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PHYSICOCHEMICAL ASSESSMENT OF PRE AND POST TREATED SEWAGE WATER OF STP, SAIDPUR PATNA.

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ABSTRACT

Sewage treatment plants (STPs) play a crucial role in mitigating environmental pollution by treating wastewater before it is released into natural water bodies. This study focuses on the physicochemical assessment of sewage water before and after treatment at the Saidpur Sewage Treatment Plant (STP). The primary objective is to evaluate the effectiveness of the treatment process in improving water quality parameters for protecting Catla catla. A study was conducted to assess the quality of untreated waste water of Saidpur Sewage treatment plant (STP). The waste water analysis showed that selected physico-chemical quality parameters were higher than the maximum permissible limits (MPL), however, after its treatment at Saidpur all these parameters approached well with in their respective MPL are adequate for Catla catla. The physicochemical assessment of the Saidpur STP reveals that the treatment processes employed are effective in significantly improving the quality of sewage water. The post-treated water meets the environmental standards for most parameters, demonstrating the plant's capability to reduce pollution load and protect Catla catla.

Keywords: Waste water, Sewage Treatment Plant, Parameters, Solid, Treated

I. INTRODUCTION

Maintaining public health and ensuring environmental sustainability in urban areas depend on the proper management and treatment of sewage water. Efficient sewage treatment methods are crucial to reduce negative environmental consequences caused by the exponential increase in wastewater volumes caused by fast urbanization and population expansion. The crucial duty of sewage treatment plants (STPs) is to treat sewage water prior to its release into natural bodies of water or reuse for other uses. Physicochemical features serve as essential indicators of water quality and environmental health among the many measures used to evaluate the success of sewage treatment.

In the physicochemical analysis of treated sewage water of Saidpur STP Patna, a number of parameters are measured and analyzed, including pH, electrical conductivity, biological oxygen demand, chemical oxygen demand, total solids, total dissolved solids, total suspended solids, and concentrations of specific chemical components, such as nutrients and more. These metrics shed light on the treated sewage water's general composition, quality, and possible effects on the environment.

The physicochemical evaluation has several functions when applied to STPs. It checks if the treatment process successfully removed organic matter and contaminants from the sewage water, which is the first step in making sure it complies with environmental norms and regulations. It also aids in the detection of any pollutants or impurities that may still be present after first treatment and may need further steps before disposal or recycling. Additionally, STP operators may improve treatment operations, increase efficiency, and decrease environmental concerns associated with wastewater discharge by continuously monitoring and assessing physicochemical parameters.

There are many different uses for the treated sewage water that is collected by STPs. Some of these uses include irrigation, aquaculture, industrial operations, and recharging groundwater. In order to protect public health and aquaculture, the environment, and sustainable water management practices, it is crucial to conduct a thorough physicochemical evaluation to ensure its quality and safety. As a result of rising concerns about water shortage and the need for more sustainable water sources, reusing treated sewage water has become an attractive option for areas already struggling with water constraint.

II. REVIEW OF LITERATURE

Thanappan, Subash. (2021) The excessive organic load in sewage may not be acceptable for ultimate disposal in water bodies. The degree of biochemical oxygen demand (BOD) in sewage directly reflects the quantity of organic matter contained in the sewage. Industries are responsible for reducing the amount of BOD (biological oxygen demand) since the excessive organic load might lead to increased Eutrophication in water bodies. Therefore, it is crucial to treat sewage appropriately before its ultimate disposal to ensure the maintenance of dissolved oxygen (DO) levels. This, in turn, supports the ecosystem of aquatic life in water bodies. This page presents a comprehensive overview of the sequential processes involved in treating waste water (sewage). It serves as a valuable resource for proponents, industrialists, and stakeholders in the industry.

Adbarzi, Soad et al., (2020) The proper disposal of wastewater is a challenging issue worldwide, particularly in poorer nations. The release of wastewater has an impact on the physical and chemical characteristics of water streams and soil, which then enters the food chain and has consequences for agricultural goods, as well as the health of animals and humans. This study aimed to analyze the physicochemical characteristics of pre and post-treated wastewater samples obtained from four distinct municipal wastewater treatment plants (WWTP) located in Jhunsi (16 MLD), Salori (29 MLD), Rajapur (60 MLD), and Naini (80 MLD), as well as the Ganges river in Prayagraj (Allahabad), India. An analysis was conducted on several water quality indicators, including pH, total dissolved solids (TDS), dissolved oxygen (DO), electrical conductivity (EC), turbidity, biological oxygen demand (BOD), chemical oxygen demand (COD), chloride, and total hardness. The analysis of all relevant parameters was conducted using conventional methodologies. The findings demonstrated that the wastewater treatment plants (WWTPs) in the Prayagraj area were efficiently functioning

and successfully lowering the levels of total dissolved solids (TDS), biochemical oxygen demand (BOD), and chemical oxygen demand (COD) to within acceptable thresholds.

Bhutiani, Rakesh et al., (2016) Water is an essential natural ingredient for all forms of life. The quality of water is a crucial problem for humanity since it is closely correlated with human well-being. The water samples were obtained from the sewage treatment facility located in Jagjeetpur, Haridwar, which has a capacity of 18 million liters per day (MLD) and 27 MLD. The investigation was conducted over a duration of four months, during which a total of 15 samples were collected. The results indicated that the pH in the inlet ranged from 7.13 to 8.76, while at the outflow it ranged from 6.01 to 8.2. The total solids in the inlet varied from 751 mg/l to 897 mg/l, but in the outlet it ranged from 509 mg/l to 749 mg/l. The entrance water exhibited a total hardness ranging from 212 mg/l to 249 mg/l, whereas the outflow water showed a total hardness ranging from 178 mg/l to 210 mg/l. The chloride concentration in the inlet ranged from 96.5 mg/l to 112.9 mg/l, while in the outflow it ranged from 45.4 mg/l to 57.2 mg/l. The alkalinity readings in the inlet were found to be between 178 mg/l and 211 mg/l, while in the exit they ranged from 154 mg/l to 205 mg/l. The concentration of dissolved oxygen in the intake ranged from 0.70 mg/l to 1.96 mg/l, while at the outflow it ranged from 4.01 mg/l to 6.22 mg/l. The biochemical oxygen demand (BOD) in the intake varies between 90 mg/l and 129 mg/l, while at the outlet it ranges from 3.6 mg/l to 8.5 mg/l. The chemical oxygen demand (COD) in the inlet ranges from 231 mg/l to 252 mg/l, while in the exit it varies between 16 mg/l and 30 mg/l. This analysis demonstrated that both treatment plants are functioning well.

Velusamy, Karthika & Kannan, Jegatheesh. (2016) This study examines the bacteriological and physicochemical properties of sewage water collected from three locations in Coimbatore over the course of two seasons. According to seasonal trends, physical characteristics like total dissolved solids (TSS) (600 mg/L) are more prevalent after the monsoon, whereas the majority of nutrients (i.e., total nitrogen, phosphates, nitrates, chlorides, and sulphates) are plentiful before the monsoon. The Ukkadam sample point differs considerably from the other two locations, according to several comparisons done using analysis of variance. In the raw sewage samples taken from Ukkadam, the total coliform count was above 2400 (MPN/100ml). The results of this investigation show that untreated sewage has absurd physicochemical and microbiological characteristics, but that these undesired characteristics are minimized after treatment. To understand the pollutant levels across different time scales and the treatment status, which is essential for improving the state-of-the-art treatment process, studies on the sewage characteristics of treatment facilities are essential.

Iram, Shazia et al., (2012) We took water samples from a few spots at the Nullah Lai and Koh-e-Noor textile mills in Pakistan's Rawalpindi and Islamabad metropolitan areas. By comparing sites, locations, and following intervals of three months, conventional analytical techniques were used to assess physicochemical characteristics and heavy metals. The following range was derived from the physicochemical study that was conducted at several sites of the Nullah Lai and Koh-e-Noor textile mill at 3-month intervals: pH (7.16-8.29), temperature (17.8-28.8 °C), conductivity (1,005-3,347 μS/m), TDS (754.3-2,519.5 mg/L), turbidity (272.8-487.05 NTU), total hardness (300-452 mg/L), nitrates (10.11-22.95 ppm), calcium (74.31-139.2 ppm),

chloride (127.72-396.16 ppm), sulphate (15.97-87.38 ppm), NaCl (210.5-631.1 ppm), Ni (0.30-0.72 ppm), Cd (0.005-0.03 ppm), Cr (0.2-7.4 ppm), Pb (0.12-0.73 ppm), Zn (0.03-0.08 ppm) and Cu (0.01-0.06 ppm). In comparison to Nullah Lai, the areas around the Koh-e-Noor textile factory had the best values for physicochemical characteristics. The findings obtained were higher than the World Health Organization's maximum permitted level for drinking, but they may be utilized further by following appropriate treatment and purification.

III. MATERIALS AND METHODS

Monthly samples of treated and raw wastewater were taken from the Saidpur STP Patna throughout the research period. Duplicate samples were obtained in polyethylene vials that had been previously rinsed with deionized water and 30% distilled nitric acid. A cold ice box was used to transport the materials, and they were kept refrigerated (at 5^{o}C) until analysis was done. The pH, temperature, oxygen demand (DO) biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), and aquaculture water quality metrics such residual sodium carbonate were all measured in a portion of the sample. Chemical analysis followed the protocols set forth by the APHA. Results were compared to norms established by the Central Pollution Control Board (CPCB), the Bureau of Indian Standards (1991), and the World Health Organization (WHO). Use of the EDTA (Versanate) technique allowed for the estimation of magnesium and calcium concentrations.

The statistical analysis was carried out using the XLStat program. It was determined if the variations in selected compounds concentrations between the treated and untreated wastewater samples were statistically significant. Statistics were deemed significant when the probability was 0.05 or below.

IV. RESULTS AND DISCUSSION

In Table 1 we can see the results of the physicochemical tests and the selected compounds content of the wastewater that the STP Saidpur Patna washes.

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Table 1: Composition of sewage water pre and post the sewage treatment at STP Saidpur

Pollutant	Untreated				Treated				MPL**
	Min	Max	Mean	SD	Min	Max	Mean	SD	
pH	7.25	7.71	7.39	0.18	7.7	7.9	7.57	0.089	5.5-9
Temperature (Degree C)	10	40	25	3.6	10.5	39.5	25	3.5	-
BOD(mg/L)	113	214	146	35.6	25	37	35	6	30
COD(mg/L)	160	198	179	4.5	6	12	9	2.05	15
DO(mg/L)	4.2	6	4.1	1.4	5.9	9	7.4	1.7	-
Ca(mg/L)	35	39.5	37.25	4	9	26	17.7	4.1	-
NO_3^-(mg/L)	35.5	38.6	37.05	6.1	1	3.2	2.2	2	2.0
NH_3 (mg/L)	20	21.6	20.8	2.5	1.6	2.8	2.2	1.4	2.0
PO_4^{3-}(mg/L)	1.48	1.66	1.57	0.8	1.25	1.56	1.4	0.8	3.0

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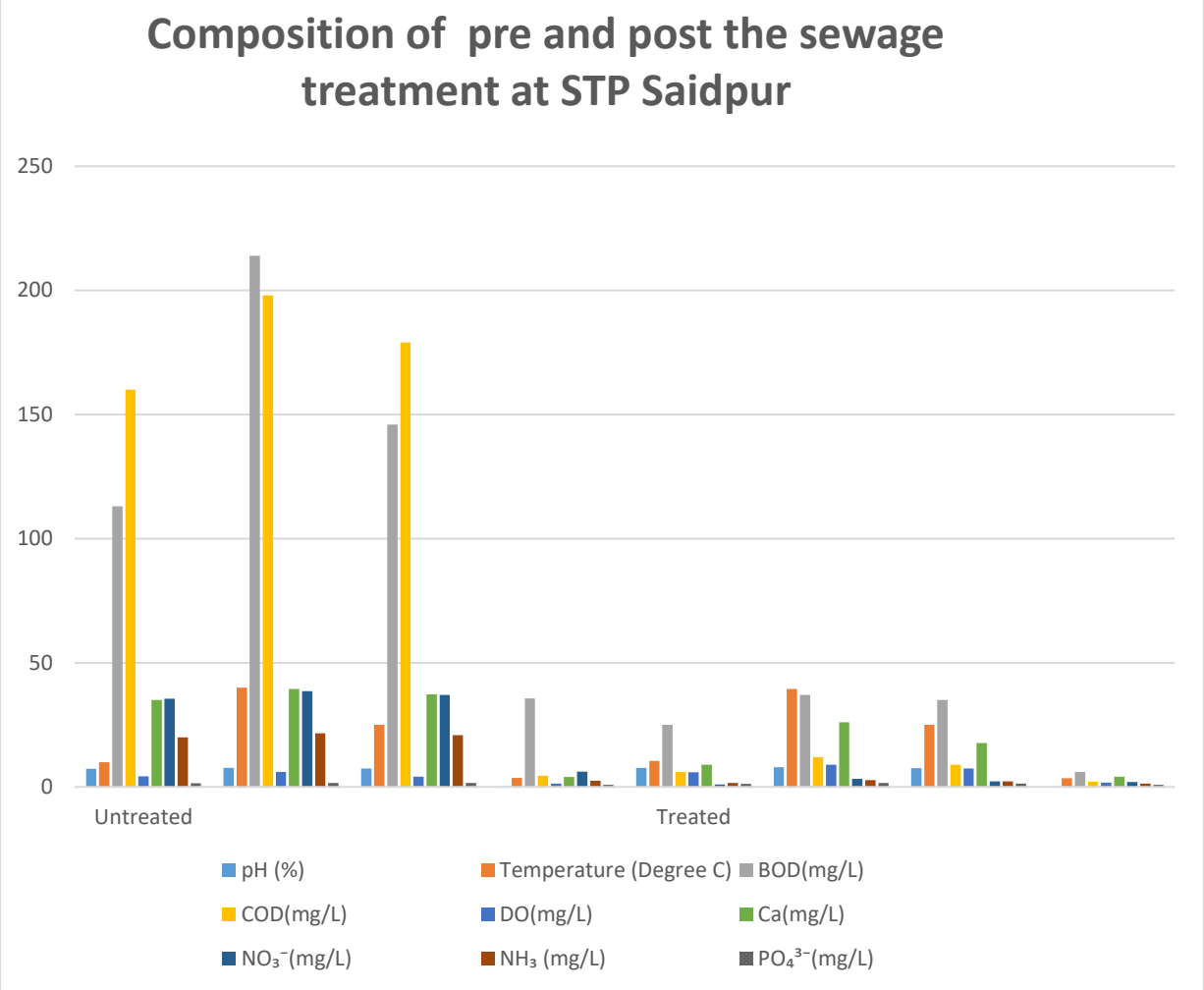

In the table that follows, you can see the Maximum Permissible Limits (MPL) for each pollutant, as well as a comparison of the sewage water's composition before and after treatment at the Sewage Treatment Plant (STP) Saidpur Patna.

The composition of sewage water both before and after treatment at the STP Saidpur Patna is detailed in Table 1. The table includes the pH, temperature, biochemical oxygen demand (BOD), chemical oxygen demand (COD), dissolved oxygen (DO), calcium (Ca), nitrate (NO_3^-), ammonia (NH_3), and phosphate (PO_4^{3-}) levels. Before treatment, the pH of the sewage water ranged from 7.25 to 7.71, with a mean of 7.39 and a standard deviation of 0.18. Post-treatment, the pH slightly increased, ranging from 7.7 to 7.9, with a mean of 7.57 and a standard deviation of 0.089, all within the maximum permissible limit (MPL) of 5.5 to 9. The

temperature of untreated sewage water was between 10 to 40°C, with a mean of 25°C and a standard deviation of 3.6. After treatment, the temperature ranged from 10.5 to 39.5°C with a mean of 25°C and a standard deviation of 3.6°C.

The BOD levels in untreated water varied from 113 to 214 mg/L, averaging 146 mg/L with a standard deviation of 35.6. Treatment reduced the BOD to between 25 and 37 mg/L, with a mean of 35 mg/L and a standard deviation of 6 mg/L, which is above the MPL of 30 mg/L. The COD of untreated water ranged from 160 to 198 mg/L, with a mean of 179 mg/L and a standard deviation of 4.5 mg/L. Post-treatment, COD levels dropped to between 6 and 12 mg/L, averaging 9 mg/L with a standard deviation of 2.05 mg/L, which is below the MPL of 15 mg/L.

For dissolved oxygen (DO), untreated levels ranged from 4.2 to 6 mg/L, with a mean of 4.1 mg/L and a standard deviation of 1.4 mg/L. After treatment, the levels increased between 5.9 to 9 mg/L, with a mean of 7.4 mg/L and a standard deviation of 1.7 mg/L.

Calcium concentrations in untreated water ranged from 35 to 39.5 mg/L, with a mean of 37.25 mg/L and a standard deviation of 4.05 mg/L. After treatment, calcium levels dropped to between 9 and 26 mg/L, averaging 37.25 mg/L with a standard deviation of 4.05 mg/L.

Nitrate levels were high in untreated water, ranging from 35.5 to 38.6 mg/L, with a mean of 37.05 mg/L and a standard deviation of 6.1 mg/L. After treatment nitrate levels reduced to between 1 to 3.2 mg/L, with a mean of 2.2 mg/L and a standard deviation of 1.4 mg/L, all well below the MPL of 2.0 mg/L.

Ammonia in untreated water ranged from 20 to 21.6 mg/L, with a mean of 20.8 mg/L and a standard deviation of 2.5 mg/L. Post-treatment levels were between 1.6 and 2.8 mg/L, with a mean of 2.2 mg/L and a standard deviation of 1.4 mg/L, within the MPL of 2.0 mg/L. Phosphate levels in untreated water ranged from 1.48 to 1.66 mg/L, with a mean of 1.57 mg/L and a standard deviation of 0.08 mg/L. After treatment, phosphate levels ranged from 1.25 to 1.56 mg/L, with a mean of 1.4 mg/L and a standard deviation of 0.08 mg/L, all below the MPL of 3.0 mg/L.

V. CONCLUSION

An analysis of the physicochemical properties of the sewage water from STP Saidpur Patna in reference of culture of fish *Catla catla*, both before and after treatment, in light of how efficient these procedures are, which in turn affects aquaculture, public health and environmental sustainability. It is clear that STP Saidpur is essential in enhancing water quality, lowering pollutant levels to protect *Catla catla* from the thorough examination of several parameters including pH, temperature, BOD, COD, calcium, nitrate, phosphate, ammonia, and concentrations of different selected compounds. Sewage treatment plant (STP) Saidpur treatment efficacy is shown by the considerable decreases in pollutant concentrations seen after treatment compared to untreated sewage water in reference of culture of fish *Catla catla*.

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