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Study on Physical and Chemical Parameters of Sewage Water Collected from Different Place in Chennai

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Abstract*: Sewage water quality is determined by analyzing various physical, chemical, and biological parameters that influence environmental and public health. Physical parameters include temperature, turbidity, and total suspended solids (TSS), which affect water clarity and treatment efficiency. Chemical parameters such as pH, biochemical oxygen demand (BOD), chemical oxygen demand (COD), dissolved oxygen (DO), nutrients (nitrogen and phosphorus), and heavy metals indicate the level of organic and inorganic pollutants. Biological parameters, including bacterial and viral contaminants like coliforms and pathogens, assess the microbial safety of wastewater. Regular monitoring of these parameters is essential for wastewater treatment efficiency, pollution control, and water resource management. Understanding sewage characteristics helps in designing effective treatment processes, reducing environmental contamination, and promoting sustainable water reuse.*

Keywords: Sewage water quality

I. INTRODUCTION

Sewage is a mixture of water and various impurities, including excrement, industrial waste, and debris. It comes from homes, businesses, and other public facilities. Sewage water is a heterogeneous mixture that contains a wide variety of contaminants, both organic and inorganic. Wastewater resulting from human consumption and discharged into sewage is one of the most productive sources of wastewater. And for the purpose of measuring the absorptive capacity of the stream. It is necessary to adopt a realistic design number to adequately accommodate future changes within the life of the design stream. As well as suitable for the current conditions. Sewage/ Wastewater treatment involves breakdown of complex organic compounds in the wastewater into simpler compounds that are stable and nuisance-free, either physico-chemically and or by using micro-organisms (biological treatment). The adverse environmental impact of allowing untreated wastewater to be discharged in groundwater or surface water bodies and/or land is as follows :-

The decomposition of the organic material contained in wastewater can lead to the production of large quantities of malodorous gases,

Untreated wastewater (sewage) containing a large amount of organic matter , if discharged into a river/stream , will consume the dissolved oxygen for satisfying the biochemical oxygen demand (BOD) of wastewater and thus deplete the dissolved oxygen of the stream causing fish kills and other undesirable effects.

II. EXPERIMENTAL SECTION

2.1 Physical and chemical parameters:

The physical and chemical characteristics of industrial effluents parameters viz. pH, COD, sulphate, Total suspended solids (TSS) and oil and grease were analyzed.

2.2. PH

To determine the pH of a water sample using the **pH meter**. pH stands for potential of hydrogen (H) and it represents the measure of concentration of H+ ions in a solution. As a mathematical consequence of the formula that defines pH,

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the units on the pH scale range from 0 to 14. A value of 7 indicates neutrality, values < 7 are acidic, and values > 7 are basic or alkalinity.

In a 100 ml beaker take pH 7.0 buffer solution and place the electrode in the beaker and stir well. Allow the reading to stabilize, and using the calibration knob adjust the reading to 7.0. Take the electrode from the buffer, wash it with distilled water and then wipe gently with soft tissue. Similarly, the same procedure has been followed for pH 4.0 and 9.0 buffer solution, and using the knob adjusted the reading to 4.0 and 9.0.

2.3. BIOCHEMICAL OXYGEN DEMAND

Biological Oxygen Demand (BOD) is commonly measured using the **Winkler's Method** or by using **DO (Dissolved Oxygen) Meters**. Collect the water sample in a clean BOD bottle, avoiding any air bubbles in the conical flask. Add 2 ml of manganese sulfate solution and 2 ml of alkaline iodide reagent. Mix well by inverting the bottle and add 2 ml of concentrated sulfuric acid. Mix thoroughly until a clear solution is obtain and tightly seal it. Incubate at 27°C for 3 days in the dark to prevent photosynthesis. Take 200 ml sample from the BOD bottle in the measuring cylinder and transfer to conical flask without air bubbles.Add3 to 4 drops of starch indicator and appears dark blue colour. Titrated with 0.01N sodium thiosulfate solution until the blue color disappear.

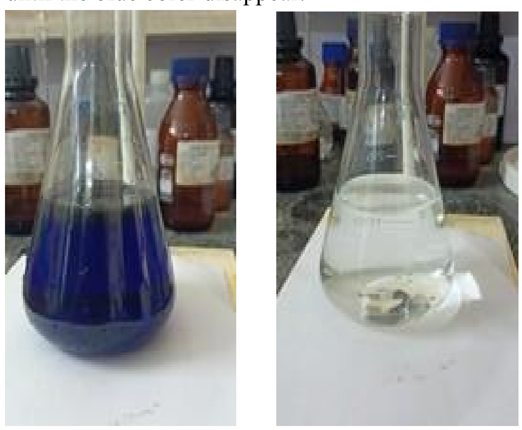

Fig 1. Titration of BOD

2.4.TOTAL DISSOLVED PHOSPHOROUS OR PHOSPHATE (PO4)

Prepare phosphate standard solutions of known concentrations (e.g., 0.1, 0.2, 0.5, 1.0, 2.0 mg/L) by diluting the stock phosphate solution with distilled water. Take 100 ml of the water sample in a 100ml beaker.Add **1 ml of conc. Sulfuric acid** and **5 ml of conc. Nitric acid** and mix well. Place the beaker in the hot plate and boil the solution until reduced to 20 ml. Transfer the sample to 100 ml SMF and make up to the mark by distilled water. Transfer the sample to the Nessler tube. Add 3 drops of phenolphthalein indicator. If pink colour appear add conc. H_2SO_4 till the colour disappear. Add 4 ml of ammonium molybdate and **0.5 mL of stannous chloride solution**, mix, and allowthe color to develop for **10 minutes**. Place the treated sample in a Nessler tube and compare it with the prepared standard solutions in identical tubes. Read at spectrophotometer at **690 nm** for improved accuracy.

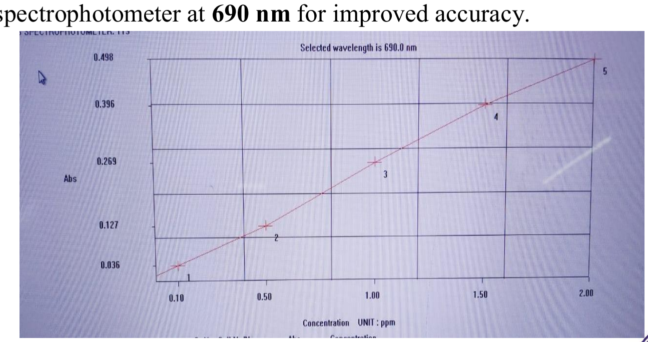

Fig 2. UV-Visible spectrum

2.5. OIL AND GREASE `

To determine the oil and grease of a water sample using the **EPA method** (Hexane extractable material (HEM). Allow the sample to reach at room temperature. Take 1L of sample in a beaker and maintained the pH range to 2 by using 1:1HCl.Transfer the sample into a separatory funnel and add**30 mL of hexane** to the sample. Shake vigorously for **2 - 5 minutes**. Let the layer get separate and drain the aqueous phase. Repeat the extraction two more times (total of 90 mL hexane used).Pass the hexane extract through an anhydrous sodium sulfate column to remove residual water by using 41 filter paper. Collect the extract in a pre-weighed evaporation dish (W1). Place the dish in a water bath at 80-85℃ to remove the solvent. Dry in an oven at **105°C for 1 hour**. Coolin a desiccator for 30 mints and weighed (W2).

Fig3. Final weigh(W2)

2.6. TOTAL SUSPENDED SOLID (TSS)

To determine the concentration of total suspended solids (TSS) in a water sample using **filtration and gravimetric analysis**. Pre-weigh the clean, dry filter paper using a digital balance. Record the weight (W1).Set up the filtration apparatus. Mix the water sample thoroughly to ensure homogeneity. If the sample is large, use a graduate cylinder to take a representative volume (typically 100 mL to 1 liter depending on expected TSS concentration).Place the pre-weighed filter paper in the filtration apparatus. Pour the water sample slowly through the filter paper to capture the suspended solid and apply the vacuum gently to speed up filtration. Rinsethe container and the filter paper with distilled water to ensure that all suspended solids are transferred on the filter paper. Carefully remove the filter paper using forceps. Dry in an oven at **105°C for 1 hour** to remove moisture. Transfer the dried filter to a desiccator using tongs for 30 minutes to prevent moisture absorption. Weigh the filter paper with the retained solids and record the final weight (W2).

Fig4. Final Weigh (W2)

2.7. TURBIDITY

Turbidity is commonly measured in **Nephelometric Turbidity Units (NTU)** using a **turbidity meter**. Calibrate using turbidity standard solution (100 NTU) and run a blank sample (distilled water) to ensure the instrument read close to zero. Periodically check calibration with standard solutions. Collect a water sample in a clean sample cell, avoiding air bubbles. Wipe the sample cell with a lint-free cloth to remove any fingerprints or dust. Insert the sample cell into the turbidity meter. Close the lid and allow the meter to stabilize. Record the turbidity reading in NTU (Nephelometric Turbidity Units).

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Fig 5. Nephelometric meter (NTU)

III. RESULT AND DISCUSSION

S. No	Parameters	Unit	Test method	Results		Permissible limit as per TNPCB Standards
				Sample1	Sample2	
1	pH @ 25°C	-	IS 3025 PART 11: 1983	7.20	7.37	6.5 – 9.0
2	Electrical Conductivity	µs/cm	IS 3025 PART 14 : 1984	1170	1750	NA
3	Biological Oxygen Demand	mg/L	IS 3025 PART 58 : 2006	27.8	23.5	<30
4	Phosphate as PO4	mg/L	IS 3025 PART 24 : 2022	67.2	75.2	NA
5	Oil and Grease	mg/L	IS 3025 PART 39 : 1991	BDL(DL:5.0)	BDL(DL:5.0)	NA
6	Total Suspended Solids	mg/L	IS 3025 PART 17 : 1984	82	90	<100
	Turbidity	NTU	IS 3025 PART 10 :1984	BDL(DL:5.0)	BDL(DL:5.0)	NA

Note: BDL – Below Detection Limit; DL - Detection Limit; NA – Not Applicable.

IV. CONCLUSION

The presence study was carried out to determine various physical and chemical parameters of sewage water collected from EHS360/TR/2024-25/N14003 and EHS360/TR/2024-25/N1893. This study examines the quality of water and ranges are within the TNPCB standard limits. Treated sewage can be repurposed for irrigation, industrial cooling, and groundwater recharge. Integrating sewage treatment with sustainable urban planning can reduce environmental impact. Industries and municipalities must adopt best practices for sewage management, including recycling and reuse. Achieving full compliance with IS standards will promote a cleaner, healthier, and more sustainable future.

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