Environment and Ecology 43 (3A) : 954—963, July—September 2025
Article DOI: https://doi.org/10.60151/envec/WBPW8179
ISSN: 0970-0420 (Print), ISSN: 3049-3625 (Online)

Assessment of Water Quality of Different Water Bodies in and around Delhi, India

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Received 22 June 2025, Accepted 10 September 2025, Published on 25 September 2025

ABSTRACT

Water quality plays a crucial role in sustaining ecosystems, supporting agriculture, and safeguarding human health. This study assessed the physico-chemical characteristics of water samples collected from three distinct water bodies in the Delhi-NCR region: The Yamuna River in Haryana, a natural pond at Sunder Nursery in Delhi, and a village pond in Greater Noida. Parameters including chemical oxygen demand (COD), dissolved oxygen (DO), free carbon dioxide, chloride, alkalinity, sulphate concentration, and total dissolved solids (TDS) were analyzed to evaluate pollution levels and their potential impacts. The results revealed marked site-specific variations, with Delhi water exhibiting the highest COD (48 mg/L), sulphate (7.1 mg/L), and TDS (1480 ppm), indicating heavy contamination from urban and industrial sources. The Yamuna sample showed critically low DO (0.125 mg/L) and elevated chloride (298 mg/L), reflecting the combined influence of sewage discharge, industrial effluents and agricultural runoff. Comparatively, the Noida Pond displayed relatively better water quality, although still impacted by moderate bicarbonate alkalinity and chloride levels. These findings highlight significant risks to agricultural productivity, as polluted irrigation water can alter soil chemistry, reduce crop yields, and lead to long-term soil salinity and toxicity. Overall, the study underscores the urgent need for improved wastewater management, stricter regulation of agricultural and industrial discharges, and community-level awareness to safeguard water quality, ensure agricultural sustainability and protect public health in the Delhi-NCR region.

Keywords Water quality, Assessment, Dissolved oxygen, Water bodies, Public health.

INTRODUCTION

Water quality is a pivotal element for sustaining environmental health and promoting human well-being. India is endowed with an abundance of diverse and unique traditional water bodies distributed across the nation (Asim and Rao 2021). These water bodies play an essential role in maintaining and restoring ecological balance. They continue to serve as sources of

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clean drinking water, recharge groundwater reserves, mitigate flooding, support biodiversity and provide livelihood opportunities, particularly in rural areas.

However, these vital resources have been subjected to continuous and intense stress, largely driven by rapid urbanization and unplanned development (Li *et al.* 2017). The resulting decline in both the quality and quantity of water bodies has significantly diminished their capacity to deliver critical economic and environmental services.

Increased water pollution poses a significant environmental challenge with profound impacts on ecosystems, human health, and biodiversity. This issue stems from various anthropogenic activities introducing pollutants into water bodies (Kamaruddin *et al.* 2017). The Yamuna River, a tributary of the sacred Ganga, is one of the most polluted rivers in the Delhi-NCR region (Arora and Keshari 2021), drawing attention due to excessive foaming in recent years. This phenomenon is linked to the overuse of surfactants and the discharge of untreated domestic and textile wastewater into the river (Arora *et al.* 2023). Industrial facilities and factories contribute to water pollution by releasing heavy metals, chemicals, and toxins into rivers and streams, adversely affecting aquatic life and water quality (Brown and Tregunna 1967). Similarly, agricultural practices involving fertilizers, pesticides and herbicides lead to runoff carrying excess nutrients and chemicals into water bodies, resulting in algal blooms and contamination.

Urban stormwater runoff introduces pollutants such as oil, heavy metals and debris into rivers and oceans, degrading water quality and aquatic habitats (Falkenberg *et al*. 2020). Improper disposal of household waste, including plastics, pharmaceuticals, and hazardous materials, further contaminates water sources, threatening aquatic ecosystems and human health (Stets *et al.* 2017, Brown and Tregunna 1967). Additionally, inadequate sewage and wastewater treatment releases pathogens, nutrients and pollutants into water bodies, fostering waterborne diseases and ecosystem degradation. Atmospheric deposition of pollutants, including mercury and persistent organic pollutants, exacerbates water pollution through precipitation.

Fig. 1. Sampling location in Haryana (NCR): Yamuna River flowing through Gurugram..

As part of the study, water samples were collected from three distinct locations to capture a broad spectrum of environmental conditions and contamination sources. These include the Haryana sample (Fig. 1), obtained from the banks of the Yamuna River; the Delhi sample (Fig. 2), sourced from a natural pond at Sunder Nursery; and the Greater Noida sample (Fig. 3), taken from a pond in Kasna village, which serves as a drinking water source for residents. This diverse collection strategy facilitates a comprehensive assessment of water quality variations and their potential impacts.

This study systematically evaluates water quality across different geographical regions, encompassing urban, rural and industrial areas. A comprehensive set of parameters is employed, including chemical tests for oxygen content, carbon dioxide content, nitrate, sulfate, carbonate, bicarbonate, chloride concentration and pollutant phosphate levels, providing valuable insights into water quality dynamics and

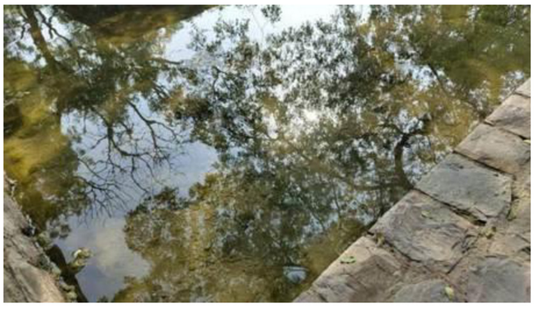

Fig. 2. Sampling location in Delhi: Natural Pond at Sunder Nursery.

Fig. 3. Sampling location in Greater Noida (UP): Village Pond in Kasna.

challenges.

MATERIALS AND METHODS

Estimation of chemical oxygen demand (COD)

A water sample (50 mL) was taken and pipetted into a 500 mL conical flask. Subsequently, 25 mL of standard potassium dichromate solution (0.0125 N) and 50 mL of concentrated sulfuric acid were added carefully. One gram each of silver sulfate ($AgSO_4$) and mercuric sulfate ($HgSO_4$) was incorporated to minimize interferences. Two to three boiling chips were introduced into the flask to prevent bumping during reflux. A reflux condenser was attached, and the mixture was heated on a heating mantle for two hours. After cooling, the condenser was rinsed with distilled water, and the washings were collected in the flask. Approximately 0.5 mL of ferroin indicator solution was added to the flask. The unreacted dichromate was titrated with standard ferrous ammonium sulfate solution until the endpoint was reached. The color change from blue to reddish-brown indicated the endpoint of the titration.

Table 1. Chemical oxygen demand observation table.

Samples	Initial (ml)	Final (ml)	Difference (ml)	COD mg/l
Noida	0	1.1	1.1	40
Haryana (Yamuna)	1.1	2.3	1.2	44
Delhi (Sunder Nursery)	2.3	3.3	1	48
Distilled water (for reference)	0	2.2	2.2	———

To ensure accuracy, the procedure was repeated several times, and concordant readings were noted. A blank titration was performed using distilled water to correct for reagent impurities and establish a baseline (Wojnárovits *et al.* 2024). Table 1 provides a summary of the experimental results and key observations.

Estimation of dissolved oxygen (DO) by Winkler's method

Two hundred and fifty mL of BOD bottles were filled with the water sample, avoiding the inclusion of air bubbles. Using a calibrated pipette, 2 mL of manganese sulfate solution was added to the sample. It was ensured that the pipette tip remained below the liquid's surface to prevent air introduction. Similarly, 2 mL of alkaline potassium iodide-azide solution was added. The bottle is stoppered and inverted several times to mix the contents thoroughly. The formation of a brown precipitate (floc) is observed. The floc is allowed to settle and mixed again by inverting the bottle repeatedly. This process was repeated until the floc settled consistently. One mL of concentrated sulfuric acid was added just above the liquid surface. The bottle was stopped and mixed well by inverting it multiple times to dissolve the floc. At this stage, the sample is "fixed" and can be stored for up to 8 hrs in a cool, dark place. Transfer 100 mL of the fixed sample to a conical flask. The sample was titrated with sodium thiosulfate solution (0.0125 N) until the solution turned a pale straw color. Two mL of starch solution was added to the flask. A blue color was formed. Titrating continued until the solution turned clear, ensuring the endpoint was reached with

Table 2. Titrant volume used .

Samples	Initial volume (ml)	Final volume (ml)	Difference	Average value (ml)
Noida	0	3	3	
	3	6	3	2.9
	6	8.8	2.8	
Yamuna	0	1	1	
(Haryana)	1	1.9	1.9	1
	1.9	3	1.1	
Delhi	0	1.3	1.3	
(sundar	1.3	2.6	1.3	1.3
nursery)	2.6	4	1.4	

a single drop of titrant (Golomzik *et al*. 1967). The DO concentration is calculated based on the volume of titrant used (Sakai *et al*. 2004). The final results and observations obtained from the experiment are presented in Tables 2 – 3.

Estimation of free carbon dioxide (CO_2)

A 50 mL water sample was measured and transferred into a 100 mL conical flask. Two drops of phenolphthalein indicator were added while gently swirling the flask to ensure proper mixing. The sample was titrated with 0.1 N NaOH solution until a faint pink coloration appeared, indicating the endpoint (Mills *et al.* 2023). The titration was repeated until two concordant readings were obtained to ensure precision and reproducibility. The findings derived from the experiment are illustrated in Table 4.

Estimation of chloride concentration in the water samples

The chloride content in the water sample was estimated using a titration method based on the reaction between chloride ions and silver nitrate ($AgNO_3$) in the presence of potassium chromate as an indicator. A 50 mL water sample was transferred to a clean conical flask. One milliliter (1 mL) of potassium chromate indicator solution was added to the sample, producing a yellow color. A burette was filled with the standard 0.0141 N $AgNO_3$ solution and adjusted to zero. The potassium chromate-containing water sample was titrated with $AgNO_3$ solution. The titration was continued until the color changed from pure yellow to pinkish-yellow or brick red, indicating the formation of a red precipitate of silver chromate (Ag_2CrO_4). The titration was repeated to obtain three concordant values (Berry and Driver 1939). Experimental data and corresponding observations are compiled in Table 4.

Table 3. Calculation for dissolved Oxygen.

Sample	Calculation
Noida	DO= (0.925×2.9)/100×1000 mg/L =0.3625 mg/L
Yamuna (Haryana)	DO= (0.0125×1)/100×1000 mg/L =0.125 mg/L
Delhi	DO= (0.0125×1.3)/100 ×1000 mg/L =0.1625 mg/L

Estimation of alkalinity

A burette was rinsed with 0.02 N H_2SO_4 and then filled with the same solution, ensuring no air bubbles, and adjusted to zero. A 100 mL water sample was measured using a graduated cylinder and transferred to a 250 mL conical flask. A few drops of phenolphthalein indicator were added to the sample, causing the solution to turn pink, indicating the presence of hydroxide ions (OH^-). The sample was titrated with

Table 4. Chemicals used and observations for the estimation of free CO_2 .

Samples	Amount (ml)	Chemical used	Observation	Inference
Noida	50	Phenolphthalein (3 drops)	Light pink color appeared	CO_2 absent
Delhi (Sundar nursery)	50	Phenolphthalein (3 drops)	Light pink color appear	CO_2 absent
Haryana (River Yamuna)	50	Phenolphthalein (3 drops) + 0.2 ml of N/44 H_2SO_4	Light pink color Does not appear	CO_2 present (Titration will be performed)

Table 5. Titration performed for the Haryana sample.

Sample	Initial volume (ml)	Final volume (ml)	Difference (ml)	Average (ml)
Haryana (River Yamuna)	0.3	1	0.7	
	0	0.5	0.5	0.6
	0.5	1.1	0.6	

0.02 N H_2SO_4 until the pink color disappeared, corresponding to the neutralization of hydroxide ions (phenolphthalein alkalinity). To the same solution, a few drops of methyl orange indicator were added, turning the solution yellow. The titration was continued with 0.02 N H_2SO_4 until the color changed from yellow to orange-red, signifying the complete neutralization of carbonate (CO_3^{2-}) and bicarbonate (HCO_3^-) ions (methyl orange alkalinity). The volume of H_2SO_4 used for phenolphthalein and methyl orange endpoints was recorded, and the process was repeated to obtain concordant values (Hemond 1990). A detailed account of the results and observations from the experiment is shown in Table 5.

Estimation of a pollutant sulfate in the water sample

Seven test tubes were prepared for the experiment. Test tube 1 was filled with 10 mL of distilled water, and test tube 2 was filled with 10 mL of the sample water. The remaining five test tubes were filled with standard sulfate solutions in volumes of 2 mL, 4 mL, 6 mL, 8 mL and 10 mL, respectively. To each test tube, 10 mL of sodium chloride-hydrochloric acid (NaCl-HCl) solution was added and stirred to ensure proper mixing. Subsequently, 10 mL of barium chloride ($BaCl_2$) solution was added to each tube and mixed thoroughly using a magnetic stirrer. The volume of each solution was made up to 50 mL with distilled water. The solutions were then transferred into cuvettes and placed in a spectrophotometer. The optical density (OD) of each solution was measured at a wavelength of 420 nm. A standard curve was plotted by graphing the absorbance values against sulfate concentrations of the standard solutions. The sulfate concentration in the sample water was determined by locating the optical density of the sample on the standard curve (Sheen *et al.* 2002). Table 6 outlines the experimental outcomes along with the associated observations.

Table 6. Titration values for chloride estimation.

Samples	Initial volume (ml)	Final volume (ml)	Difference (ml)
Haryana	0	14.9	
	0	14.9	14.9
	0	15.5	
Delhi	0	0	
	0	0	0
	0	0	
Noida	8.2	10.3	
	10.3	13.7	1.7
	15.5	15.5	

Estimation of electrical conductivity

The samples were labelled as Sample 1, Sample 2, and Sample 3 for identification. The electrode of a conductivity meter was immersed in the first water sample (Sample 1), and the conductivity reading was recorded. The same procedure was repeated for Sample 2 and Sample 3. The measurements were conducted at room temperature to minimize temperature-related variations in conductivity (McCleskey *et al*. 2012).

RESULTS AND DISCUSSION

Estimation of chemical oxygen demand (COD)

The Chemical Oxygen Demand (COD) of water samples is an indicator of the amount of oxygen required to oxidize organic and inorganic matter in water. A higher COD value indicates a higher level of pollutants in the water.

The Noida sample had a COD of 40 mg/l. The Haryana sample had a COD of 44 mg/l. The Delhi sample had a COD of 48 mg/l (Table 1).

For the given water samples with COD values of 40 mg/l (Noida), 44 mg/l (Haryana), and 48 mg/l (Delhi), respectively. These values suggest that the third sample has the highest level of pollutants, followed by the second sample, and then the first sample. However, it's essential to interpret these values in the context of local regulations and standards, as acceptable COD levels can vary depending on the intended use of the water and environmental considerations (Kaushik *et al.* 2009). Chemical oxygen demand is defined as the amount of oxygen equivalence consumed in oxidising the organic compounds of a sample by a strong oxidising agent such as dichromate or permanganate under acidic conditions (Gupta and Kulshreshtha 2021). It is expressed in mg/L (PPM), which indicates the mass of oxygen consumed per litre. Microbes proliferate profusely in water containing immense amounts of organic matter; as a result, they use up a lot of oxygen from the water. Thus, indirectly, COD gives an estimate of the amount of organic matter present in water. Water samples from wastewater treatment facilities or natural waters contaminated by domestic and industrial waste as usually tested for COD values.

Estimation of dissolved oxygen (DO) by Winkler's method

The dissolved oxygen of Noida, Haryana and Delhi samples were calculated to be 0.3625 mg/L, 0.125 mg/L and 0.1625mg/L respectively (Table 3).

Noida Water Sample (DO: 0.3625 mg/L). The relatively higher dissolved oxygen level in the Noida water sample suggests that it may have better water quality compared to the other samples. Noida, being a planned city with relatively newer infrastructure, may have better wastewater treatment facilities and less industrial pollution compared to older cities like Delhi (Table 2). Factors contributing to the higher DO levels could include effective sewage treatment, less agricultural runoff (Chen *et al.* 2016), and better management of industrial effluents. The presence of green spaces, such as parks and gardens, in Greater Noida may also contribute to oxygenation through photosynthesis by aquatic plants. Haryana Water Sample (DO: 0.125 mg/L): The significantly lower dissolved oxygen level in the Yamuna water sample indicates severe pollution and poor water quality. The Yamuna River is highly polluted due to a combination of factors, including industrial discharge, untreated sewage, agricultural runoff and religious activities. Industries along the riverbanks, especially in urban areas like Delhi, release a variety of pollutants into the water, reducing the oxygen content. High levels of organic Matter from sewage and agricultural runoff (Chen *et al.* 2016) can lead to increased biochemical oxygen demand (BOD), further depleting oxygen levels as microorganisms decompose organic material (Jouanneau *et al.* 2014). The low DO levels in the Yamuna water sample may have severe implications for aquatic life, leading to fish kills and degradation of aquatic ecosystems. Delhi Water Sample (DO: 0.1625 mg/L): The dissolved oxygen level in the Delhi water sample falls between that of Noida and Yamuna, indicating moderate pollution levels (Wang *et al.* 2022). Delhi, being a densely populated and highly industrialized city, faces significant challenges in managing water pollution. While efforts have been made to improve wastewater treatment and reduce pollution in recent years, the city still struggles with inadequate infrastructure and enforcement of environmental regulations (Bapat *et al.* 2020). Pollution sources in Delhi include industrial discharge, sewage, agricultural runoff, and vehicular emissions, all of which contribute to the depletion of dissolved oxygen in water bodies (Shirayama *et al.* 2001). The moderate DO levels in the Delhi water sample suggest ongoing (Yadav and Khandegar 2019) efforts to address pollution issues, but more comprehensive measures are needed to improve water quality and protect aquatic ecosystems.

Estimation of free carbon dioxide (CO_2)

Free CO_2 (mg/ml) = Vol. of NaOH × Normality of NaOH × Equivalent wt of CO_2 × 1000

Volume of water sample used.
Equivalent wt, of CO_2 = 44

Normality of NaOH = 1/44 N

Free CO_2 present in Haryana sample = (0.6 × 1000) / 50 = 12 mg/ml

The results of our experiment indicate a striking disparity in the levels of free carbon dioxide across water samples from different regions (Table 4). Surprisingly, no detectable amounts of free carbon dioxide were found in the water samples from Noida and Delhi, suggesting potentially different

Table 7. Calculation of the amount of carbonates, bicarbonates, and hydroxides. The following table shows the relationship between different kinds of alkalinity:

Samples	Value expressed in terms of $CaCO_3$ mg/L Results of titration	Hydroxide (mg/L)	Carbonate (mg/L)	Bicarbonate (mg/L)
Delhi sample	P=0, M=5.77 P=0	0	0	5.77
Haryana sample	P=0, M=4.96 P=0	0	0	4.96
Noida sample	P=0.366, M=2 i,e P < 1/2 M	0	2P=0.732	M-2P=1.286

environmental factors influencing gas solubility or perhaps effective water treatment processes in these areas (Loosdrecht *et al.* 2010). In contrast, the water sample from Haryana exhibited a substantial presence of free carbon dioxide at 12 mg per ml, highlighting a possible variation in geological or anthropogenic influences on water quality (Table 5). Further analysis and comparison with regional geological data and industrial activities (Yadav and Khandegar 2019) may provide insights into the underlying factors driving these discrepancies, shedding light on potential implications for water management and environmental health in these regions.

Estimation of chloride concentration

Calculation: Chloride (mg/L): Volume of silver nitrate used *1000/mL of water sample taken.

Chloride (Haryana) = 14.9*1000/50 = 298 mg/L

Chloride (Noida) = 1.7*1000/50 = 34 mg/L

Chloride (Delhi) = 0*1000/50 = 0 mg/L

The chloride concentrations in the water samples from Haryana, Noida, and Delhi, calculated on the basis of Table 6, are 298 mg/L, 34 mg/L, and 0 mg/L, respectively, showcasing substantial variations reflecting different environmental conditions and potential sources of contamination across these regions. The notably high chloride level in Haryana's sample could be indicative of agricultural activities, industrial discharges, or natural geological processes contributing to chloride contamination (Dugan *et al.* 2020) in the water source. Conversely, the presence of chloride in Noida's sample suggests potential anthropogenic sources such as urban runoff, industrial effluents, or sewage discharge. The absence of chloride in Delhi's sample could imply effective water treatment processes or a relatively lower impact of chloride-contributing activities in the region (Berry and Driver 1939).

Estimation of alkalinity

The alkalinity of water samples from Delhi, Haryana, and Noida presents notable variations, as evidenced by their respective hydroxide, carbonate, and bicarbonate concentrations expressed in terms of calcium carbonate (Table 7). In the case of Delhi's water sample, no detectable amounts of hydroxide, carbonate, or bicarbonate were observed, suggesting a relatively neutral pH and minimal alkalinity (Despland *et al.* 2010).

Conversely, the water sample from Haryana exhibited a low hydroxide concentration of 0 mg per liter, indicating a lack of basic ions, while the carbonate concentration was also negligible. However, the bicarbonate concentration was notably higher at 4.96 mg per liter, indicating a predominantly bicarbonate alkalinity. Interestingly, the water sample from Noida displayed a similar absence of hydroxide and carbonate ions but demonstrated a substantial bicarbonate concentration of 1.268 mg per liter. This suggests a moderate bicarbonate alkalinity in Noida's water, potentially influenced by geological factors or anthropogenic activities (Yadav and Khandegar 2019). Overall, these findings underscore the importance of

Table 8. Experimental outcomes along with the associated observations.

Sl. No. (Test tubes)	Standard Sulphate solution (ml)	NaCl.HCL (ml)	BaCl2 (ml)	Water makeup (50 ml)	OD
1	0	10	10	50 (Haryana sample)	0.178
2	0	10	10	50 (Noida sample)	0.097
3	0	10	10	50 (Delhi sample)	0.415
2	2	10	10	50 (Distilled water)	0.112
3	4	10	10	50 (Distilled water)	0.232
4	6	10	10	50 (Distilled water)	0.333
5	8	10	10	50 (Distilled water)	0.462
6	10	10	10	50 (Distilled water)	0.595

assessing alkalinity components comprehensively, as they provide crucial insights into water quality and potential impacts on aquatic ecosystems and human health in different regions.

Estimation of pollutant "sulfate" in the water sample

Using the plotted standard curve from the data of Table 8, the sulfate content in water samples from Noida, Haryana and Delhi was determined as 1.8 mg/L, 3.5 mg/L and 7.1 mg/L, respectively.

The variation in sulfate concentration among water samples from Noida, Haryana, and Delhi, with values of 1.8 mg/l, 3.5 mg/l, and 7.1 mg/l, respectively, suggests geographical disparities or differences in water sources and local environmental conditions. The higher concentration observed in Delhi's water sample may be attributed to various factors such as industrial discharge, urban runoff and agricultural practices, as Delhi is a densely populated and industrialized urban area (Yadav and Khandegar 2019). On the other hand, Noida and Haryana, while also urbanized to some extent, may have different land use patterns and industrial activities, leading to comparatively lower sulphate levels (Sharma and Kumar 2020).

Measurement of electrical conductivity

The TDS value of the Noida sample, the Haryana sample, and the Delhi sample was 146 ppm, 585 ppm, and 148*10 ppm, respectively.

Different Total Dissolved Solids (TDS) (Samuel, 2022) levels in water can have varying effects on the body. Higher TDS levels may lead to a salty or metallic taste, while lower TDS levels may taste purer. It's important to note that consuming water with extremely high TDS levels may not be suitable for drinking. High TDS levels in water can potentially have health risks. Drinking water with high TDS may contribute to mineral imbalances in the body. It can also affect the taste and odor of the water (Brent *et al.* 2022). It's generally recommended to consume water with TDS levels below 500 milligrams per liter for optimal health (Wang 2021). The significant disparity in Total Dissolved Solids (TDS) values among water samples from Noida, Haryana and Delhi, with measurements of 146 ppm, 585 ppm, and 1480 ppm, respectively, highlights distinct variations in water quality across these regions. The elevated TDS level in the Delhi sample suggests a higher concentration of dissolved solids (Yadav and Khandegar 2019), potentially stemming from industrial effluents, agricultural runoff, and urban activities characteristic of a densely populated metropolitan area. In contrast, the relatively lower TDS values in Noida and Haryana could indicate differences in land use practices, geological formations, and water treatment processes (Loosdrecht *et al.* 2010).

CONCLUSION

Maintaining and monitoring water quality is vital for ecological balance and human health (Dey and Vijay 2021). Our findings indicate that water bodies in Noida are relatively less polluted compared to those in Delhi and Haryana. However, none are entirely safe for consumption or domestic use. Pollutants present in these waters pose risks of gastrointestinal, dermatological, and even long-term organ damage (Asim and

Rao 2021). Additional toxic contaminants, beyond the scope of this study, may also be present, underscoring the need for remedial measures by authorities.

The discussion highlights how human activities such as industrial discharge, agricultural runoff, and improper waste disposal can directly impair water quality (Chen *et al.* 2016). Effective management requires collaborative efforts among policymakers, industries, communities, and individuals to enforce regulations, adopt eco-friendly practices (Ding and Zeng 2022), and raise awareness. Ultimately, safeguarding water quality demands a holistic approach that integrates scientific research, sustainable practices, and collective responsibility to ensure clean and secure water resources for future generations.

ACKNOWLEDGMENT

The authors are grateful to the University of Delhi's Gargi College for all of their assistance with this research.

REFERENCES

Arora, J., Ranjan, A., Chauhan, A., Rajput, V. D., Sushkova, S., Prazdnova, E. V., Minkina, T., Biswas, R., Joshi, S., Jindal, T., & Prasad, R. (2023). A Novel Study on Anionic Surfactant Degradation Potential of Psychrophilic and Psychrotolerant Pseudomonas spp. Identified from Surfactant-contaminated River Water. *Applied Biochemistry and Biotechnology*, 196, 2612—2629. https://link.springer.com/article/10.1007/s12010-023-04647-y

Arora, S., & Keshari, A. K. (2021). Dissolved oxygen modelling of the Yamuna River using different ANFIS models. *Water Science & Technology*, 84 (10-11), 3359—3371. https://doi.org/10.2166/wst.2021.466

Asim, M., & Rao, K. N. (2021). Assessment of heavy metal pollution in Yamuna River, Delhi-NCR, using heavy metal pollution index and GIS. *Environmental Monitoring and Assessment*, 193,103. https://link.springer.com/article/10.1007/s10661-021-08886-6

Bapat, S., Jaspal, D., & Malviya, A. (2020). Integrated textile effluent treatment method. *Water Environment Research*, 93 (7), 1060—1076. https://doi.org/10.1002/wer.1494

Berry, A. J., & Driver, J. (1939). Observations on the use of potassium chromate as indicator for the titration of chlorides with silver nitrate. *Analyst*, 64, 730—734. Https://pubs.rsc.org/en/content/articlelanding/1939/an/an9396400730

Brent, R. N., Kunkel, J., Tomek, Z., Buchardt, D., DeLisle, P. F., & Sivers, S. (2022). A Novel Approach to Developing Thresholds for Total Dissolved Solids Using Standardized and Experimental Toxicity Test Methods. *Environmental Toxicology and Chemistry*, 41 (11), 2782—2796. https://doi.org/10.1002/etc.5466

Brown, D. L., & Tregunna, E. B. (1967). Inhibition of respiration during photosynthesis by some algae. *Canadian Journal of Botany*, July 1967. https://doi.org/10.1139/b67-118

Chen, Y. J., Hu,W. X., Pang, S. J., & Wang, X.Y. (2016). Spatial Distribution Characteristics and Source Analysis of Dissolved Organic Matter in Beiyun River. *Huan Jing Ke Xue*, 37(8), 3017—3025. DOI: 10.13277/j.hjkx.2016.08.024

Despland, L. M., Clark, M. W., Aragno, M., & Vancov, T. (2010). Minimising alkalinity and pH spikes from Portland cement-bound Bauxsol (seawater-neutralized red mud) pellets for pH circum-neutral waters. *Environ Science & Technology*, 44 (6), 2119—2125. https://doi.org/10.1021/es9032138

Dey, J., & Vijay, R. (2021). A critical and intensive review on assessment of water quality parameters through geospatial techniques. *Environ Science & Pollution Research*, 28 (31), 41612—41626. https://pubmed.ncbi.nlm.nih.gov/34105074/

Ding, M., & Zeng, H. (2022). A bibliometric analysis of research progress in sulfate-rich wastewater pollution control technology. *Ecotoxicology and Environmental Safety*, 238, 113626. https://doi.org/10.1016/j.ecoenv.2022.113626

Dugan, H. A., Skaff, N. K., Doubek, J. P, Bartlett SL, Burke SM, Krivak-Tetley, F. E., Summers, J. C., Hanson, P. C., & Weathers, K. C. (2020). Lakes at Risk of Chloride Contamination. *Environ Science & Technology*, 54 (11), 6639—6650. https://doi.org/10.1021/acs.est.9b07718

Falkenberg, L. J., Bellerby, R. G. J., Connell, S. D., Fleming, L. E., Maycock, B., Russell, B. D., Sullivan, F. J., & Dupont, S. (2020). Ocean Acidification and Human Health. *International Journal of Environmental Research & Public Health*, 17 (12), 45—63. https://pmc.ncbi.nlm.nih.gov/articles/PMC7344635/

Golomzik, A. I., Kovalenko, K. P., & Briantsev, I. V. (1967). Modification of Winkler's method for assay of dissolved oxygen in acid solutions. *Mikrobiologiia*, 36 (2), 355—360. https://pubmed.ncbi.nlm.nih.gov/4899309/

Gupta, S., & Kulshreshtha, P. (2021). Perspectives in Practical Ecology. Prestige publisher, India.

Hemond, H. F. (1990). Acid neutralizing capacity, alkalinity, and acid-base status of natural waters containing organic acids. *Environmental Science & Technology*, 24 (10), 1486—1489. https://pubs.acs.org/doi/10.1021/es00080a005

Jouanneau, S., Recoules, L., Durand, M. J., Boukabache, A., Picot, V., Primault, Y., Lakel, A., Sengelin, M., Barillon, B., & Thouand, G. (2014). Methods for assessing biochemical oxygen demand (BOD): A review. *Water Research*, 49, 62—82. https://doi.org/10.1016/j.watres.2013.10.066

Kamaruddin, M. A., Yusoff, M. S., Rui, L. M., Isa, A. M., Zawawi MH, & Alrozi, R. (2017). An overview of municipal solid waste management and landfill leachate treatment: Malaysia and Asian perspectives. *Environmental Science & Pollution Research*, 24 (35), 26988—27020. https://pubmed.ncbi.nlm.nih.gov/29067615/

Kaushik, A., Kansal, A., Meena, S., Kumari, S., & Kaushik, C.P. (2009). Heavy metal contamination of river Yamuna, Haryana, India: Assessment by Metal Enrichment Factor of the Sediments. *Journal of Hazardous Materials*, 164 (1), 265—270. https://doi.org/10.1016/j.jhazmat.2008.08.031

Li, J., Luo, G., He, L., Xu, J., & Jinze, Lyu. (2017). Analytical Approaches for Determining Chemical Oxygen Demand in Water Bodies: A Review. *Critical Reviews in Analytical Chemistry*, 48(1), 47—65. https://www.tandfonline.com/doi/full/10.1080/10408347.2017.1370670

Loosdrecht, M. C. M., Nielsen, P. H., Lopez-Vazquez, C. M. & Brdjanovic, D. (2010). Experimental Methods In Wastewater Treatment. Published by IWA Publishing, London, UK. ISBN: 9781780404745 (Hardback), ISBN: 9781780404752 (eBook).

McCleskey, R. B., Nordstrom, D. K., & Ryan, J. N. (2012). Comparison of electrical conductivity calculation methods for natural waters. *Limnology and Oceanography*, 10 (11), 952—967. https://aslopubs.onlinelibrary.wiley.com/doi/10.4319/lom.2012.10.952

Mills, A., McDonnell, L., & Yusufu, D. (2023). Colorimetric CO_2 Indicators. *Accounts of Material Research*, 4 (7), 570—579. https://pmc.ncbi.nlm.nih.gov/articles/PMC10391618/

Sakai, T., Piao, S., Teshima, N., Kuroishi, T., & Grudpan, K. (2004). Flow injection system with in-line Winkler's procedure using 16-way valve and spectrofluorimetric determination of dissolved oxygen in environmental waters. *Talanta*, 63(4), 893—898. https://pubmed.ncbi.nlm.nih.gov/18969515/

Samuel, R. (2022). Total Dissolved Solids (TDS) Less Than 1000 ppm in Drinking Water Did Not Impact Nursery Pig Performance. *Veterinary Sciences*, 9 (11), 622. https://doi.org/10.3390/vetsci9110622

Sharma, M. K., & Kumar, M. (2020). Sulfate contamination in groundwater and its remediation: an overview. Environmental Monitoring and Assessment, 192 (2). https://doi.org/10.1007/s10661-019-8051-6

Sheen, R.T., Kahler, H. L., Ross, E. M, & Bet, W. H. (2002). Turbidimetric Determination of Sulfate in Water. *Industrial & Engineering Chemistry Analytical Edition*, 7 (4) In press. https://doi.org/10.1021/ac50096a022

Shirayama, H., Tohezo, Y., & Taguchi, S. (2001). Photodegradation of chlorinated hydrocarbons in the presence and absence of dissolved oxygen in water. *Water Research*, 35(8), 1941—1950. https://doi.org/10.1016/S0043-1354(00)00480-2

Stets, E. G., Butman, D., McDonald, C. P., Stackpoole, S. M., DeGrandpre, M. D., & Striegl, R. G. (2017). Carbonate buffering and metabolic controls on carbon dioxide in rivers. *Global Biogeochemical Cycles*, 31 (4), 663—677. https://doi.org/10.1002/2016GB005578

Wang, B. B. (2021). Research on drinking water purification technologies for household use by reducing total dissolved solids (TDS). *PLoS ONE*, 16 (9), e0257865. https://doi.org/10.1371/journal.pone.0257865

Wang, Z., Wang, C., Jiang, H., & Liu, H. (2022). Higher dissolved oxygen levels promote downward migration of phosphorus in the sediment profile: Implications for lake restoration. *Chemosphere*, 301, 134705. https://doi.org/10.1016/j.chemosphere.2022.134705

Wojnárovits, L., Homlok, R., Kovács, K., Tegze, A., & Takács, E. (2024). Wastewater Characterization: Chemical Oxygen Demand or Total Organic Carbon Content Measurement ? *Molecules*, 29 (2), 405. https://doi.org/10.3390/molecules29020405

Yadav, A., & Khandegar, V. (2019). Dataset on assessment of River Yamuna, Delhi, India using indexing approach. *Data in Brief*, 22, 1—10. https://doi.org/10.1016/j.dib.2018.11.130