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Methods for Handling Wastewater and Production Filtration Systems

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ABSTRACT
As in the past, the lack of a reliable supply of potable water is a major problem in both urban and rural communities. The high expense of water treatment is a major factor in why people in many Indian cities drink unfiltered tap water. Water-borne diseases such as diarrhoea, typhoid, and others are extremely harmful to human health, and their spread is often caused by drinking contaminated water. One of the most pressing issues today is figuring out where to send all the waste that gets produced, both by homes and by businesses and factories. Water and wastewater can be filtered to remove impurities by passing them through a porous medium. The term "filter media" is used to describe the layer of filter materials used in filtration systems. As part of this effort, a unified filtering unit is designed to purify both potable water and wastewater produced on-site. The multimedia filtering system will be built using a number of different materials, including activated carbon, activated zeolite, and activated alumina. As an added bonus, this project will aid in neutralising acidic water, raising TDS levels in potable water supplies, reducing TDS levels in wastewater, and eliminating organic matter in wastewater. Adsorption is a key mechanism in treating wastewater by removing pollutants.

Keywords: *construction, wastewater, methods, material, sample, design*

I. INTRODUCTION

There are many valuable resources on Earth, and water is one of the most essential ones. About 97% of the water on Earth comes from salty oceans and lakes, while the remaining 3% comes from rivers, streams, and glaciers. Earth's water resources include all forms of water obtained from below ground, including water in aquifers. In India, the monsoon season is when the country's ground water supplies are refilled from the previous year's rainfall. Groundwater is replenished in part through canal irrigation and other types of irrigation systems. In India, natural groundwater recharge from rainfall has a yearly capacity of approximately 342.43 km3, or 8.56 percent of total annual rainfall. The yearly potential groundwater recharge enhancement from the canal irrigation system is about 89.46 km3.

In most places across India, access to potable water is limited to a few hours per day, and the quality of the water often falls short of expectations. Water issues are also caused to insufficient or low pressure and unpredictable supplies. The rural population suffers from low water quality, but the urban and semi-urban areas are especially prone to water shortages. It is not sufficient to just provide water without regard to its microbiological safety. Another factor is water lost through plumbing leaks and other unauthorised uses. The water quality monitoring data acquired throughout 1995 to 2006 reveals that organic and bacterial contaminants continue to be critical in water bodies. Most of this is because most of the country's cities dump their wastewater into the environment without first having it cleaned. Untreated sewage from cities cannot be treated by those municipalities. Second, there is not enough water in the bodies that will be receiving the pollution to dilute it.

Consequently, the need for oxygen and the accumulation of harmful germs are both rising. Most infectious infections that spread through water are caused by this. (CPCB: http://cpcb.nic.in/water.php). A water filter can use a chemical process, a biological process, or a tiny physical barrier to purify water. Water filtration systems are used for a variety of functions, including the purification of water for human use, the maintenance of public and private aquariums, and the protection of bodies of water like ponds and swimming pools. Filters remove contaminants from water using a variety of mechanisms, including sieving, adsorption, ion exchanges, and the transfer of biological metabolites. Filters, in contrast to sieves and screens, have the potential to remove particles that are smaller than the openings through which the water flows. After the wastewater has gone through the primary and secondary treatment phases and before it is disinfected, filtration is often used as part of the tertiary treatment process. The filter works by capturing any remaining suspended particles or bacteria in the water as it goes through. Physical obstruction, biological action, adsorption, absorption, or a combination of these can all serve to restrict a passage. Filtration of wastewater is typically the last stage in the solids removal process.

II. OBJECTIVE OF THE STUDY

The primary objective of this study is to develop a single-unit filtering system that can treat both potable water and wastewater, the latter of which is often produced on-site. Multimedia filtration systems use zeolite, activated carbon, and activated alumina as their primary media.

- Additional goals of this study include:
- In order to lower overall treatment costs,
- To improve the treatment system's effectiveness.
- Improve the standard of raw water.
- To treat wastewater produced on-site.
- Wastewater reuse and recycling.

III. SUPPORTING ELEMENTS AND METHODS

Sample Gathering

It was decided to collect 10 samples for the purpose of experimentation (5 water samples and 5 wastewater samples). From the Sabarmati River, we took water samples every two days. Sullage water was the sample of wastewater that was collected for testing purposes. Sullage water is typically produced in domestic settings such as the kitchen, bathroom, sink, etc. There were a total of five wastewater samples taken over a two-day period. A variety of tests were performed on the materials as soon as they arrived at the lab.

Experimentation

A number of tests, including those for pH, TDS, and turbidity in water and for pH, COD, TDS, and turbidity in wastewater, were conducted. Examining the sample's pH value can shed light on whether or not it has acidic or basic properties. The pH scale is typically used between 0 and 14. A pH of 0-7 is considered acidic, a pH of 7 neutral, and a pH of 7-14 alkaline.To calculate how much oxygen is needed for the chemical oxidation of organic matter with a powerful chemical oxidant like potassium dichromate under reflux conditions, scientists use a metric called the chemical oxygen demand (COD). Normal refluxing times at 150 C are 2 hours.Ferrous ammonium sulphate is used as a titrant in the sample analysis. There should not be more than 250 mg/L of COD in a waste container. The concentration of inorganic substances in water can be quantified by measuring its total dissolved solids (TDS). Electricity conductivity in water is measured to get this value. More and more inorganic chemicals in water make it a stronger conductor of electricity. The presence of suspended or dissolved materials in a sample causes cloudiness and haziness, which is referred to as turbidity. NTU is the unit of measurement (Nephelometer Turbidity Unit). A maximum of 10 NTU is recommended for safe drinking. The experiments followed the 19th Edition of the American Public Health Association's Standards Methods for the Examination of Water and Waste Water, which came out in 1985.

The Construction of the Model

Separate filtration systems for water and wastewater were integrated into a single physical model. The configuration of the filter materials is the same for both.

Table 1: Design of Filtering Materials

Layer-1	Primary Resources	Gravel	A thickness of 5 centimeters
Layer-2	Contents of Filter	Activated Alumina	A thickness of 5 centimeters
Layer-3	Contents of Filter	Zeolite	A thickness of 5 centimeters
Layer-4	Contents of Filter	Activated Carbon	A thickness of 5 centimeters

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Figure 1: Synthetic representation of a simplified filtering system

IV. FINDINGS AND DISCUSSION

The acidity or alkalinity of water is a chemical feature that is crucial from both a human health and environmental perspective when it comes to drinking water and wastewater discharge. There appears to be a rising trend in this case. A rise of almost 2 points in pH has been seen across all of the analysed water (Figure 2). This is a novel idea that has emerged from our studies. By raising the pH level by two units, acidic water will become basic. You can safely consume this or flush it away. The pH rises because the filtration mechanism is made of acidic components. Activated carbon, zeolite, and activated alumina are the three components. Most of the time, zeolite has a pH range of 7.35–7.45, while activated carbon has a range of 9–11.

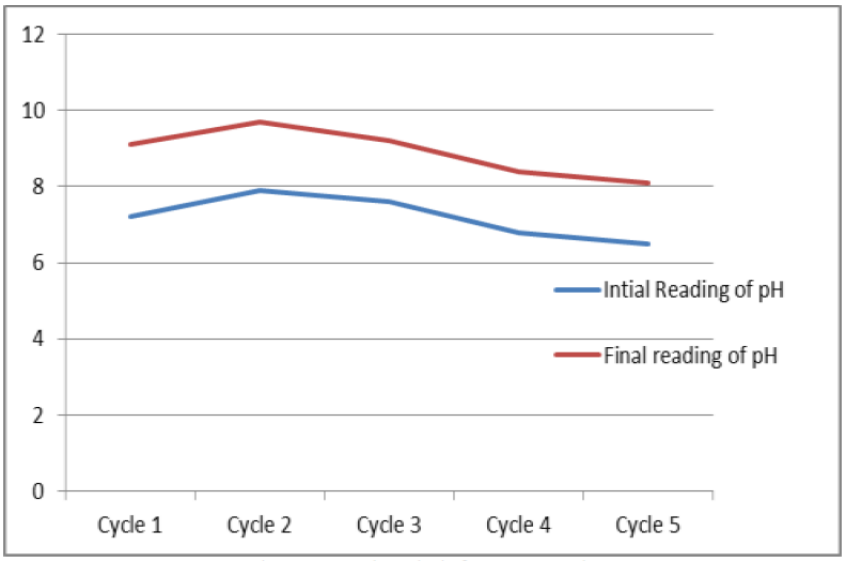

Figure 2: Evaluation of Water Sample pH Values

From a turbidity removal standpoint, the filter we developed works well for both potable water and wastewater. The Bureau of Indian Standards (BIS) sets the maximum allowable turbidity for drinking water at 10 NTU, but there is no such standard for wastewater discharge. The raw water's turbidity was 14.8 NTU, but after filtering, it was only 8.44 NTU, well below the allowed range. A first turbidity reading was taken from a sullage. Before filtering, the turbidity ranges from 103 NTU to 49 NTU (Figure 3). The level of turbidity has dropped by nearly half. Adsorption is the mechanism responsible for clarifying water and wastewater. As the filter material took in the floating particles, their number in the water decreased.

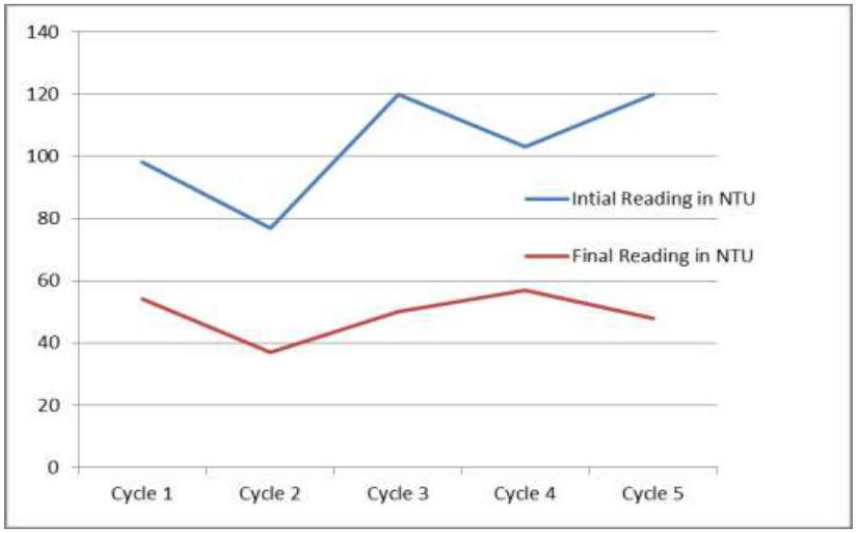

Figure 3: Examining Wastewater Samples Based on Turbidity

There was a general trend toward lower TDS concentrations in the wastewater samples. After being filtered, the average TDS concentration in treated wastewater drops from 1028 PPM to 662 PPM. In the range of 35-40% of total dissolved solids (TDS), wastewater is removed (Figure 4).A high concentration of TDS in sullage wastewater can be effectively filtered out with our filter. An intriguing pattern, though, was noticed in the water supply. The value of TDS is rising rather than falling, as concentration remains constant. The mean total dissolved solids concentration (TDS) of the five Sabarmati River water samples obtained was 78.52 PPM, although it peaked at 510 PPM (Figure 4). It's because of the filter material that was used. Activated carbon is typically placed at the top of a filter. Meilani and Santoso found that the TDS of water was highest for the biggest pieces of activated carbon. When the smallest size activated carbon was used to treat the water, the total dissolved solids (TDS) were the lowest. Activated carbon produced a wide range of TDS values, from 0.01 to 0.64 gm/L. The TDS value of water rose steadily when the weight of medium-sized activated carbon was 0.5 g, 1 g, 3 g, 5 g, 7 g, 10 g, 15 g, and 20 g. However, the value of water TDS was reduced when 25 g of medium-sized activated carbon was used. Zeolite is a microporous, aluminosilicate mineral that is often used as a catalyst or adsorbent in industry. It is also used as a filter material, which adds to the high TDS concentration. When using zeolite resin, sodium is replaced with calcium and magnesium. Total dissolved solids rise by 0.15 ppm for every ppm of calcium that is substituted with sodium. Every 1 ppm of magnesium that is taken out and replaced with sodium makes the total dissolved solids go up by 0.88 ppm.

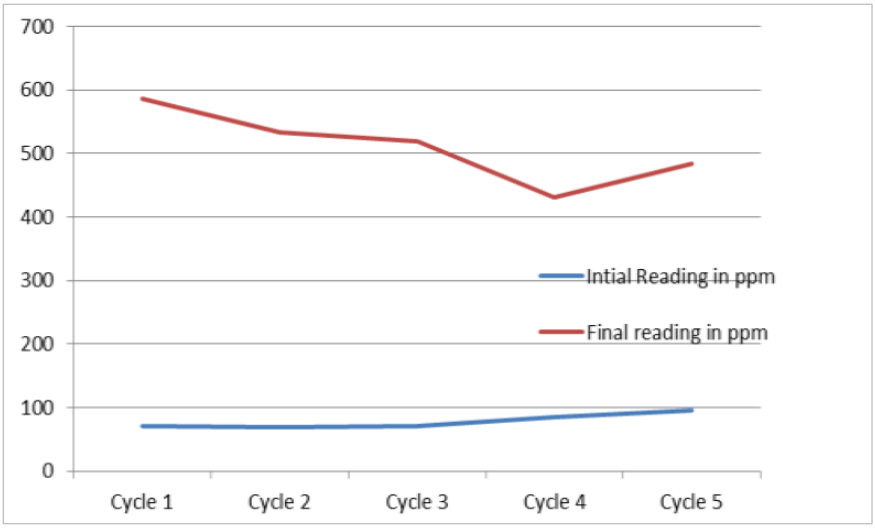

Figure 4: TDS Analysis of Water Sample

The mean COD for the pooled sullage sample of size 5 was measured at 1296 mg/L. The concentration of chemical oxygen demand (COD) in the resulting filtered wastewater is significantly reduced. The typical level of COD is 538 mg/L. A reduction in COD content of about 58% has been observed (Figure 5). The filter media used for the filtration process makes this possible. Non-biodegradable organic debris in the wastewater was absorbed by the filter media. Therefore, there is less total organic matter in the effluent.

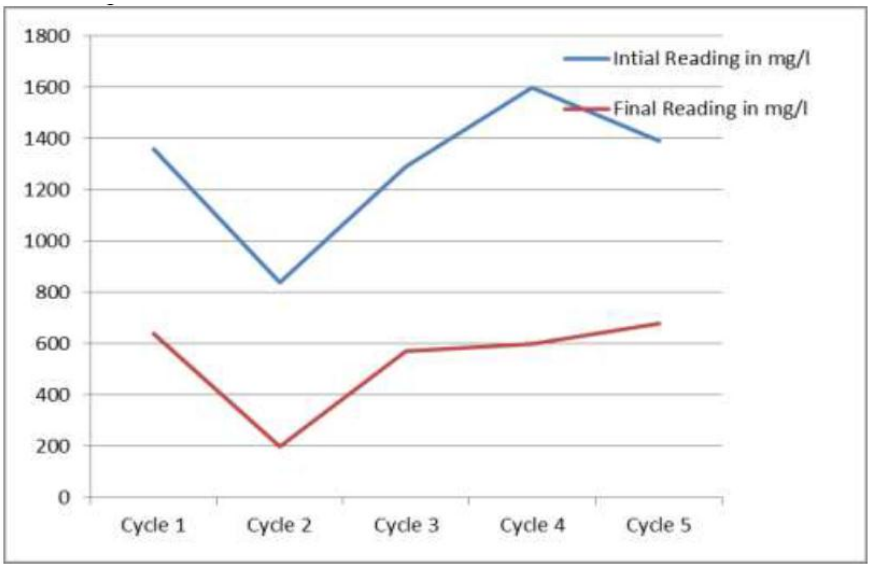

Figure5: Calculation of Chemical Oxygen Demand in Wastewater Sample

V. CONCLUSION

Overall, the study's findings support the filter's efficacy in both water and sewage filtration. This novel idea for a filter that can purify both water and wastewater is revolutionary. Each quarter of the total filtration area is dedicated to water filtration, and the other half to wastewater filtration. When compared to other systems, ours is far more effective for

- The pH of both the water and the wastewater sample was raised by 23.6% and 27.5%, respectively.
- Dissolved solids are reduced by 35% in wastewater, whereas dissolved solids are raised by 550% in the water sampled.
- boosts water clarity by 42.97% and sewage clarity by 52.5% by removing turbidity.
- Since the biodegradable organic matter was taken out of the wastewater sample, the concentration of COD has gone down by 58.48%.

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