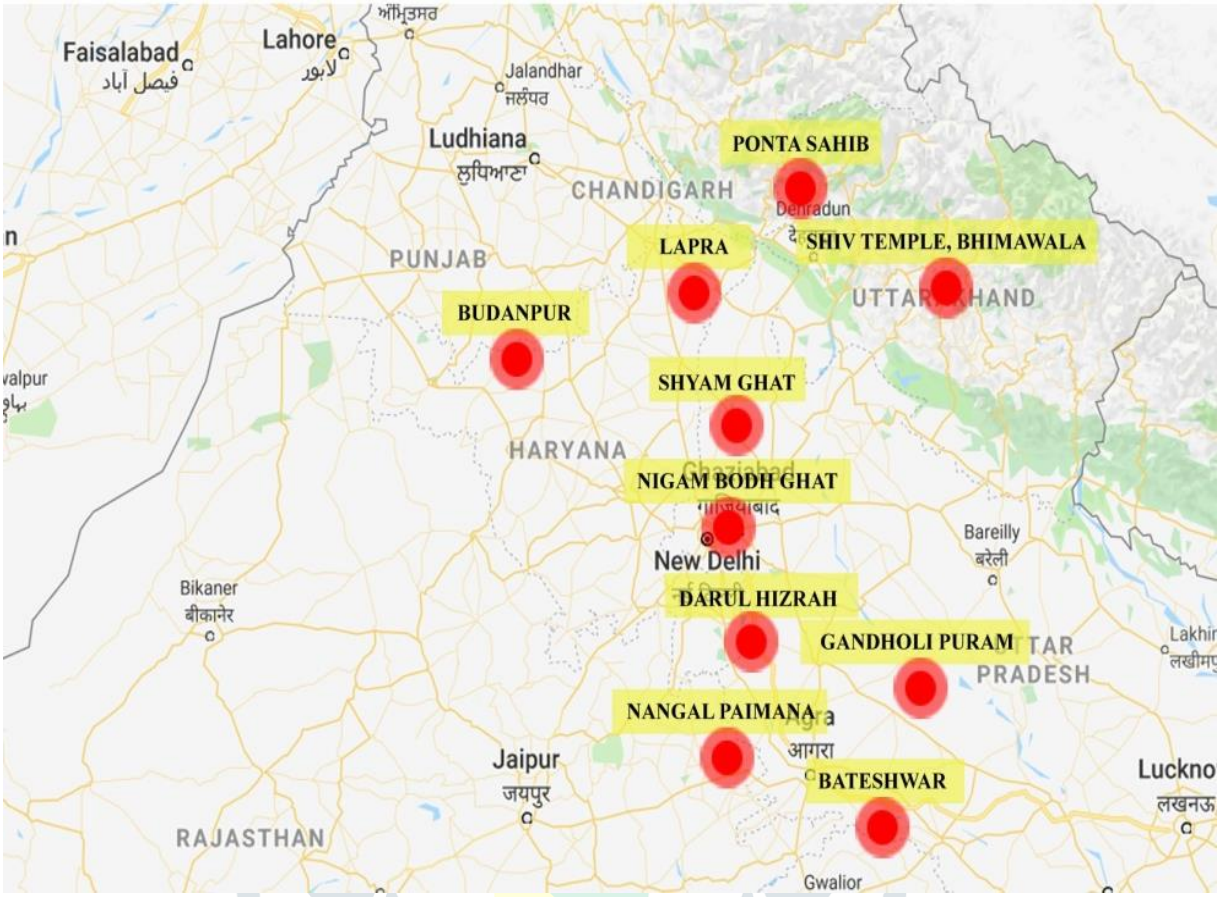

Fig 1: Map of Study Area

MATERIALS AND METHODS

The water samples were collected from midstream either by using a boat or from an over bridge. Samples were collected in pre-cleaned polyethylene bottles from the river Yamuna at different locations. Starting from November 22, 2017 to December, 2017 and were stored in refrigerator below 4°c until used. Physicochemical properties such as water temperature, Total Dissolved Solids (TDS), Electrical Conductivity (EC), Dissolved Oxygen (DO), Total Alkalinity, Chloride, Total Hardness (TH), pH, Chloride, Calcium and Magnesium were measured using standard methods APHA. The description of sampling site is provided in Table 1

RESULT AND DISCUSSION

Water samples were collected from the Yamuna river during winter seasons and tested for physical and chemical parameters. The important water quality parameters such as water temperature, Total Dissolved Solids (TDS), Electrical Conductivity (EC), Dissolved Oxygen (DO), Total Alkalinity, Chloride, Total Hardness (TH), pH, Chloride, Calcium and Magnesium were analyzed. Assessment of the water samples for pollution is made by comparison of assessed values of all the physico-chemical parameters with the corresponding standards prescribed for drinking water by BIS. The results of Water Quality of Yamuna River are shown in Table 2 and from Fig2 to Fig 11.

As shown in Fig 2, Mean pH of Yamuna water varied from 7.4 to 8.3 at different sampling locations. At location No. 1,6 and 7, pH was approximately equal, not showing statistically significant difference. Higher pH at some sampling locations could be due to carbonate and bicarbonates of calcium and magnesium in wastewater. Such pollutants should be entered in river through urban runoff or/and industrial effluents. The overall results indicate slightly basic water.

Table 2. Water Quality of Yamuna River

Location Name	Location Number	Temperature	pH	EC mS/cm	Total Alkalinity mg/l	Total Hardness mg/l	Dissolved Oxygen mg/l	Calcium mg/l	Magnesium mg/l	Chloride mg/l	TDS mg/l
Shiv Temple, Bhimawala	01	23	7.4	0.252	84	110	8.0	33.6	16.1	6	161
Ponta Sahib	02	20	8.1	0.339	64	128	8.4	31.2	18.73	14	217
Lapra	03	19	7.9	0.264	80	120	8.8	35.2	17.56	16	169
Budanpur	04	20	8.3	0.195	150	156	7.3	44	22.83	62	291
Shyam Ghat	05	20	8.2	0.797	138	214	8.1	44	31.32	540	510
Nigam Bodh Ghat	06	21	7.5	1.23	136	262	00	55.2	38.35	1400	784
Darrul Hizrah	07	20	7.6	0.852	124	210	2.3	47.2	30.74	1000	545
Gandholi Puram	08	21	7.8	0.928	166	238	0.4	54.4	34.84	1880	756
Nangal Paimana	09	21	7.8	1.14	168	238	2.4	55.2	34.84	1600	721
Bateshwar	10	20	8.2	1.16	172	218	3.2	48	31.91	1320	653
BIS Values			6.5-8.5	1.5	200	300	5	75	30	250	500

The measurement of Electrical Conductivity is directly related the concentration of ionized substances in the water. It increases with addition of industrial effluents and urban runoff. The EC values were found higher at Location No. 06 and lowest is at Location No. 01, 1.23 and 0.252 µS/cm respectively. All sites were found under the prescribed limit.

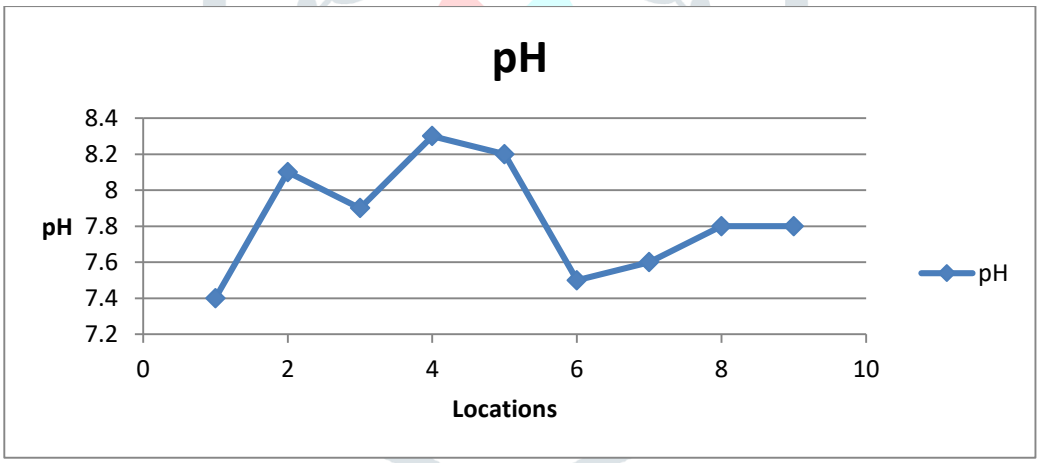

Fig 2: pH values for various locations

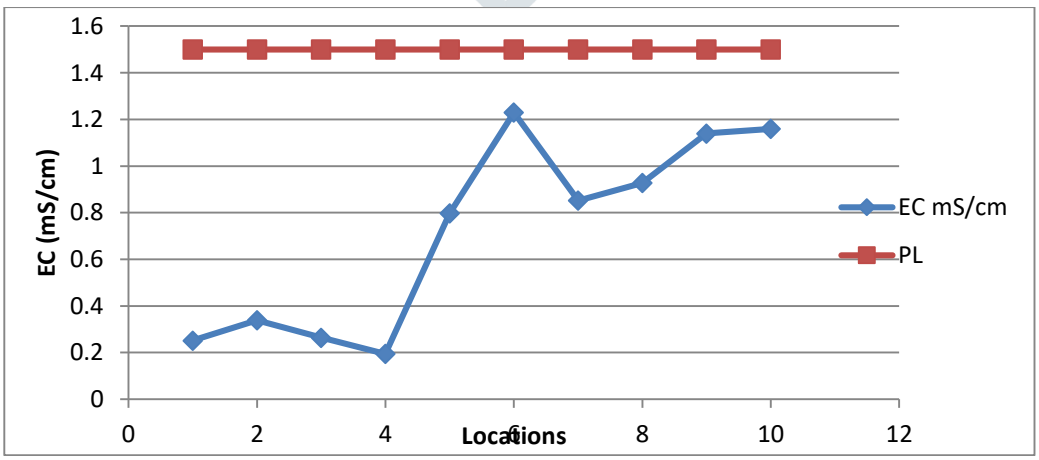

Fig 3: EC values for various locations

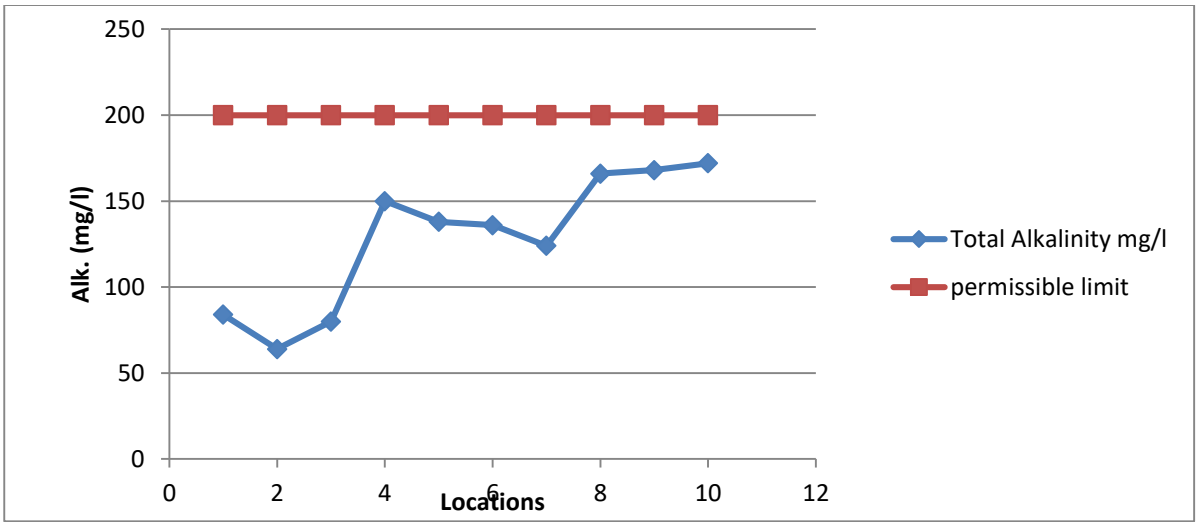

Fig 4: Total Alklinity values for various locations

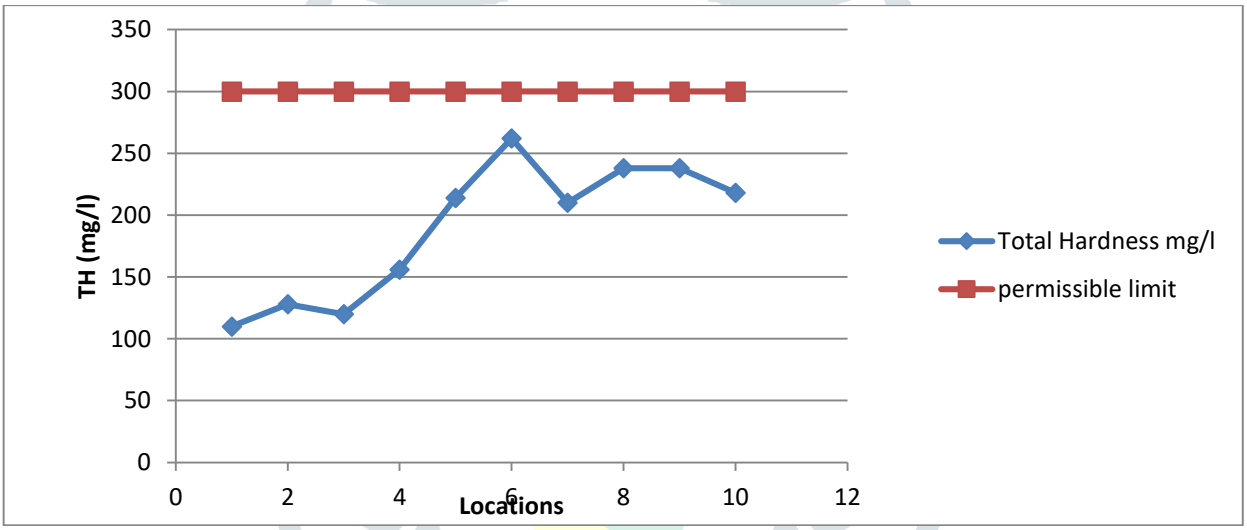

Fig 5: Total Hardness values for various locations

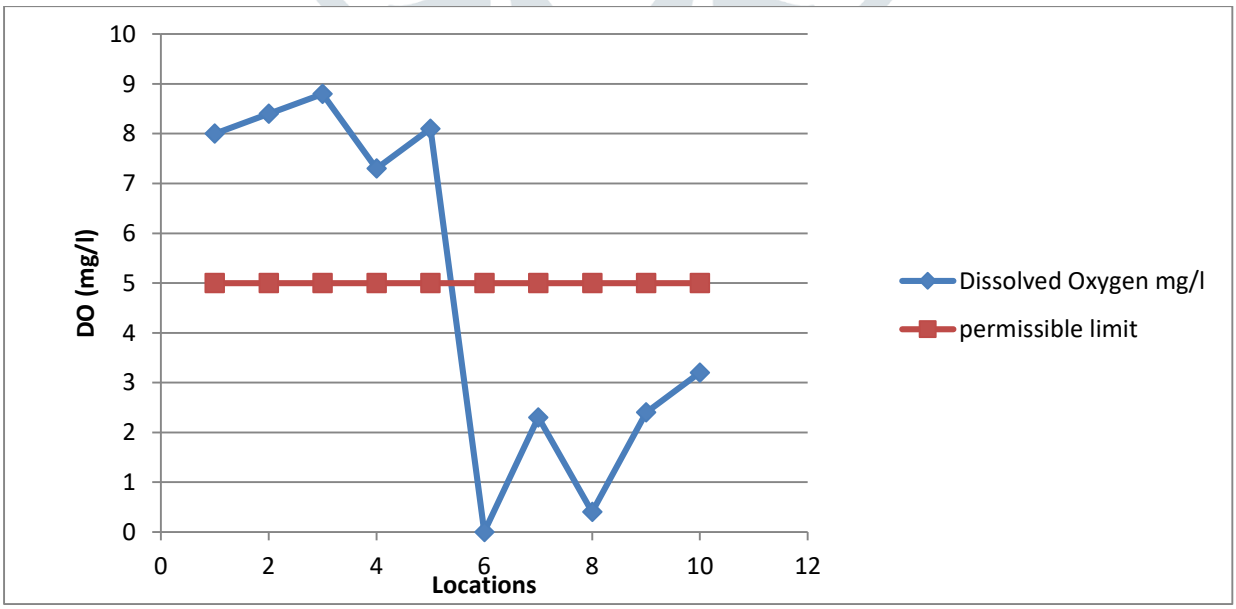

Fig6: Dissolved Oxygen values for various locations

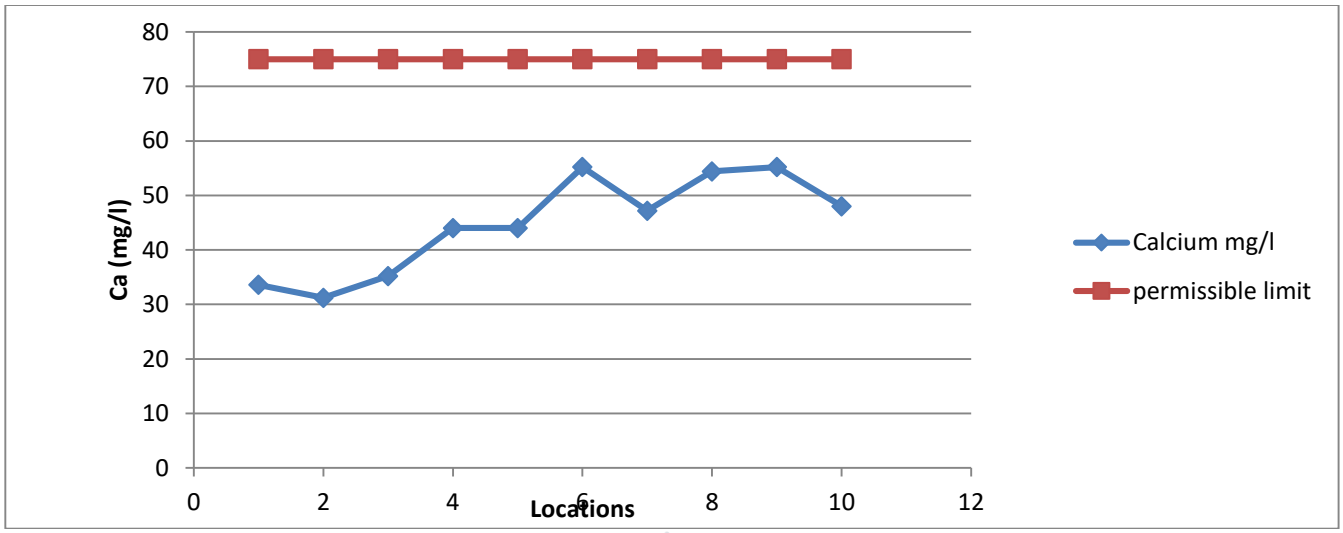

Fig7: Calcium values for various locations

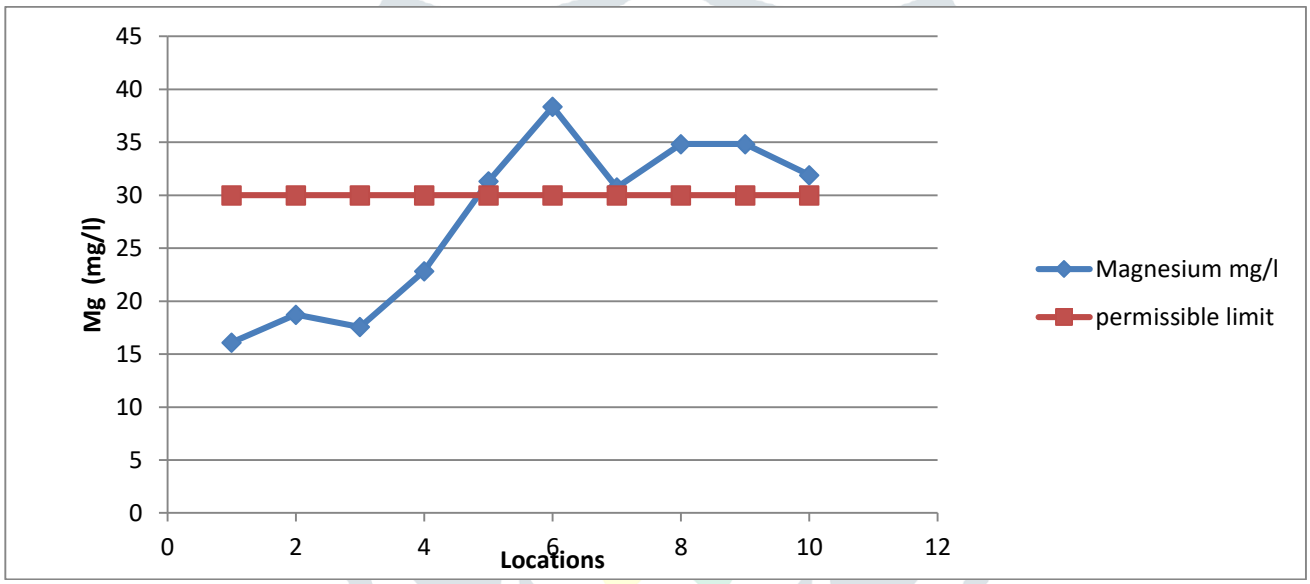

Fig8: Magnesium values for various locations

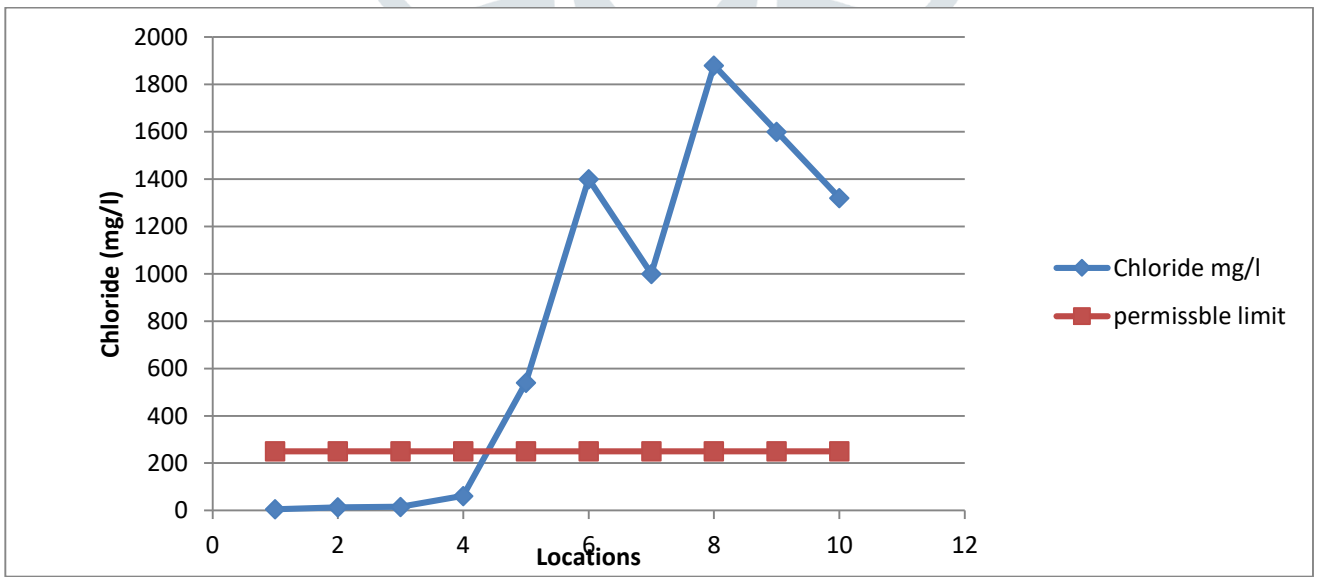

Fig9: Chloride values for various locations

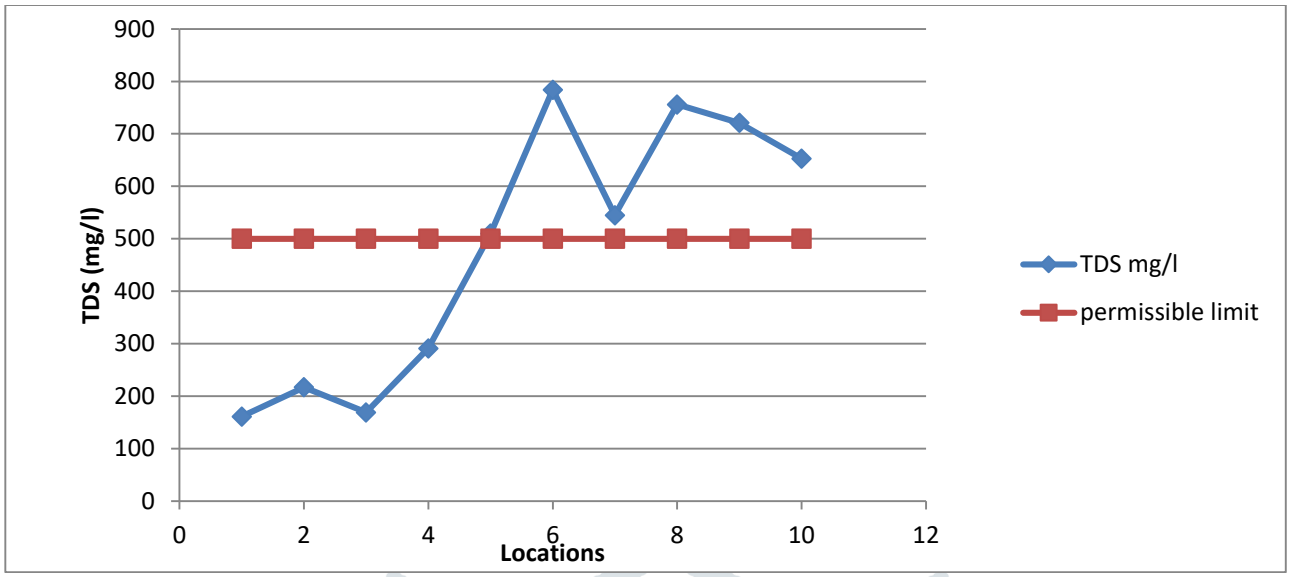

Fig10: TDS values for various locations

The experimental values of TA were in various ranges as reported in Table 2. and shown in figure 4.As we are moving downstream the river due to increase the amount of carbonates, bicarbonates and hydroxyl ions, the TA value is respectively increased. The values for TA were found within the desirable limits of BIS 2004.

Total Hardness is also an important parameter of water quality from its domestic and industrial use point of view. Hardness results from the presence of divalent metal cataions, of which calcium and magnesium are the most abundant. [27] The sampling is done in winter after rain, so the values of TH were although increasing from upstream to downstream but all found below the limits. Its minimum value was 110mg/l for location 01 and highest was 262 mg/l at location 06.

Dissolved Oxygen is always of important factor of river quality assessing urban impacts on river ecosystem. Since less dissolved oxygen is available in the water, the category of water of Delhi segment is dead water quality. As shown in Fig. 5, very low values of DO were found and even at location 06, the value was found zero. DO is good at the hilly areas but continuously decreased in the plain areas. This may be due to the heavy load of organic pollution from surroundings.

The concentration of calcium in the study area ranged from 31.2 to 55.2mg/l. All the samples were within the desirable limit of BIS (2004). Magnesium concentrations found in the samples of study area were ranging from 16.1mg/l to highest 38.35 mg/l for the location 06. Starting from location 05 onwards, due to addition of vast domestic and industrial effluents, all location crossed the prescribed limit for magnesium.

Chlorides the most common anion in natural water and it occurs naturally in all types of water. Limited chloride concentration in water is useful, while higher concentration of chloride in freshwater act as a pollutant. Chloride concentrations in all samples starting from location 05 to location 10 were very high. The highest was for location 08 with value of 1880mg/l. TDS parameter represents the salinity nature of water of Yamuna River. TDS of all water samples were shown in Table 2 and in Fig 10. The maximum TDS range observed in all studied samples, indicating the mixing of large amount of fine chemical pollutants are completely dissolved in the water samples. Higher TDS level in rivers increase the chemical and Biological Oxygen Demand which directly based the dissolved oxygen level in water. The minimum and maximum values for TDS were 161 and 784mg/l respectively. Maximum samples in the studied area show high values then the permissible limit.

CONCLUSION

The Yamuna River is one of the most important river of India that feeding many states in many ways. It also contents all kinds of garbage. From the beginning the importance of the river was very much and increasing day by day. Like other rivers in the country its water quality is losing day by day. From the above chemical analysis, most of the parameters in the upstream are within the permissible limits but going downstream, the river is getting highly polluted. This is clear from above analysis that the river water is unfit for various purposes without any form of treatment. Still we have little time to control the pollution of the river. So, it is very much necessary to prevent the river water by making suitable treatment technology and spreading awareness among people about the pollution problem.

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