



LIMNOLOGICAL ANALYSIS AND DETERIORATING IMPACT ON WATER QUALITY OF YAMUNA RIVER AT AGRA REGION

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Abstract

Our present study was focused on find out to analyses of Samples taken from the Yamuna River in both rural and urban regions of the Agra region were analysed for their physicochemical characteristics. Such sampling sites belong to 3 locations water samples were collected from 3 urban and rural as Kailash Ghat, Rambagh, Bateshwar Ghat of Agra region. Throughout this study water samples were collected during summer, winter and monsoon season and Pressures in lab and analysed. The research was done for the parameters like pH, DO, BOD, COD, TDS, Total Hardness during this pH determine that water of Yamuna river is alkaline disposition. Perceptively the nature of all the parameter appeared in disparate, which determine the purity and impurity of Yamuna river at various locations. Along with this, it was also analyzed that what effect it has on the aquatic animals living in the Yamuna water, it was evaluated. The observation was done for the period of April 2022 to February 2023 indicated. During this analysed such component was used to identify the presumable sources of defilement and to evaluate the spherical changes of water quality in Yamuna river.

Keywords: Physicochemical, Toxicity, Organic, Inorganic, Weapons, Water Quality Index, Sewage Drain, Aquatic

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Introduction

A medial concern about water quality is critically interlinks to sustainable animal, human health and agriculture together with environmental quality globally also including Indian subcontinent (Kumar *et al.* 2017). Fortunately River Yamuna is widely worshipped by devotes in Indian country. Moreover rivers perform a major role in integrating, convening as well as organizing the landscape and moulding; shaping the ecological environment also frame of a basin. As they are major and prime components also main factors which controlling the global water cycle and together with the hydrologic cycle, obviously they are the main dynamic representative agents of transport. (Garrets *et al.*, 1975) Ultimately such healthy and Salubrious ecosystem depends on the biological and physico-chemical features. (Venkatesharaju *et al.* 2010) River Yamuna is the largest or enormous tributary river of the Gangas in northern Indian and It is originating from Yamunotri Glacier within height about 6,387 meters on the south western slopes located of Banderpoch Peaks, Tremendously Agra is situated or established in western U.P. amid 27.11' degree Latitude North located and about 78.0' degree to 78.2' degree Longitude East side, together with its altitude is about 169 meters higher than sea level (Gupta *et al.*, 2013). In India rivers are getting contaminated be presented with huge and large quantity of untreated waste water existent drained from industrial and urban sources or modality (CPCB; 2012)

In India from urban areas total wastewater generation is above 38,000 MLD. In which only 35% is treated wastewater in urban region. (CPCB, 2010) Although major Indian urban

sides or cities remove fresh water from river for domestic and industrial purposes, that why quality of water in river stands so critical or severe from human and animal health as well as ecological imbalance situation point of view. Total length of Yamuna river about 1376 km and it has a catchment area of over 366,220 km². (CPCB 2012) Such as Yamuna river is one the most contaminated rivers in the world mainly about 85%. Pollution or heavy metals contributes by human domestic sewage and industrial wastes, therefore such types water is unfit for drinking, washing, bathing, swimming and also fisheries purposes (Shrivastava *et al.* 2007). Many years ago Mughals established prompted to build on their most illustrious mountains' as the example for Taj which is on its bank factually sediments are studied as mixture of various components of mineral species and reprints the crucial sink for many pollutants in aquatic manner factually the natural phenomena and the anthropogenic activities change the physico-chemical properties of the sediment these have been some of prominent natural phenomena such as weathering of rocks and volcanic activities, surely sediment or soil is an integral part of aquatic ecosystem, it is significance reason to complex reaction which arise in itself and resulting exchange of chemical components between water and soil. Unfortunately silver plating and many tanneries and small pesticides factories and companies in Agra, which is most reasonable for severe human health hazards and also aquatic animal life. Yamuna river flows through states of Delhi, Haryana and Uttar Pradesh; prior to merging with Ganga at Prayagraj, ultimately city of Delhi, Mathura, Agra and Firozabad on its bank. Yamuna river is mainly used for drinking, irrigation, fishing and also aquaculture purposes.

To reduce the pollution and toxicity of river Yamuna; Indian government launched a mega project, its called 'Yamuna Action Plan' in 1993 (CPCB; 2006). However, reparation of ecological fitness and aquatic life of Yamuna river to the essential required water quality standard is big concernment for peoples. As we know that its concern about especially for poor farmers, as the poor farmer uses this contaminated water to grow crops, if the quality of Yamuna water is not Pure then how can the grains be Pure? Often its causes thousands severe disease, related health hazards. Yamuna river water, obviously which can be derimental to crop quality, included soil, human, animal health and so as environmental property. (Harsh *et al.*, 2017)

Aim of the Study - According to this observation we will test some physicochemical (parameters) elements, during this research we have chosen three different sites. In which we have to find out and analysed variation in physico chemical quality of Yamuna river. Apart from this, surely we have observed its effects on fauna.

Literature Review- About the riverine resources of India fortunately India contain approximately 113 river basins out of which 14 rivers are major, then included 44 medium and remaining 55 are minor rivers (Kumar, 2002). In Kerala, Periyar river indicated pollution profile through the water analysis, result found as related to heavy industrial load or urbanization, it was studied with general parameters such physical and chemical as well as heavy toxic metals for its surface water and also found bed sediment (Paul and Pillai, 1978). During the research of various water quality, the plight of Damodar river was one of them as about the pollution profile of Damodar river, in which industrial wastes as well as coal mining are the main major factors which were exploiting or destroying the river (De, Sen and Karim, 1985; Singh and Gupta, 2000). Currently, in USA Wilkes university provide facilitates a simple on live calculator for the NSF WQI its using beneficially nine WQ parameter (WU, 2008). Although maximum freshwater bodies have p-limited stage that influence the aquatic balance throughout disturbing the formation and diversity of micro organism as well as there plants vital for keep in existance a healthy ecosystem (Wade *et al.*, 2004). According to the most researcher Yamuna river is one of the most polluted tributaries of Ganga and also presented over 76% of total pollution load of nation's from Delhi NCR its majorly converting into a "sewage drain" (Press Trust of India, 2018; CPCB, 2021a, 2021 b). About the nutrient pollution it remains a significant concerns such as it obviously create a major issues by alternations in the food chain dilapidation of water quality and destruction or deleterious effects on the health of living organism (Bende-Michi and Hairsine, 2010). Other than appropriate major river restoration initiative by Government, about the concerns YAP, it was started to clean and maintaining the Yamuna river. Appropriate action plans I, II and III constitute the YAP between the Government of Japan and India it based on a bilateral agreement. Yamuna action plan-III is founded recently being performed with an allocated budget of Rs. about 1.656 crores (Srivastava and Prathna, 2022).

Sampling Site and Sample Collection

To study water samples were collected from three different sites of Yamuna River at Agra site (a) Kailash Ghat, site (b) Rambagh and site (c) in Bateshwar Ghat. Such samples were

collected in pre-cleaned container as bottle or glass although water samples from selected sites were collected during the month of April in 2022 to February 2023 as the samples were collected from shallow bottom region.

Physicochemical parameters- For the study such included some physicochemical parameters such as pH. Dissolved oxygen (DO), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Dissolved solids (TDS), Total Hardness, were analysed by following the standard methods of APHA (1998) and (2007).

Analyses-

Table – 1 Analytical method (Water Quality Standard)

S.N	Water Quality Parameters	Units	Analytical Methods
1.	pH Value	**	pH meter
2.	Dissolved Oxygen	mg/L	Winkler method
3.	Biological Oxygen Demand	mg/L	Titrimetric
4.	Chemical Oxygen Demand	mg/L	Titrimetric
5.	Total Dissolved Solids	mg/L	TDS meter
6.	Total Hardness	mg/L	Titrimetric

Estimation of water quality Index

According to WQI is a mathematical tool it used to variation large quantities of water quality data into a single increasing or cumulatively received number. Obviously a certain level of water quality representing while repel the subjective assessment or appraisal of such quality (stanbuk-Giljanovic, 1999, 2003, Miller *et al.*, 1986) Through the water index calculation we have obtained seasonal data. Although WQI values derived from the study of physicochemical analyses of Yamuna river in different season and still found that Yamuna water is poisonous and not suitable for drinking purpose, literally its presenting under grading 'E' which mainly causes of anthropogenic activities also occur to exploitation. Tremendously such results represent that Yamuna river water in summer season is much. Poorer condition in comparison to monsoon season status, other than this winter season status is not also good. Hence, the summer and winter season status of Yamuna river result shows the similarity stated that on the basis of WQI values of upstream and downstream region in Agra. (Kumar *et al.*, 2015). Unfortunately this result indicates that Yamuna water may be harmful and injurious for human and animal health. Many researchers and investigators such as (Trivedi and Pathak 2007) observed or estimated water quality Index (WQI) under in their studies on various water bodies so they clearly mentioned that Yamuna water is not fit for drinking other than this WQI values clearly aware that Yamuna river water of Agra region is Toxic heavy metals have been found in large quantities, hence it is highest priority of government and also of us should be treated water quality monitoring and other various technologies adopted which should be make fit for aquatic biodiversity, human consumption and also agriculture purposes.

Table – 2 Physico-Chemical Parameters of Yamuna river: Site – 1 Kailash Temple from April 2022 – February 2023

Months	Year	pH	DO	BOD	COD	TDS	Total Hardness
April	2022	8.5	4.8	24.4	574.6	1172	862
May	2022	7.3	3.5	48.5	482.4	1144	919
June	2022	7.9	4.9	47.2	580.3	1097	923
Summer	2022	7.6	3.2	48.3	525.4	1099	803
July	2022	7.5	4.2	42.1	210.3	1025	480
August	2022	8.5	3.3	39.2	235.2	972	585
September	2022	8.9	4.9	45.5	294.5	912	638
October	2022	7.5	5.4	41.3	298.8	1012	697
Monsoon	2022	7.3	5.8	30.2	241.9	1031	448
November	2022	7.7	4.7	20.9	172.5	928	598
December	2022	9.2	5.6	28.5	192.9	819	645
January	2023	8.3	5.7	18.2	104.4	897	495
February	2023	8.6	4.7	25.4	238.2	1124	665
Winter	2023	8.8	4.9	20.2	197.0	940	431

All values are represented in mg/L except pH

Table – 3 Physico-Chemical Parameters of Yamuna river : Site – 2 Rambagh from April 2022 – February 2023

*All values are represented in mg/L except pH

Months	Year	pH	DO	BOD	COD	TDS	Total Hardness
April	2022	9.2	5.0	20.4	581.5	1090	761
May	2022	8.4	3.6	35.6	424.0	1032	951
June	2022	8.0	4.0	42.3	520.1	1151	922
Summer	2022	9.5	3.0	45.1	473.2	1142	812
July	2022	8.1	3.3	40.0	320.3	995	814
August	2022	8.0	4.0	31.0	310.0	915	880
September	2022	8.3	4.0	42.0	290.0	1020	637
October	2022	7.9	4.1	40.0	272.4	1061	699
Monsoon	2022	7.6	4.0	44.0	204.5	1078	513
November	2022	8.0	5.1	22.0	183.4	829	634
December	2022	9.0	3.2	32.1	190.4	821	678
January	2023	8.4	3.4	21.0	11.05	928	597
February	2023	8.5	4.8	20.0	251.0	1026	881
Winter	2023	8.4	4.7	30.2	220.2	904	594

Table – 4 Physico-Chemical Parameters of Yamuna river : Site – 3 Bateshwar Ghat from April 2022 – February 2023

Months	Year	pH	DO	BOD	COD	TDS	Total Hardness
April	2022	8.2	4.5	29.5	441.6	1021	823
May	2022	7.6	4.2	35.6	485.2	1131	882
June	2022	7.8	4.8	38.8	395.3	1041	991
Summer	2022	7.6	3.8	47.2	515.0	1121	920
July	2022	7.2	4.1	42.3	505.1	951	715
August	2022	7.7	4.0	42.5	491.2	987	612
September	2022	7.5	3.6	40.0	255.2	1045	698
October	2022	7.4	5.2	32.0	213.8	1066	611
Monsoon	2022	7.5	5.0	21.5	231.0	921	571
November	2022	8.0	4.9	26.5	210.9	890	745
December	2022	8.1	4.9	20.8	190.0	932	632
January	2023	7.8	4.2	25.2	171.2	1131	444
February	2023	7.6	4.7	31.5	187.5	1161	881
Winter	2023	8.5	4.8	30.5	192.1	1012	342

*All values are represented in mg/L except pH

Fig. 1(a-f) : Seasonal variation in physico-chemical parameters of Yamuna river (site-1, site-2 and site-3) during 2022-2023.

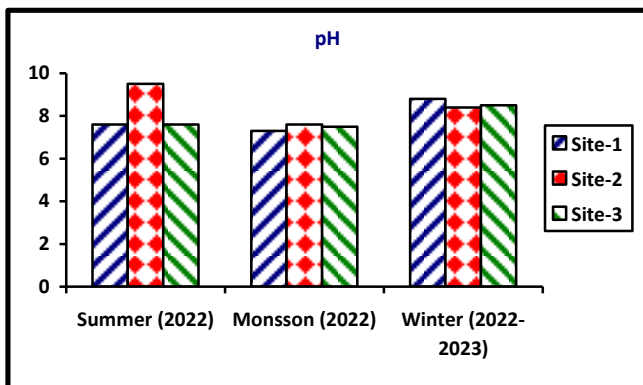


Fig. 1(a)

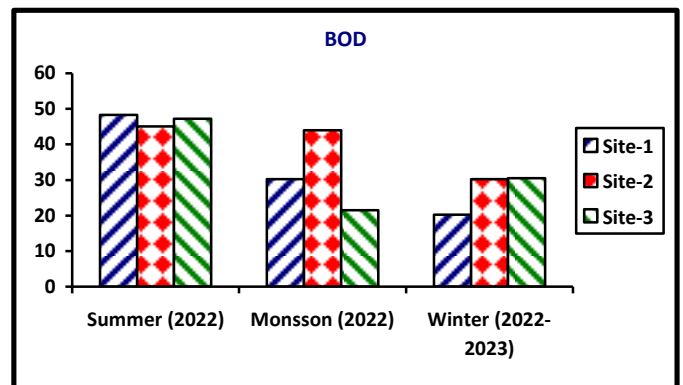


Fig. 1(c)

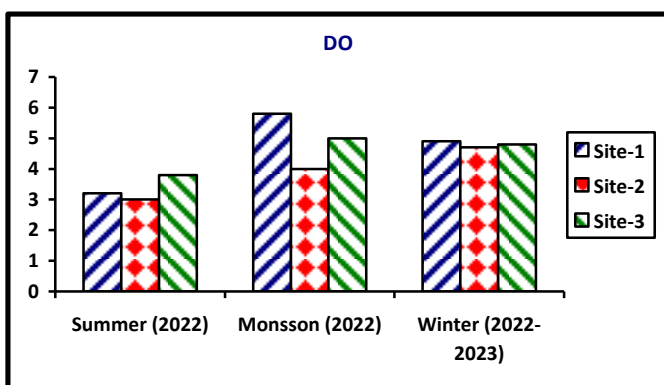


Fig. 1(b)

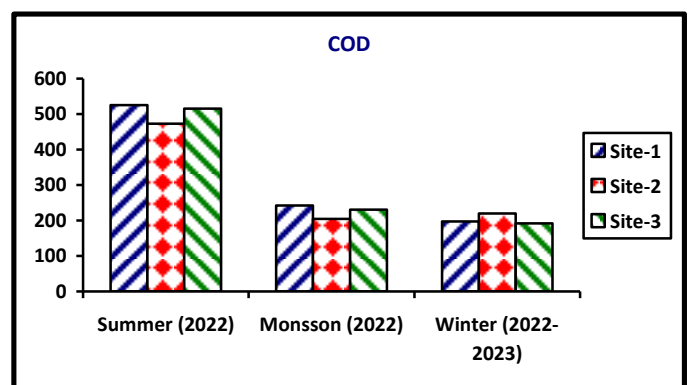


Fig. 1(d)

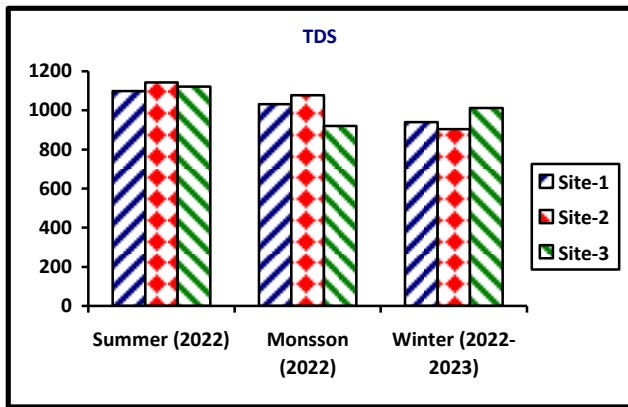


Fig. 1(e)

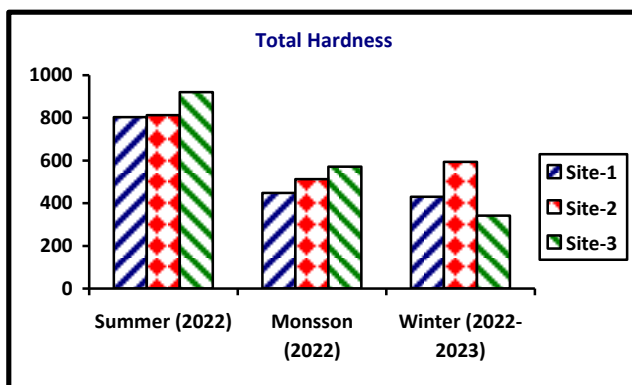


Fig. 1(f)

Results and Discussion

pH- pH value presented analyzed the water quality assessment and major estimated major influence on biological and chemical processes in aquatic life (Ahmed *et al.*, 2011). Such as Yamuna river water sample pH values ranged varied between (8.2-8.5-9.5) during summer, (7.3-7.5-7.6) monsoon and (8.4-8.5-8.8) winter seasons. Throughout the observation period unfortunately Yamuna river water found alkaline in nature due to presence of alkali metals.

DO-Dissolved oxygen is crucial factor of water quality and it consider the physical and also biological operation in the water (Trivedi and Goel, 1984). DO estimated ranged between (3.0-3.2-3.8 mg/L) during summer, (4.0-5.0-5.8 mg/L) monsoon and (4.7-4.8-4.9 mg/L) during winter season. Hence low level of dissolved oxygen as an high indicator of heavy contamination of aquatic bodies which estimated lower index. Obviously it was found low values in summer season while higher ranges were studied during winter and monsoon season.

BOD-During the research work it was observed of biochemical oxygen demand as varied from (45.1-47.2-48.3 mg/L) in summer, (21.5-30.2-44.0 mg/L) monsoon within it was observed about (20.2-30.2-30.5 mg/L) during winter season. Literally BOD is a measure of the oxygen rate in water because of the aerobic organism which most required for them. BOD increases when the biodegradation of organic matter or substance exerts oxygen level in the water (Abida, 2008). Hence result of BOD was recorded in maximum in summer while minimum was in monsoon and winter season.

COD- Chemical oxygen demand is used to found the amount of organic compound in water although COD is a measure of the oxidation of reduced or decreases chemical substance, toxicity in water (Kumar *et al.*, 2011). COD was recorded to be ranging from (473.2-515.0-525.4 mg/L) during summer, (204.5-231.0-241.9 mg/L) monsoon and (192.1-197.0-220.2 mg/L) in winter season. Such as COD was found higher in summer season and minimum in monsoon and winter season.

TDS- Total dissolved solids (TDS) comprise a variation of organic material, solidity and salts which easily dissolves in water, as on often impact a degree of hardness. Tremendously TDS value measure ranged between (1099-1121-1142 mg/L) during summer ; (921.1031-1078 mg/L) monsoon then about in (904-940-1012 mg/L) winter season. Hence TDS was observed in summer season was maximum in site-2 Rambagh. Then Bateshwar and then Kailash temple. Moreover, TDS was observed and found during monsoon, while minimum value, moreover low value was observed in winter season at site 2 Rambagh site, Kailash Ghat and Bateshwar Ghat was observed in minimum range.

Total Hardness- The variation in total hardness during observation at study sites were estimated values such as (803-812-920 mg/L) during summer, (431-594-342 mg/L) winter and about (571-448-513 mg/L) in monsoon season. Such as higher values studied of total hardness during summer season then observed lower values in monsoon and winter season. According to (Taylor, 1949) total hardness described the effect of dissolved minerals and substance which regulate and determining fitness or suitability of water for drinking, domestic and industrial purposes because of attributed to presence of chloride, nitrates, sulphates, Ca and Mg many more.

Conclusion

Such as described study was conducted to observe the water quality of Yamuna river at Agra region during the summer, monsoon and also winter season from April to February. During this study, according to such parameters, we were able to determine which of 3 sites like as (1. Kailash Ghat, 2. Rambagh, 3. Bateshwar Ghat) had the highest level of water quality degression. Majorly the highest level of water quality index polluted causes of urbanization, industrialization and also excessive population. As we know water body such as (river, lake, reservoir etc.) exactly so necessarily, essential an understanding of physiochemical and biological conditions from the observation or analysis of water quality parameters as (physiochemical) of Yamuna river in Agra city, it could be clearly visible that Yamuna river water quality in not fit and healthy causes to increases or enhancement in alarming levels of organic and inorganic wastes due to outcome of anthropogenic activities unfortunate that directly or indirectly destruct the aquatic management and influences the aquatic system and foist serious health hazards to terrestrial existance forms including human beings. Therefore, to treated water quality and control further pollution by regular monitoring to essential weapons and implementation of strict laws is most required, mandatory to control the environmental peril and to renovate the water quality status of Yamuna river at Agra city.

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