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A Physico Chemical Assesment on Microbial Pollution of Yamuna River: A Case Study of Delhi

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Abstract – Present study manages an appraisal of some Physico chemical parameters of the Yamuna River at Mathura. The study territory encounters a regular atmosphere and comprehensively partitioned into three seasons as winter (November to February), Summer (March to June) and blustery (July to October). The examples were gathered and investigated for two sequential years 2011 and 2012. Examination of some physico-chemical aspects like, water temperature, ph, D.o. (mg/L), BOD (mg/L), C.o.d. (mg/L), and T.d.s. (mg/L) has been carried out amid the examination period. The water ph of river ran from a base 7.2 and 8.3 in summer D.o 3.0 to 10.4 in winters B.o.d. 14.0 to 52.7 in summers and C.o.d. 11.4 to 35.2 in winters while as T.d.s. 460 to 553in downpours.

Customarily, the river pollution has been broadly contemplated as to physical and chemical attributes. Then again, recently microbiological nature of the river has gone under more prominent center owing to injurious impacts of pollution on human health, particularly in the connection of Designated Best Use (DBU) of the river waters. With this purpose, the paper presents pollutional parts of river Yamuna at Delhi, the capital of India, amid lean the period. Out of huge number of microbial parameters connected with human health, some noteworthy sullying pointers, specifically, heterotrophic plate check (absolute plate number, CFU/ml), downright coliform (MPN/100 ml), Fecal Coliform (MPN/100 ml), pathogenic parasites, in particular, Helminths (eggs/l), coliphages/100 ml have been distinguished and measured alongside the related regular parameters, specifically, disintegrated oxygen (ppm), biochemical oxygen request (ppm), chemical oxygen request (ppm), ph, temperature (0c), aggregate broke up solids (ppm) and turbidity (NTU). Six inspecting areas (extension locales) were chosen and aggregate 24 example sets were gathered over a time of four months from March 2004 to June 2004.

The high estimations of microbial pointers and pathogens located uncovered that the microbiological nature of Yamuna waters was poor, perilous and not adequate even for the most reduced DBU. The consequences of the study have uncovered the requirement for pollution decrease measures to guarantee river water quality according to the prerequisite of DBU. Further, an endeavor has been made for producing the fast technique for estimation of organic pollution and comparing microbial pollution, amid Delhi stretch of Yamuna river, through determined connections, specifically, Chemical oxygen request (COD, mg/l) and Fecal Coliform (FC, MPN/100ml). The consequences of Fecal Coliform acquired by lab examination might be confirmed by looking at the results got from different between connections explored in this study. The copy examination or utilization of control tubes might be dodged in standard microbial dissection.

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INTRODUCTION

Water quality, which is affected by different characteristic courses of action and anthropogenic exercises, is overall flow natural issue in exploration (Ouyang, 2005; Mukherjee et al., 2007 and Shrestha and Kazama, 2007). The suspended and accelerated (non-skimming) substances and organic substances in waters are equipped for following poison particles (adsorption). The residue, both suspended and encouraged substances put away on the water lowest part, structure a store for some contaminations and follow substances of low solvency and low level of degradability (Biney et al., 1994). The River Yamuna, the biggest tributary of River Ganga has been a standout amongst the most conspicuous & essential rivers of India. The river Yamuna, emptying the southern slants of the Himalaya in its upper scopes, is the biggest tributary of the Ganga (Negi, 1991).

At the conjunction, water release of the Yamuna is one and half times that of the Ganga (Rao, 1975).

The Yamuna and its significant tributaries in the Himalaya constitute the Yamuna River System(negi, 1991). River Yamuna water is most contaminated on the planet. 85% of this pollution helps by modern and household sewage. This water is unfit for drinking, swimming and fisheries (Shrivastava et al., 2001). Amid a decade ago, this is watched that the ground water get dirtied radically in light of the expanded human exercises (Abdul, 1998 and Sirkar, 1996).

Report of the researchers at All India Institute of Medical Sciences (AIIMS), New Delhi, discovers a disturbing pervasiveness of different sicknesses creating organisms in drinking water and recreational water. The utilization of this water may prompt a few life undermining maladies. The causative microbial executors, likewise called pathogens, reproduce in the intestinal tract of the persons experiencing the malady and are released in their dung in extensive numbers. The illness is then transmitted to healthy people through water or sustenance defiled with the excrement. Since, the spread of these maladies is predominantly through the water course they are additionally called as water borne maladies. The pathogenic creature may have a place with any of the gathering of micro creatures, for example, virus, bacteria, protozoa and helminths (worms). Since, it is illogical to test water for all pathogens identified with water borne illnesses because of the many-sided quality of the testing, time and expense, pointer creatures are utilized. Notwithstanding, no straightforward marker that consents to all the criteria is accessible, subsequently more than one pointer organic entity is utilized.

RIVER YAMUNA

The river Yamuna, the biggest tributary of river Ganga has been a standout amongst the most conspicuous and sacrosanct rivers of India through the ages. Yamuna, as indicated by the legends, was the girl of Surya, the Sun God and sister to Yama, the God of Death. Thusly, well known conviction is that the individuals who take a plunge in its sacred water are not tormented by apprehensions of death. Yamunotri, which is the north of Haridwar in the Himalayan Mountains, is the wellspring of the Yamuna. The river Yamuna, a major tributary of river Ganges, starts from the Yamunotri glacial mass close Banderpoonch tops (38°59' N, 78°27' E) in the Mussourie scope of the lower Himalayas at an height of around 6387 m above mean ocean level in region Uttarkashi (Uttranchal).

The catchment of Yamuna river framework spreads parts of Uttar Pradesh, Uttranchal, Himachal Pradesh, Haryana, Rajasthan, Madhya Pradesh and National Capital Territory (NCT) Delhi. The whole Yamuna river right from its inception to intercection with the Ganga and its tributaries are subject to human exercises, which straightforwardly or in a roundabout way influence the water quality.

NCT — Delhi, placed at a scope of 28°34'n and longitude of 77°07'e, is confronting the difficulties of sanitation and ecological corruption because of expanding populace and urbanization. Delhi alone helps around 3 296 MLD/day of sewage by excellence of channels out falling in Yamuna Delhi fragment stream (22 km length). This is more than that of every last one of class II urban communities of India set up together. Regardless of the most modest rate of catchment range in Yamuna, just 0.4% of all out catchment territory, Delhi is the biggest supporter of pollution to the river.

TEST COLLECTION

Test accumulation is an extremely paramount piece of river study since conclusions drawn are built just in light of the testing of gathered examples. The reason for taking specimens is to acquire data, which somehow embodies the oceanic framework from which examples are drawn. Get Examining strategy was embraced as proposed by Standard Method for microbiological examination. Tests were gathered amid lean season, on month to month premise, for a time of four months from March 2004 to June 2004. Three sets of water specimens, from each one inspecting area also for each inspecting date, were gathered for this study.

Test preservation and storage - Microbiological dissection of water examples was begun at the earliest opportunity after accumulation to keep away from erratic changes in the microbial populace. As the specimens can't be handled inside 1 h after accumulation, in this way for most exact results, examples were accumulated frosted protected compartment, amid transport from Delhi to IIT Roorkee lab.

Investigation of samples - The Samples were investigated as per the standard techniques. The methods, instruments and standards included in touching base at distinctive parameters are arranged in Table.

Parameters	Principle	Instruments/ technique used	Observed values		
			Minimum	Maximum	Average
Temperature, °C	Metric	Thermometer	19	36	28
pH	Metric	Digital pH meter	7	9.2	7.5
TDS, mg/l	Metric	Digital TDS meter	190	700	460
Turbidity, NTU	Nephelometric	Digital Turbidity Meter	3.6	52.0	32.1
DO, mg/l	Volumetric	Modified Winkler's method Titrant — N/40 $Na_2S_2O_3$ Ind — starch	0.0	8.2	1.5
BOD, mg/l	Volumetric	Winkler's method, incubation for 3 days at 27°C (IS : 3025 part 4, 1993)	3.0	52.0	34.2
COD, mg/l	Closed Reflux, colorimetric	Hach COD system (DR/ 4000 U spectrophotometer) set at λ = 600 nm	6.0	120.0	75.5
TC, MPN/100 ml	MPN index	Lauryl tryptose broth, incubation temperature 35 ± 0.5°C for 24 h to 48 h	2.1E04	4.3E07	9.3E06
FC, MPN/100 ml	MPN index	EC Medium, incubation temperature 44.5 ± 0.2°C for 24 ± 2 h	3.9E03	3.9 E 07	4.6 E 06
HPC, CFU/ml	Total plate count	Pour plate method, plate count agar, incubation temperature 35°C for 48 h, digital colony counter	2.4E03	1.5E06	2.6E05
Coliphages, per ml	Equations (APHA 9211 D 3)	Inte-relationship between TC and coliphages, FC and coliphages	5.2E03	9.0E08	1.2E08
Helminth eggs, per ml	Microscopic count	Modified Bailenger method, centrifuge (1000 g), compound microscope	5	38	23

Table : Summary of analytic methods and observed values

RESULTS AND DISCUSSION

Broke down O2 went between 2.5 to 8.6 mg/l. amid summer, 3.0 to 5.0 amid blustery and 3.0 to 10.4 mg/ml. amid winter. Low level of DO is again demonstrative of contaminated nature of water body. Such low level of oxygen was likewise noted by Iqbal et al. (2006) on expansion of sewage waste from human settlements to Dal Lake.

Broke up oxygen demonstrates an opposite association with water temperature. Higher estimations of DO saw amid winter, when temperature was least, may be because of the way that the dissolvability of oxygen in water expands with reduction in temperature (Singh et al., 1980; Ali, 1999). Chemical Oxygen Demand is a measure of the oxidation of lessened chemicals in water. It is ordinarily used to by implication measure the measure of organic mixes in water (Kumar et al. 2011). The measure of COD decides the amount of organic matter found in water.

This makes COD valuable as a pointer of organic pollution in surface water (Faith, 2006). COD indicating a crumbling of the water quality created by the release of mechanical profluent (Mamais et al., 1993). It is a measure of the aggregate amount of oxygen needed to oxidize all organic material into carbon dioxide and water. COD qualities are constantly more noteworthy than BOD values.

The variety is predominantly related with the temperature of environment and climate conditions. Higher temperature amid summer was because of more noteworthy warming (Adebowale and Sawyer 2008). ph of the oceanic framework is a paramount pointer of the water quality and the degree pollution in the watershed ranges. ph was recorded to be changing from 7.2 to 8.43in late spring, whileas 7.0 to 8.2 in downpours and 7.3 to 8.5 in winter amid the study period.

It has been said that the expanding ph seem, by all accounts, to be connected with expanding utilization of antacid cleansers in local locations and basic material from wastewater in modern zones (Chang, H., 2008). The TDS qualities have a tendency to be weakened by surface spillover and for most rivers there are a converse connection between release rate and TDS (Charkhabi and Sakizadeh, 2006).

CONCLUSIONS

During the most recent 20 years, the yearly normal worth of BOD, TC and FC esteem, in river Yamuna, has increments from 17.0 mg/l to 34.2 mg/l, 2.06 E05 MPN/ 100 ml to 9.3 E06 MPN/100 ml and 1.4 E05 MPN/100 ml to 4.6 E06 MPN/100 ml, separately. The BOD quality builds by 100 percent, TC and FC Values expanded to 4000 % and 3000 % fold, separately. The moderately higher build in Microbiological pollution burden demonstrates that little accentuation was given to control of the microbial nature of effluents being released in river.

The high estimations of microbial markers and pathogens recognized uncovered that the microbiological nature of water was poor, dangerous and not worthy actually for the least DBU. The crumbling in water quality is found because of the consistent outfalls of 23 channels convey wastewater to river Yamuna amid Delhi Section. Roughly 3296 MLD/day of sewage by goodness of above channels outfalls in Yamuna.

In spite of the above situation, the populace of Delhi broadly utilize the water of river Yamuna for different purposes. The aftereffects of the study have uncovered the requirement for arranging what's more usage of different pollution reduction measures for development in the river water quality according to necessity of DBU.

REFERENCES

- A H EL-Shaarawi and R E Kwiatkowski. 'Statistical Aspects of Water Quality Monitoring'. Elsevier Science Publishers, New York, 1985.
- American Public Health Association (APHA) (1999). Standard methods for the examination of water and wastewater (20th ed.). Washington D.C.: APHA, AWWA, Washington D.C1999.
- Arch Hydrobiol Suppl, vol 0945-3748/95/0101, 1995, pp 405 - 426.
- B.Abida, Harikrishna, (2008). Study on the Quality of Water in Some Streams of Cauvery River, E- Journal of Chemistry, 5(2008) 377-384.
- C J Hurtz, R L Crawford, M J Mclnerney and L D Stetzenbach. 'Manual of Environmental Microbiology'. Second Edition, ASM Press, Washington, 2002.
- C N Sawyer, P L McCarty and G F Parkin. 'Chemistry for Environmental Engineering'. Fifth Edition, Tata McGraw-Hill Publication Co Ltd, New Delhi, 2003.
- CPCB. 'Water Quality Status of Yamuna River'. Assessment and Development Study of River Basin Series: ADSORBS, vol 32, 1999 -2000.

- EPA, Methods for chemical analysis of waters, method 353.3. EPA. Washington D.C. US, 1979.
- F A Gaudy. 'Microbiology for Environmental Scientists and Engineers'. McGraw Hill International Book Company, 1998.
- J A Tree and M R Adams. 'Chlorination of Indicator Bacteria and Viruses in Primary Sewage Effluent'. Journal of Applied and Environmental Microbiology, vol 69, no 4, 2003, pp 2038 - 2043.
- Metcalf and Eddy. 'Wastewater Engineering Treatment Disposal and Reuse'. Tata McGraw-Hill Publication Co Ltd, New Delhi, 2003.
- N Kumar. 'Pollution Studies on River Ramganga at Moradabad'. ME Thesis, Env Engg Section, Civil Engg Deptt, UOR, Roorkee, 1997.
- NHMRC. 'Microbial Indicators of Water Quality'. An NHMRC Discussion Paper, 2001.
- S Aggarwal and R C Trevedi. 'Ecological Analysis of The River Yamuna — a Functional Approach in a Diversified Ecosystem in India'.
- S J Arceivala. 'Wastewater Treatment and Disposal'. Marcel Dekker, Inc Newyork and Basal, 1981.
- V. Shankar, R.P.S. Sangu, G.C. Joshi, 'Impact of distillery effluents on the water quality an eco-system of river Reh in DoonValley'.Poll. Res,5(1986)137-142.
- World Health Organization. 'Water Quality: Guidelines, Standards and Health'. IWA Publishing, 2002, London.