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Study of Water Treatment Process for Sewage Water Process

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Abstract - Sewage is one of the major sources of water pollution in developing and rapidly urbanizing regions. Untreated sewage contains suspended solids, dis dissolve substances, organic matter, nutrients, Microorganism and other contaminants that can adversely affect surface water, soil and groundwater. The present experimental investigation that was undertaken to evaluate the quality of sewage water and to study the effectiveness of a selective treatment process. She weighs samples were collected and analyzed using selected physiochemical parameters, namely PH, temperature, color, turbidity and total dis dissolved solids (TDS). The experimental work consisted of sample collection, preliminary examination, treatment and post treatment analysis. The observed characteristics of untrained CVS were compared with those of treated sewage to determine the extent of improvement. Treatment efficiency was evaluated using the percentage removal equation. The investigation shows that the treatment produced a noticeable improvement in the visual quality of sewage and reduced avidity and dissolved solid concentration to varying degrees. Turbidity a particularly important because suspended particles can interfere with subsequent treatment and this infection. Who identifies stability as an important indicator of source water and treatment quality. The study demonstrate that appropriate treatment processes can significantly improve sewage so water quality however, complete assessment of treatment sewage requires additional parameters such as bod, cod, TSS, nutrients and microbiological indicators. The study provides a basis for evaluating low-to moderate - scale sewage treatment and the potential reuse of treated wastewater for suitable non-portable purposes.

Keywords: Sewage, wastewater treatment, pH, turbidity, TDS, color, physio-chemical analysis, treatment efficiency, wastewater reuse.

INTRODUCTION

Water is an essential natural resource for human life, agriculture, industry and ecosystem functioning. Increasing population, urbanization and economic development have resulted in a continuous increase in water consumption and wastewater generation. When wastewater is not properly collected and treated, it becomes an important source of environmental pollution.

Sewage primarily consists of wastewater generated from domestic activities such as bathing, washing, sanitation, cooking and other household processes. Depending upon its source, seaways may contain suspended solids, dissolved organic and inorganic substances, nutrients, microorganisms, oils, detergents and other contaminants.

The dishes of untrained seaweeds into natural water bodies can reduce water quality and affect aquatic ecosystem. Organic matter can increase oxygen demand, while nutrients can contribute to eutrophication suspended solids can reduce water clarity and interfere with ecological process is pathogenic microorganisms may create significant public health risk.

Treatment of sewage therefore necessary before discharge or use. Wastewater treatment generally involves a combination of physical, chemical and biological processes. Preliminary and primary processes are used to remove the large and settleable solids, while biological processes remove biodegradable organic matter. Tertiary or advanced processes may subsequently be used for nutrients, dissolved contaminants and pathogen reduction.

The present study focuses on the experimental investigation of severe statement using selected physiochemical water quality parameters. The research forms 1 components of broader M.tech study entitles " **Experimental study of water treatment process for sewage water using physio-chemical process".**

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RESEARCH GAP

Although numerous wastewater treatment technologies have been investigated, treatment performance depends strongly on wastewater characteristics, treatment conditions, local environmental condition and intended and use.

Many small-scale investigations focus on only one or two parameters a combined assessment of pH, temperature, color, turbidity and TDS before and after treatment provides a useful preliminary evaluation of treatment performance.

The present study attempts to provide an experimental comparison between untreated and treated sewage using readily measurable physiochemical parameters. This study also identifies the limitation of relying only on these parameters for determining complete treatment performance.

Aim of the Study

The main aim of the study was to experimentally investigate the effectiveness of the selected treatment process in improving the physiochemical quality of sewage water.

Objective

The objectives were:

1. To collect representative sewage water sample.
2. To determine selected physio-chemical characteristics of sewage.
3. To investigate the selected sewage treatment process
4. To compare water quality before and after treatment.
5. To determine the reduction in turbidity and TDS.
6. To calculate treatment efficiency.
7. To evaluate the significance of the observed changes
8. To assess the potential of treated sewage for appropriate non-potable application.
9. To identify limitations and future requirements for improved treatment.

MATERIALS AND METHOD

Simple Collection

Sewage samples were collected in clean labored sampling containers the containers were properly rinsed and handled carefully to minimize contamination. Samples were transported to the laboratory and analyzed using the selected procedures. The experimental investigation included the sewage samples forming part of the 10 sample data set of the overall thesis.

Parameter Investigated

Parameter	Unit	Purpose
pH	----------	Indicate acidic/alkaline condition
Temperature	°C	Indicate thermal condition
Colour	----------	Indicate visible contamination
Turbidity	NTU	Indicate suspended colloidal matter
TDS	ppm	Indicate dissolve substances

Determination of pH

pH was determined using a calibrated digital pH meter. Calibration was performed using appropriate standard buffer solution. The electrode was immersed into the sample and the stabilized reading was recorded.

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Determination of Temperature

Temperature were measured using a laboratory thermometer or digital temperature meter. Temperature measurement was recorded immediately during the laboratory examination to minimize variation.

Determination of Turbidity

Turbidity was determined using a turbidity meter/nephelometric method and expressed in NTU.

Everyday results from suspended and colloidal material Who notes that everybody can be caused by clay, silt, chemical precipitates, organic particles and organisms, and elevated turbidity can interfere with treatment and disinfection.

Determination of TDS

TDS was measured using a calculated TDS meter and expressed in ppm. TDS provides an indication of the total concentration of dissolved material.

WHO notes that TDS has no health- based guideline value that concentration below about 600ppm are generally acceptable for palatability perspective for drinking water; This consideration Should not be confused with a sewage- discharge standard.

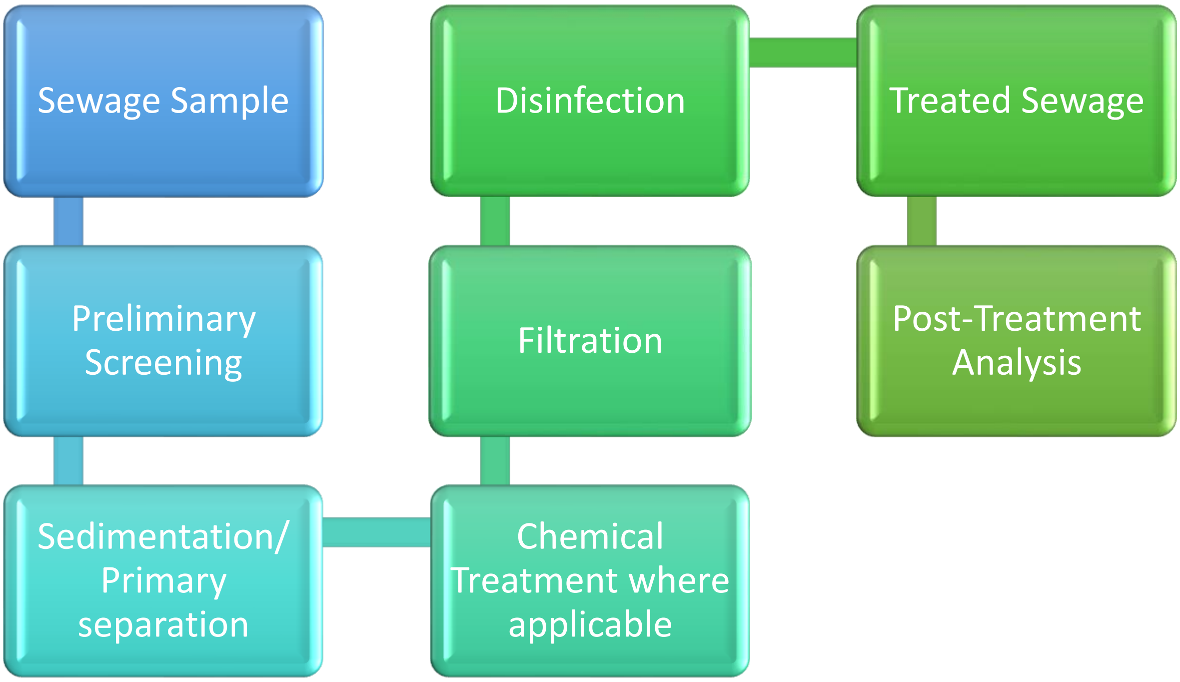
Color

Color was set visually and recorded according to the observed appearance of the sewage sample before and after treatment.

Treatment Methodology

The treatment process consisted of a sequence of operations designed to reduce suspended and visible contaminants.

General Treatment sequence



Experimental Observation

The untreated sewage was generally characterized by visible color, suspended matters and comparatively higher turbidity than treated water.

Table 1. Sewage-water observation

Sample	pH	Temperature(°C)	Colour	Turbidity (NTU)	TDS (ppm)
S1	7.1	25.4	Dark Brown	51	678

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S2	7.3	25.7	Dark Grey	56	647
S3	7.4	26.1	Brown	46	715
S4	7.6	25.5	Dark Brown	54	628
S5	7.3	25.9	Brownish Grey	59	698
S6	7.7	26.2	Dark Grey	48	713
S7	7.2	25.3	Brown	49	654
S8	7.8	26.0	Dark Brown	55	705
S9	7.5	25.2	Greyish Brown	51	663
S10	7.6	25.6	Dark Grey	56	709

POST TREATMENT OBSERVATION

Table 2. Treated Sewage-water observation

Sample	Initial Turbidity	Final Turbidity	Initial TDS	Final TDS	pH Before	pH After	Final Colour
S1	51	10	678	450	7.1	7.3	Light Brown
S2	56	9	647	430	7.3	7.4	Light Grey
S3	46	12	715	465	7.4	7.5	Light Brown
S4	54	8	628	420	7.6	7.3	Pale Brown
S5	59	11	698	455	7.3	7.4	Light Brown
S6	48	13	713	475	7.7	7.5	Light Grey
S7	49	9	654	435	7.2	7.2	Light Brown
S8	55	11	705	460	7.8	7.5	Pale Brown
S9	51	8	663	445	7.5	7.4	Light Grey
S10	56	10	709	420	7.6	7.3	Light Grey

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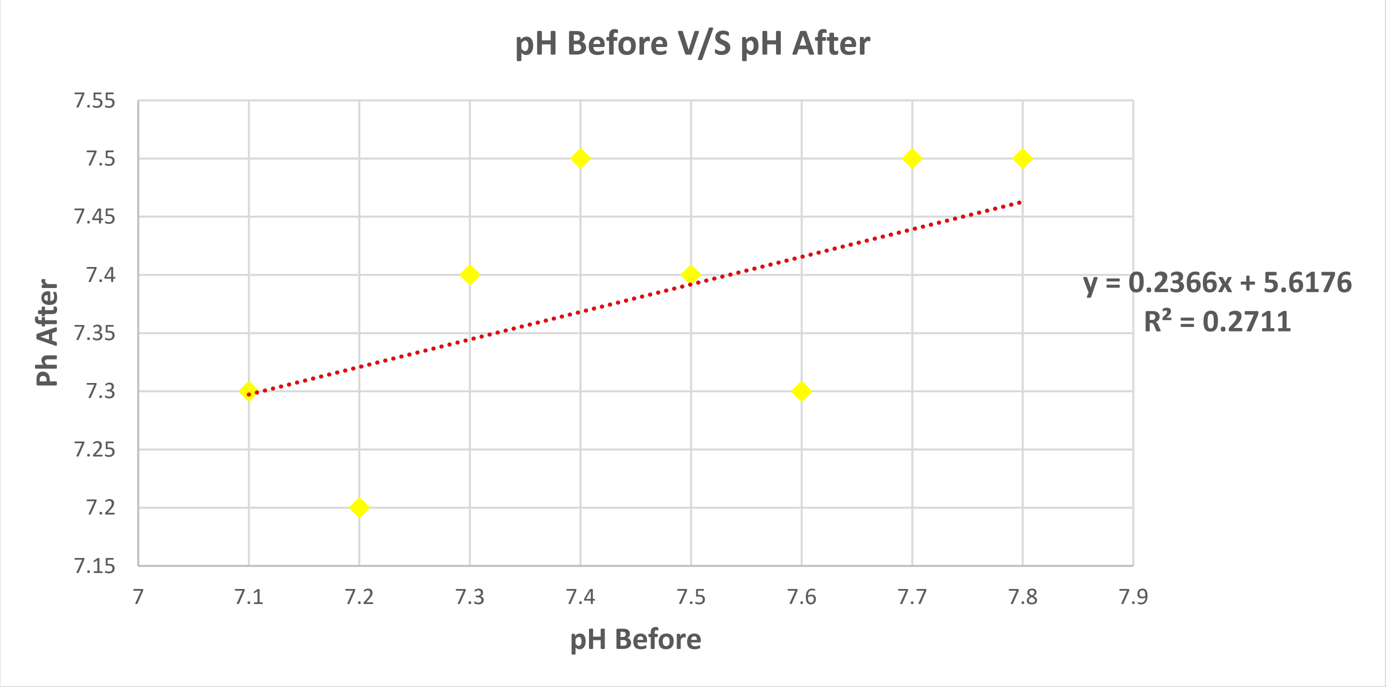
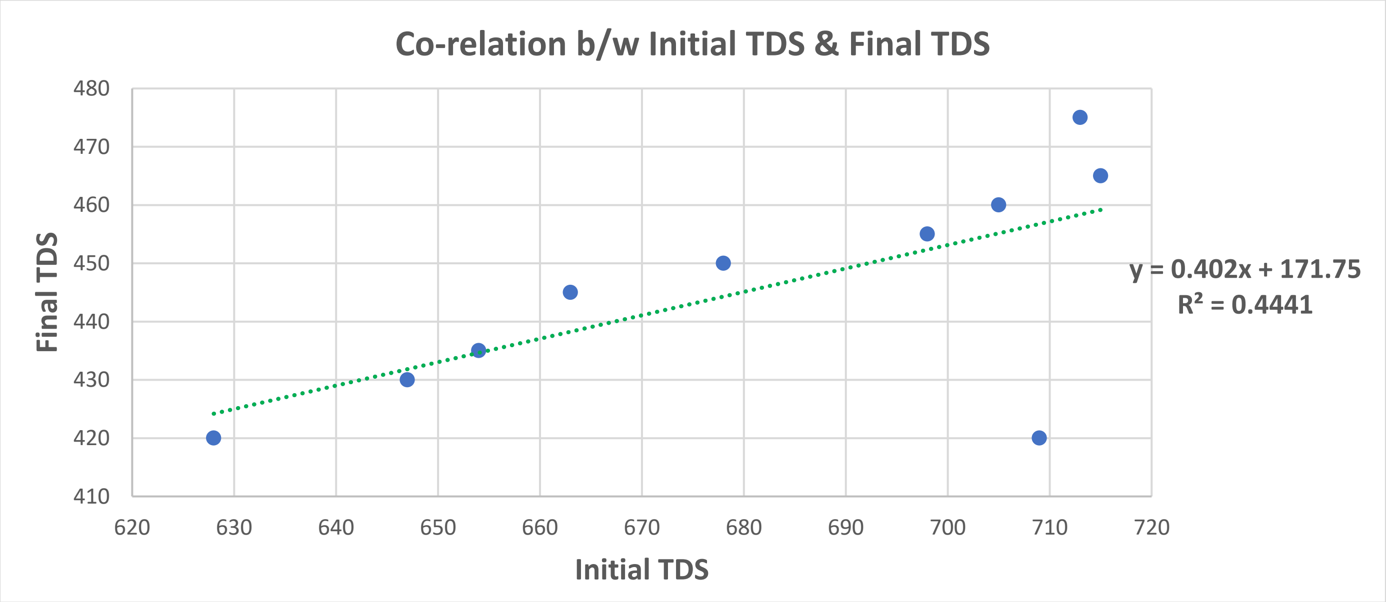


The scatter plot shows a **weak positive correlation** between pH before and pH after treatment, with **r ≈ +0.521**. The positive correlation indicates that higher initial pH values tend to be associated with higher pH values after treatment. The **R^2 value (0.2711)** indicates that approximately **27.11% of the variation** in post-treatment pH is explained by the initial pH.



The scatter plot shows a **moderate positive correlation** between initial TDS and final TDS, with **r ≈ +0.666**.
The positive correlation indicates that samples with higher initial TDS generally tend to have higher final TDS values after treatment.
The **R^2 value (0.4441)** indicates that approximately **44.41% of the variation** in final TDS is explained by the initial TDS.

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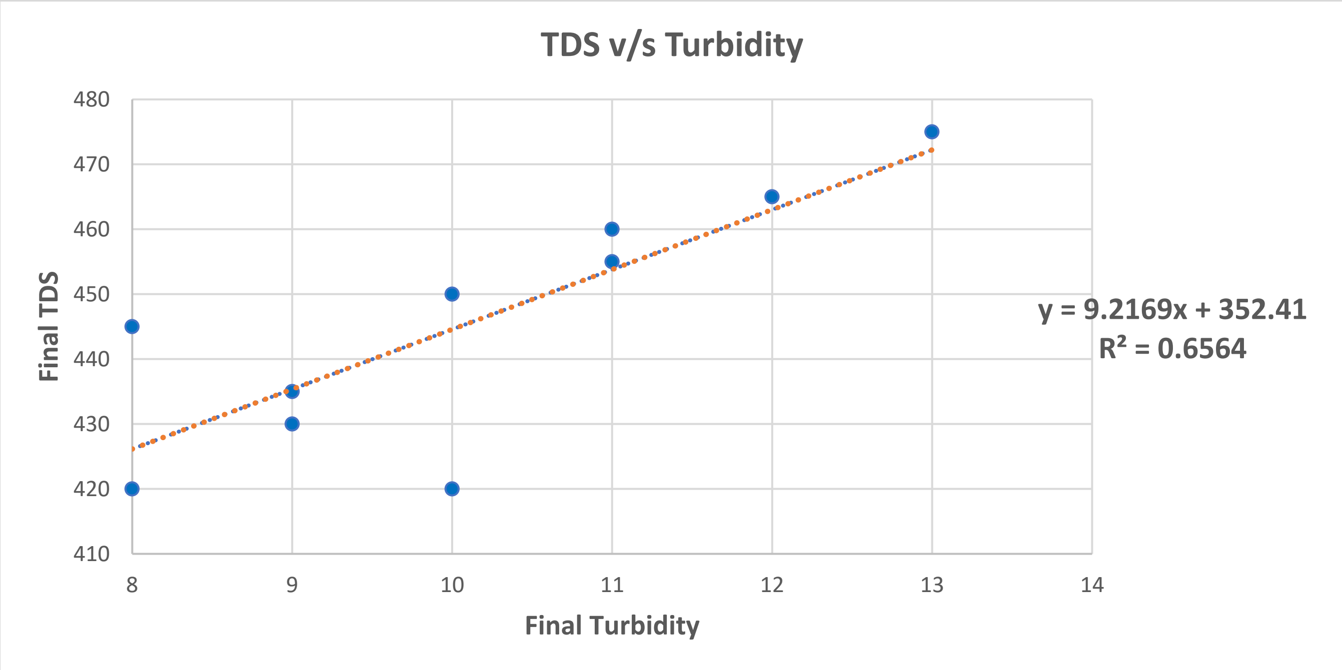
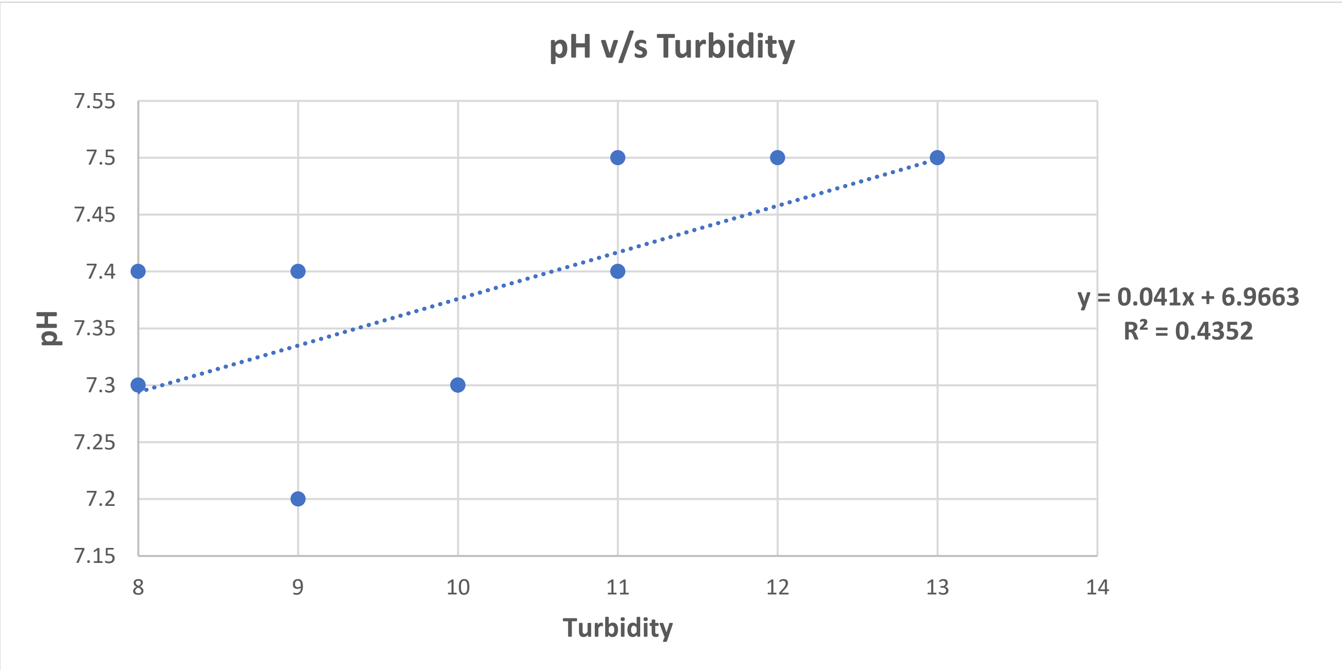


The scatter plot shows a **strong positive correlation** between TDS and turbidity, with **r ≈ +0.810**. The positive correlation indicates that turbidity tends to increase as TDS increases in the analysed water samples. The **R^2 value (0.6564)** indicates that approximately **65.64% of the variation** in turbidity is explained by the linear relationship with TDS.



The scatter plot shows a **moderate positive correlation** between pH and turbidity, with **r ≈ +0.660**. The positive correlation indicates that turbidity tends to increase as pH increases in the analysed water samples. The **R^2 value (0.4352)** indicates that approximately **43.52% of the variation** in turbidity is explained by its linear relationship with pH.

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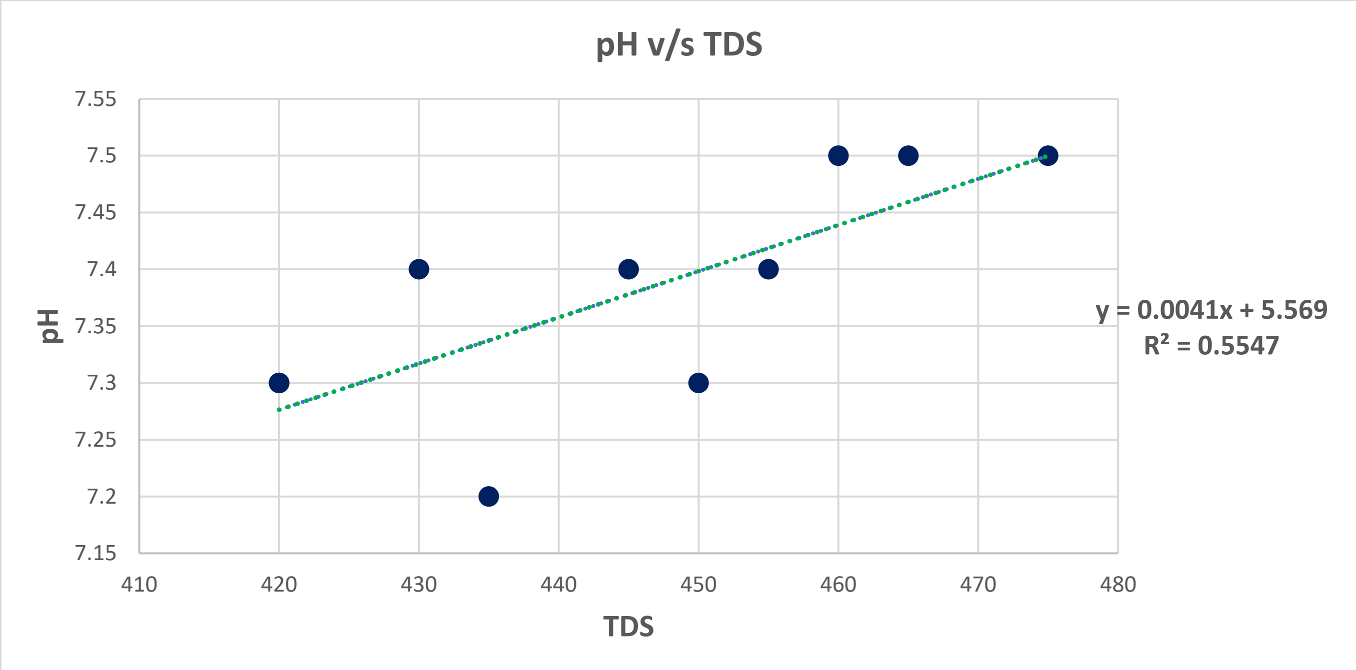
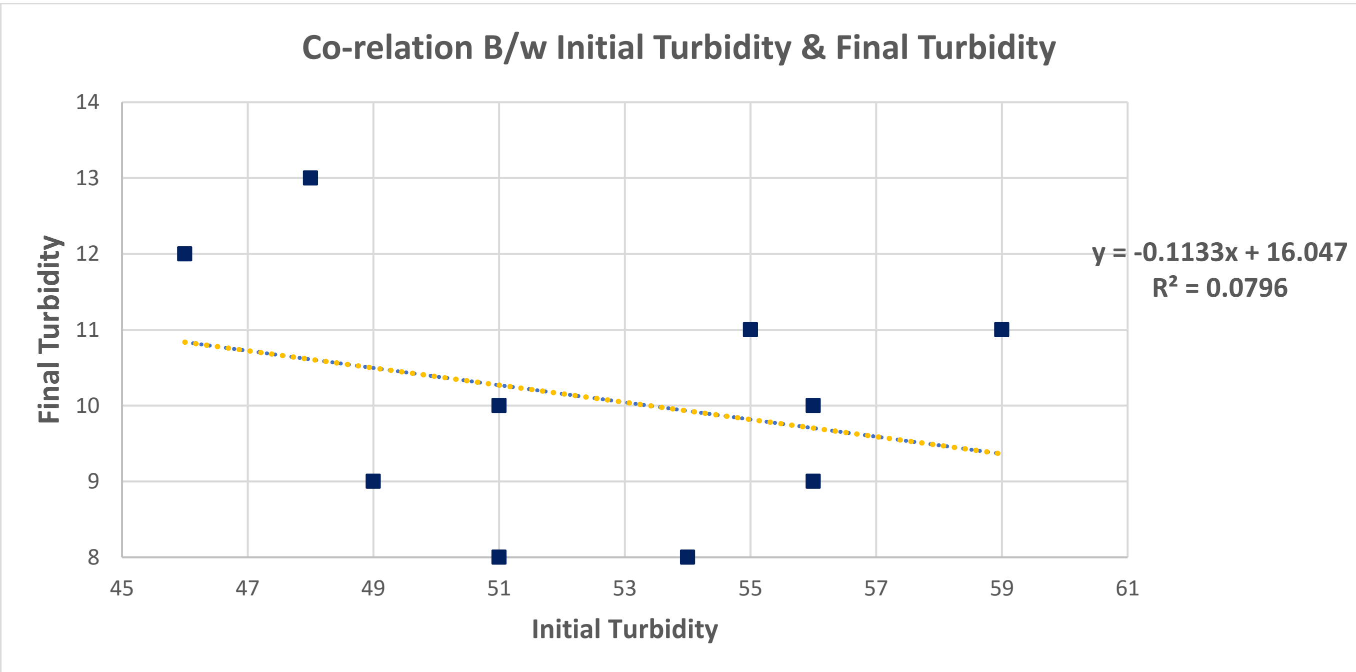


The scatter plot shows a **strong positive correlation** between pH and TDS, with **r ≈ +0.745**. The positive correlation indicates that pH tends to increase as TDS increases in the analysed water samples. The **R^2 value (0.5547)** indicates that approximately **55.47% of the variation** in pH is explained by its linear relationship with TDS.



The scatter plot shows a weak negative correlation between initial turbidity and final turbidity, with r ≈ −0.282. The negative correlation indicates that final turbidity tends to decrease slightly as initial turbidity increases. The R^2 value (0.0796) indicates that approximately 7.96% of the variation in final turbidity is explained by the linear relationship with initial turbidity.

Calculation of Treatment Efficiency

Treatment efficiency was calculated as:

$$Removal\ Efficiency\% = \frac{Ci - Cf}{Ci} \times 100$$

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C_i = initial concentration C_f= final concentration

Result and Discussion

The experimental investigation demonstrated that the treatment process produced an observable improvement in sewage quality.

The most visible change was the reduction in color and turbidity. Untreated sewage generally appeared darker and contain more visible suspended material, whereas stated water showed improved clarity.

Turbidity reduction indicates removal of suspended and colloidal particles. This is an important treatment outcome because suspended matter can interfere with subsequent statement processes.

The TDS reduction was generally less pronounced than turbidity reduction. This is expected because dissolved substances cannot always be removed effectively through simple sedimentation or conventional filtration. Advance processes such as adsorption, ion exchange, reserve osmosis or other membrane processes may be required when substantial dissolved – solute removal is necessary.

The pH generally Remained relatively stable before and after treatment. Maintaining an appropriate pH is more important because treatment reactions, biological activity and a disinfection performance can be influenced by pH.

Temperature did not show a major treatment – related change because temperature is primarily controlled by the surrounding environment and sample – handling conditions rather than the physical filtration process itself.

The result therefore suggest that thus selected treatment was more effective for improving physical characteristics, particularly turbidity and color, than four completely eliminating dissolved substances.

Comparison with Sewage-Treatment Standards

CPCB documentation for specified C- treatment plans provide limits including pH 6.5 – 9.0, BOD not more than 10 mg/L, COD not more than 50 mg/L, TSS not more than 20 mg/L, NH4 – N not more than 5 mg/L, total nitrogen not more than 10 mg/L and fecal coliform less than 100 MPN /100 ml for the cited new – STP standard.

The present investigation primarily examined PH, temperature, color, turbidity and TDS. Consequently, it cannot by itself established full compliance with a sewage – discharge standard. BOD, COD, TSS common nitrogen and microbiological parameters should be included in future work before making a definite regulatory-compliance claim.

Environmental Significance

Proper sewage treatment can reduce the pollution burden entering rivers, streams, agricultural land and groundwater.

Treatment also creates an opportunity for wastewater reuse. Depending on the quality achieved, treatment CVS may potentially be used for applications such as landscaping, toilet flushing, concentration activities or irrigation, subject to applicable standards and appropriate microbiological and chemical assessment.

Wastewater reuse is increasingly considered an important component of sustainable water – resource management.

LIMITATIONS

The major limitation of the study was:

- Limited number of physico – chemical parameters
- Limited number of sampling locations
- Absence of extensive seasonal monitoring
- Limited microbiological assessment
- Absence of comprehensive heavy – metal analysis
- Limited BOD/COD analysis
- Treatment efficiency dependent on the selected experimental conditions

CONCLUSION

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The present experiment has to be investigated the treatment of sewage water using selected physical and chemical treatment processes. The investigation demonstrated that the treatment can be significantly improved the visible and selected physio-chemical characteristics of sewage.

The greatest improvement was associated with color and turbidity, indicating effective removal of a sustain substantial a proportion of suspended and colloidal material the TDS showed comparatively lower removable, indicating the persistence of dissolved substances that may require additional treatment technologies.

The pH remained relatively stable, demonstrating that the treatment process did not produce a major change in the acid – based condition of the water.

The study confirmed that conventional treatment can provide significant improvement in sewage quality but also demonstrate that a limited site of a perimeter is insufficient for declaring treated sewage safe for all application. Comprehensive assessment involving BOD, COD, TSS, nutrients and microbiological parameters is required before discharge or use UH decision are made.

The study therefore supports the use of integrated wastewater – treatment systems and emphasizes the importance of matching treatment technology with source – water quality and the intended final use.

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