International Journal of Research Publication and Reviews, Vol 4, no 2, pp 13-16, February 2023

WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

A Case Study on the Determination of the Water Quality from Different Point Sources of North 24 Parganas, West Bengal

Debadip Bhattacharjee[1],Anwesa Manna[2], Uma Kumari[3], Pinku Chandra Nath[4], Anindya Gopal Chatterjee[5], Tamoghna Karmakar[6], Taniya Sur[7], Soumak Sadhu[8*],

[1]*Department of Botany (PMB), North-Eastern Hill University, Shillong, Meghalaya, India.*
[2]*Department of Zoology, Bethune College (University of Calcutta), Kolkata, West Bengal, India.*
[3]*Department of Biotechnology, Radha Govind University, LalkiGhati, Ramgarh, Jharkhand.*
[4]*Department of Bioengineering, National Institute of Technology, Agartala, Tripura, India.*
[5] *Department of Zoology, Raja Peary Mohan College, Kolkata, West Bengal, India.*
[6] *Department of Biochemistry, University of Calcutta, West Bengal, India.*
[7]*School of Biotechnology Kalinga Institute of Industrial Technology University, Bhubaneshwar, Orissa, India*
[8] *Demonstrator in MVLS Department, University of Glasgow, Scotland.*
DOI: https://doi.org/10.55248/gengpi.2023.4201

Abstract:

Our earth is composed of five different elements named air, water, fire, earth, and space. Most of the resources which have been supporting our lives, directly and indirectly, are now polluted due to various human activities which are resulted due to various societal advancements like rapid industrialization, population, etc. to name a few. Among all these, the pollution which has taken place due to these activities in turn has received notable research cognizance. The quality of water is judged by different parameters namely, physical, chemical, and biological. This study deals with the determination of the quality of water from two different point sources (industrial sewage (referred to as point source 1), and domestic sewage (referred to as point source 2)) through the determination of water quality indicators. The various quality indicators adopted in this study dissolved oxygen (DO), pH, electrical conductivity (EC), sulphates, chlorides, phosphates, total solid (TS), total soluble solids (TSS), total dissolved solids (TDS), biochemical oxygen demand (BOD_5), and chemical oxygen demand (COD). The result obtained from these experiments was thought-provoking and indicated that the quality of the water specimens used in this study was far below the standards. The possible cause might be due to the various activities detailed earlier. The authors truly believe that this present scheme of work will be helpful to a spectrum of stakeholders which will indeed be helpful for decision-making by various national and international agencies.

Keywords: *Water quality parameter; water pollution; environmental impact; biochemical oxygen demand; dissolved oxygen; contamination.*

Introduction:

The ever-increasing human population and the raise in living standards have in turn created a spectrum of entanglements (Roy and Ray 2020; Roy and Ray 2022). A few such entanglements are an increase in the global mean temperature, seawater acidification, ozone layer depletion, etc. Among all these, another major concern is the degradation of the quality of the ground and seawater (Roy and Ray 2019). The various underlying causes behind such deterioration are biological, organic, and inorganic contaminants. Only a small fraction of the effluent is being treated on a daily scale which is approximately 50 million liters (Akram et al. 2018). Since all forms of life are dependent on water, protecting the water is of utmost importance. There are innumerable reasons behind the contamination of water. Few of these reasons are direct and some are indirect (Roy, Debnath, and Ray 2022). Numerous industries and factories directly discharge their effluents (containing heavy metals, chemicals, etc.) into the water bodies, which are considered the direct causes of water contamination. The quality of the drinking water varies depending upon their origin like rivers, ponds, wells, etc. (Nduka et al. 2008). Such water sources may also get contaminated due to various point sources like chemicals, compounds, hazardous materials, pesticides, herbicides, etc. to name a few. The alteration of the physical, chemical, or biological properties of water is termed pollution also have been reported to impact the lives of aquatic as well as other forms of life (Song et al. 2022; Su et al. 2022).

In other words, the term pollution refers to the scenario when there are multiple unwanted particles present within the water which eventually turns the water unusable for various purposes like cooking, bathing, or drinking. The prevention and control of water pollution act 1974 legally define that any pollutants or contaminants within the water, improper discharge of sewage, change in the physical, biological or chemical characteristics, improper effluents trading of solid, liquid, or gaseous contents, etc. are the major factors, which poses threat to the various living organisms (Dey et al. 2022).

The critical consideration of the various parameters followed by their optimization is a crucial step to waive water pollution (Roy et al. 2022). Nowadays, pollution is not only considered in the context of human health but also are considered based on aesthetics and the conservation of the natural form. The microbial community has also been reported to play a critical role in maintaining and defining water quality parameters (Ghoshal et al. 2022; Parveen et al. 2023). Thus, the aim of this study is to evaluate the quality of water collected from two different point sources of North 24 Parganas of West Bengal in order to shed some insights regarding the current status of the quality. The authors firmly believe that this report will definitely be helpful to various stakeholders for decision-making and thereby policy framing for the prevention of water quality which in turn depicts the novelty of this study.

Materials and Methods:

Study area and collection of samples:

The study was carried out based on the two different locations from the North 24 Parganas. To ensure uniform collection, the specimen in the form of water was collected from two different locations for parallel comparison. The water specimen was collected from two feet depth in order to ensure the homogeneity of the specimen (Bai et al. 2013). Immediately after the collection of the specimen, the water specimen was kept in a sterile glass container. “Sample 1” indicated the collection of the water specimen from where the domestic wastes are being discharged directly in the form of a point source and “sample 2” indicated the collection of water specimens as a point source of river water where industrial effluents are mixing up. The specimens were stored at -20°C within 5 hours after collection and were further used for the experimental studies.

Methodology:

In order to determine the water quality metrics, several tests were carried out which is the major focus of this experimental accord. The temperature and the pH of the specimen were measured by using a standard laboratory thermometer and pH meter. The fixed residues and the total dissolved solids were determined by adopting a simple evaporation methodology (Roy et al. 2022). The BOD and COD of the collected water specimens from the two different locations were carried out by following the sodium thiosulphate method as indicated in the literature (Wagner et al. 2002). Atomic absorption spectrophotometer (Perkin Elmer model 5000, PerkinElmer Corp, Waltham, MA, USA) was harnessed to determine the various heavy metals present within the samples under evaluation by following standard literature-established protocols. All the experiments were carried out in triplicates, in order to define the associated errors and the values are represented in the form of mean ± standard deviation. All the chemicals required in this study were procured from Nice® Chemicals (Kerala, India). A schematic representation of the entire experimental procedure was portrayed in Figure 1.

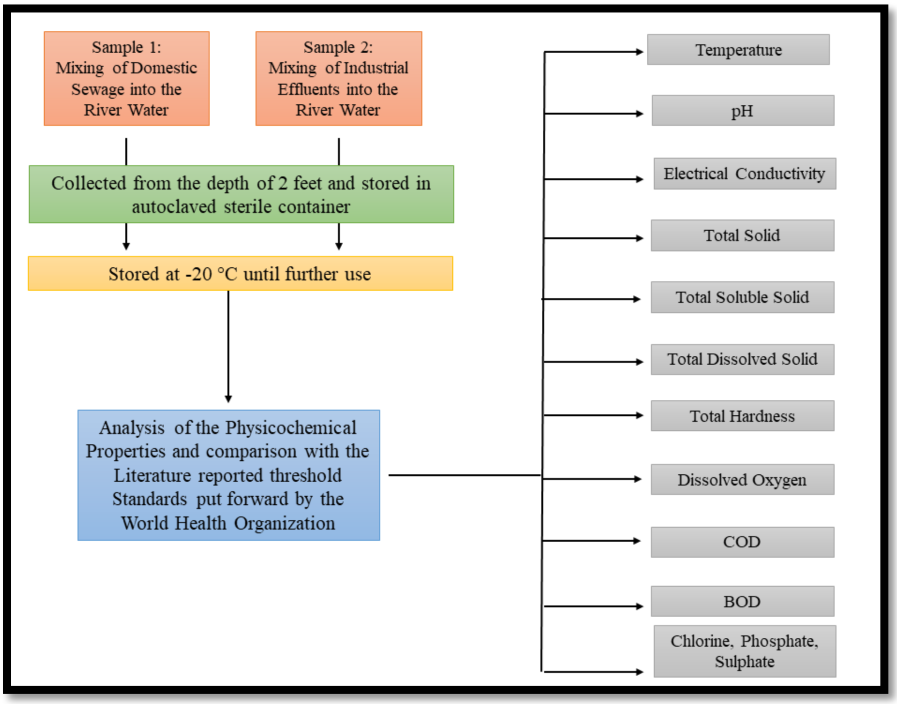

Figure 1. *Schematic experimental plan of the present study.*

Results and Discussions:

The determination of the Total solids (TS), Total dissolved solids (TDS), Total soluble solids (TSS), Total hardness (TH), Dissolved oxygen (DO), Chemical oxygen demand (COD), Biochemical oxygen demand (BOD_5), Phosphate (PO_4), Chlorine (Cl) and Sulphate (SO_4) of the water collected from the two different locations were carried out and have been indicated in Table 1. On a parallel note, the threshold limits for each category as per the recommendation of the World Health Organization have also been provided in Table 1. Consumption of wastewater might cause several diseases including cancer (Roy et al. 2022).

Table 1. *An overview of the physicochemical parameters of collected water samples from three different sewage effluents.*

Serial no.	Parameter	Sample 1 (Domestic sewage)	Sample 2 (Industrial sewage)	Standard as per WHO
1	Temp (°C)	25.552 ± 0.008	26.565 ± 0.013	NA
2	pH	6.787 ± 0.004	5.232 ± 0.006	6.5 – 8.5
3	EC ($\mu S/cm^{-1}$)	636 ± 9.565	798 ± 10.593	NA
4	TS (mg/l)	1289 ± 92.771	1567 ± 112.775	NA
5	TDS (mg/l)	723 ± 81.823	1134 ± 88.078	1000
6	TSS (mg/l)	402 ± 67.892	602.72 ± 45.892	NA
7	TH (mg/l)	198.667 ± 8.723	284.778 ± 14.672	500
8	Chloride (mg/l)	210.567 ±18.778	401.663 ± 17.723	250
9	DO (mg/l)	5.783 ± 0.045	5.122 ± 0.023	NA
10	COD (mg/l)	287.234 ± 21.284	372.119 ± 11.113	250
11	BOD_5 (mg/l)	29.128 ± 0.987	47.389 ± 1.006	NA
12	PO_4 (mg/l)	3.549 ± 0.771	6.332 ± 0.623	0.1
13	SO_4 (mg/l)	28.223 ± 0.996	33.892 ± 1.139	NA

NA indicates Not Available

The data represented in Table 1 indicated that the water temperature is higher where the industrial effluents are piling up. Thus, it may be conferred that the mixing of industrial waste into the water has a detrimental impact on aquatic life. The same trend was noted with the change in pH. The pH of the water turns slightly acidic upon the release of the industrial effluents directly into the river water. In order to identify the availability of the free ions, the electrical conductivity of the water samples collected from the two different locations was determined. It was found that the electrical conductivity of water sample 2 was much higher as compared to that of water sample 1. This in turn indicated that the release of industrial effluents into the river water was not safe at all. The presence of a higher amount of dissolved substance within the water body might result in threatening aquatic life (Bukola et al. 2015). To inspect the amount of dissolved substances, the TDS of the water specimens collected from both locations was determined. All the parameters of the dissolved solids were found to be noted higher in the case of water specimens collected from the point where the industrial effluents are mixing directly. Surprisingly, it was also found that the TDS of sample 2 was way above the threshold limit put forward by the WHO. The total hardness of both the water specimens was found below the threshold limit, however, the TH value of sample 2 was found to be much higher as compared to that of sample 1. The dissolved oxygen of sample 2 was found to be lower than that of sample 1 which in turn indicated the unsuitability of the water (from where sample 2 was collected) to support aquatic life. The presence of a significantly higher amount of chloride was found in sample 2 which in turn indicated that upon addition of the industrial effluents in the river water makes the water unsuitable to support aquatic life. In fact, the chlorine content of sample 2 was higher than the permissible limit which is again thought-provoking. The BOD and COD of the two water samples were determined in order to evaluate the level of existing organic pollutants (Koda et al. 2017). It was found that the COD of both samples was above the threshold value. The BOD of sample 2 was also found to be higher than that of sample 1. These data were indeed thought-provoking. The obtained information was found to be in line with the results obtained from the other parameters considered in this research.

The amounts of sulfate and phosphate in the water samples from the three locations considered in this investigation were also determined. Water sample B was found to contain the greatest concentrations of sulfate and phosphate. The amount of sulfate and phosphate was finally checked for both water samples. It was found that both the parameters were pretty higher in sample 2 as compared to sample 1. Thus, it may be concluded that the release of industrial effluents into the water without any treatment can be harmful to the different life forms present in the river (Vipparla et al. 2022).

Conclusion:

This study deals with a comprehensive analysis in order to determine the impact of the addition of the various point sources of pollution on the quality of the river water. Two different scenarios were considered in this study, in one case the river water was collected where the domestic effluents were piling up (indicated as Sample 1), and in the other case, where the industrial effluents were piling up (indicated as Sample 2). For the purpose of evaluation, initially, the water specimen was collected from both sources. Thereafter, a spectrum of physicochemical characterization was performed. The obtained results indicated that most of the water quality parameters were found to be higher as per the threshold standards defined by the WHO.

Sample 2 which represented the amalgamation of the industrial effluents directly into the river water displayed an apical level of deterioration. The obtained results indicated that the direct release of industrial effluents into the river water might result in the killing and hampering of aquatic lifeforms. Thus, special emphasis should be paid to wastewater treatment before its release into the river.

Conflict of Interest: No potential conflict of interest was reported in this study.

References:

Akram, R., Turan, V., Hammad, H. M., Ahmad, S., Hussain, S., Hasnain, A., ... & Nasim, W. (2018). Fate of organic and inorganic pollutants in paddy soils. Environmental pollution of paddy soils, 197-214.

Bai, B., Elgmati, M., Zhang, H., & Wei, M. (2013). Rock characterization of Fayetteville shale gas plays. Fuel, 105, 645-652.

Bukola, D., Zaid, A., Olalekan, E. I., &Falilu, A. (2015). Consequences of anthropogenic activities on fish and the aquatic environment. Poultry, Fisheries & Wildlife Sciences.

Dey, P., Roy, R., Mukherjee, A., Krishna, P. S., Koijam, R., & Ray, S. (2022). Valorization of Waste Biomass as a Strategy to Alleviate Ecological Deficit: A Case Study on Waste Biomass Derived Stable Carbon. Advanced Microscopy, 167-196.

Ghosal, A., Roy, R., Sharma, K., Mitra, P., & Vora, K. (2022). Antibiofilm activity of Phytocompounds against Staphylococcus aureus biofilm forming Protein-In silicostudy. American Journal of Applied Bio-Technology Research, 3(1), 27-29.

Koda, E., Miszkowska, A., &Sieczka, A. (2017). Levels of organic pollution indicators in groundwater at the old landfill and waste management site. Applied Sciences, 7(6), 638.

Nduka, J. K., Orisakwe, O. E., &Ezenweke, L. O. (2008). Some physicochemical parameters of potable water supply in Warri, Niger Delta area of Nigeria. Scientific Research and Essay, 3(11), 547-551.

Parveen, S., Sur, T., Sarkar, S., & Roy, R. (2023). Antagonist Impact of Selenium-Based Nanoparticles Against Mycobacterium tuberculosis. Applied Biochemistry and Biotechnology, 1-9.

Roy, R., Debnath, D., & Ray, S. (2022). Comprehensive Assessment of Various Lignocellulosic Biomasses for Energy Recovery in a Hybrid Energy System. Arabian Journal for Science and Engineering, 47(5), 5935-5948.

Roy, R., & Ray, S. (2019). Effect of various pretreatments on energy recovery from waste biomass. Energy Sources, Part A: Recovery, Utilization, and Environmental Effects, 1-13.

Roy, R., & Ray, S. (2020). Development of a non-linear model for prediction of higher heating value from the proximate composition of lignocellulosic biomass. Energy Sources, Part A: Recovery, Utilization, and Environmental Effects, 1-14.

Roy, R., & Ray, S. (2022). Upgradation of an Agro-residue by Acid Pretreatment into a Solid Fuel with Improved Energy Recovery Potential: An Optimization Study. Arabian Journal for Science and Engineering, 47(5), 6311-6323.

Roy, R., Sarkar, S., Kotak, R., Nandi, D., Shil, S., Singha, S., ... &Tarafdar, S. (2022). Evaluation of the Water Quality Parameters from Different Point Sources: A Case Study of West Bengal. American Journal of Applied Bio-Technology Research, 3(3), 18-28.

Roy, R., Shil, S., Choudhary, D. K., Mondal, P., Adhikary, P., Manna, U., ... & Maji, M. (2022). Conversion of glucose into calcium gluconate and determining the process feasibility for further scaling-up: An optimization approach. Int. J. Exp. Res. Rev, 27, 1-10.

Roy, R., Srinivasan, A., Bardhan, S., & Paul, T. (2022). Evaluation of the Expression of CD-4 and CD-45 Count among Patients Having Non-Small Cell Lung Cancer. Journal homepage: www. ijrpr. com ISSN, 2582, 7421.

Song, B., Liu, X., Dong, H., & Roy, R. (2022). miR-140-3P Induces Chemotherapy Resistance in Esophageal Carcinoma by Targeting the NFYA-MDR1 Axis. Applied Biochemistry and Biotechnology, 1-19.

Su, Q., Dong, J., Zhang, D., Yang, L., & Roy, R. (2022). Protective effects of the bilobalide on retinal oxidative stress and inflammation in streptozotocin-induced diabetic rats. Applied Biochemistry and Biotechnology, 1-16.

Vipparla, C., Sarkar, S., Manasa, B., Pattela, T., Nagari, D. C., Aradhyula, T. V., & Roy, R. (2022). Enzyme Technology in Biofuel Production. In Bio-Clean Energy Technologies Volume 2 (pp. 239-257). Singapore: Springer Nature Singapore.

Wagner, M., Brumelis, D., &Gehr, R. (2002). Disinfection of wastewater by hydrogen peroxide or peracetic acid: development of procedures for measurement of residual disinfectant and application to a physicochemically treated municipal effluent. Water Environment Research, 74(1), 33-50.