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Determination of Physico-Chemical Parameters of Sewage Water Collected from Anna Nagar Area in Chennai

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Abstract: *Sewage parameters are crucial indicators used to assess the quality and composition of waste water ensuring proper treatment and environmental protection. These parameters can be broadly classified into physical, chemical and biological categories. Physical parameters include temperature, turbidity, colour and total suspended solid (TSS) which affect efficiency of treatment processes. Chemical parameters such as pH, Biochemical Oxygen Demand(BOD), Chemical Oxygen Demand(COD), Nitrogen compounds, phosphates and heavy metals determine the level of organic and inorganic pollutants. Biological parameters, including coliform bacteria, virus and parasites, indicate the presence of pathogenic microorganisms that pose health risks. Monitoring these parameters is essential for compliance with environmental regulations, optimizing treatment efficiency, and minimizing the impact of sewage discharge on natural water bodies. Advanced analytical techniques and continuous monitoring systems help ensure waste water treatment plants operate effectively, protecting both public health and aquatic ecosystems.*

Keywords: UV-Visible spectrophotometer, COD, TSS, Turbidity

I. INTRODUCTION

Sewage water, also referred to as wastewater, is a byproduct of daily human activities and industrial processes. It primarily consists of water that has been contaminated by human and industrial waste, including water from toilets, kitchens, baths, and industrial discharges. This contaminated water is typically directed to sewage treatment facilities where it undergoes various processes to remove pollutants, making it safer for disposal or reuse. The management of sewage water is one of the most pressing environmental and public health challenges faced by modern societies. Sewage/Wastewater are essentially the water supply of the community after it has been fouled by a variety of use. From the standpoint of sources of generation, wastewater may be defined as a combination of the liquid (or water) carrying wastes removed from residences, institutions, commercial and industrial establishments, together with such groundwater, surface water and storm water as may be present. Generally, the wastewater discharged from domestic premises like residences, institutions and commercial establishments is termed as "Sewage/Community wastewater". It comprises of 99.9% water and 0.1% solids and is organic because it consists of carbon compounds like human waste, paper, vegetable matter etc. Besides community wastewater/sewage, there is industrial wastewater in the region. Wastewater in general consists of about (99%) of water and about (1%) of impurities and harmful pollutants. This is due to environmental pollution and most communicable diseases that pose a threat to public health. Hence, this water must be disposed of by transporting it away from cities and then treating it in treatment plants to remove organic and bacterial pollution and to obtain pure water that can be used again.

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, 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 takePh 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. Chemical Oxygen Demand (COD)

To determine the Chemical Oxygen Demand (COD) of a wastewater sample using the **closed reflux method**. Take 10 ml or 20 ml of the sample into a reflux flask based on the nature of sample.Add0.4g of mercuric sulphate and mix it well. Add 10 ml of 0.25N potassium dichromate ($K_2Cr_2O_7$) solution and vigorously shake for 6 times. Place the sample in cold water then slowly add 30ml of conc. H_2SO_4. Addpinch of silver sulphate to speed up the reaction. Using reflux flasks, attach to the condenser. Digest the sample at 150°C for 2 hours in a COD reactor. After digestion allow the sample to cool at room temperature.Add 20ml of distilled water in top of the condenser and 40ml in reflux flask. Transfer the solution to the Erlenmeyer flask.Add3-4 drops of Ferroin indicator. Titratewith 0.1N Ferrous Ammonium Sulfate (FAS**)** until color changes from blue-green to reddish-brown. Recordthe volume of FAS used.

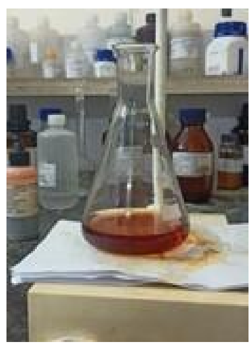

Fig1. End point of COD

2.4. Sulphate

Prepare sulfate standard solutions at the range of 20 ml in 100 ml SMF and make up to the mark with distilled water.Volume of sample is taken based on EC value,

Value of EC is below 500@µs/Cm – volume of sample 100 ml

Value of EC is above 500@ µs/Cm – volume of sample 20 ml – 100 ml

Value of EC is above 1000@ µs/Cm – volume of sample 10ml – 100ml

Take the volume of water sample in 100ml SMF and then transfer to conical flask.Add 10 ml of sulphate buffer solution.Add1 spatula of **$BaCl_2$**solution while stirring continuously.Measured turbidity at **420 nm** using a spectrophotometer. Compare with standard calibration curve to determine sulfate concentration.

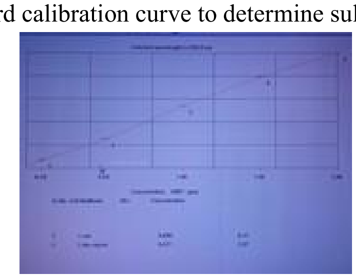

Fig2. UV-Visible adsorption spectrum of SO4

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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 mLof hexane** to the sample.Shake vigorously for **2 - 5 minutes**.Let the layer get separateand 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).

Fig 3. 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 desicator 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

The values of the physico -chemical parameters observed in the present study may serve as an indicator of the fertility or pollution level of the study area. The experimental data on physico-chemical properties of wastewater samples collected from different indusial area in Anna Nagar.

S. No	Parameters	Unit	Test method	Results	Permissible limit as per TNPCB Standards
1	pH @ 25℃	-	IS 3025 PART 11: 1983	7.70	6.5 – 9.0
2	Electrical Conductivity @ 25℃	µs/cm	IS 3025 PART 14 : 1984	1930	NA
3	Chemical Oxygen Demand	mg/L	IS 3025 PART 58 : 2006	97.5	NA
4	Sulphate as SO4	mg/L	IS 3025 PART 24 : 2022	67.2	NA
5	Oil and Grease	mg/L	IS 3025 PART 39 : 1991	BDL(DL:5.0)	NA
6	Total Suspended Solids	mg/L	IS 3025 PART 17 : 1984	94	<100
7	Turbidity	NTU	IS 3025 PART 10 : 1984	BDL(DL:5.0)	NA

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

IV. CONCLUSION

From the result of physico-chemical analysis of industrial effluents, it has been concluded that pH, EC, TDS, Chlorides, Sulphate, TSS, BOD and COD are low in concentration compared to the standards prescribed by WHO and EPA. . For the assessment of sewage water samples collected from EHS360/TR/2024-2025/N13837, the water quality data of the analyzed samples were compared with the prescribed sewage water with TNPCB standard are within the limits and non – pollutant to environment. Such effluent should be discharged into the nearby water body or soil without treatment. This ranges does not cause's environmental problems to plant, animal and human life.

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