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DESIGN OF LOW-COST FILTER MEDIA

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ABSTRACT: *Purification has always been a necessity since the dawn of humanity. Purification is important for decreasing the risk of toxins from recharging runoff rainwater and avoiding numerous ailments. As a result, the national and state governments in India are developing water treatment plants to provide society with adequate and safe drinking water. Rapid sand filters are commonly used in India to remove suspended and colloidal particles from water in the filtering process at a faster rate by laying down separate sand beds. The usage of a sand filter as a technique is taken into consideration. In industry, it is often used to remove impurities from water and wastewater treatment. The filtration process degrades at the beginning and end, affecting the initial quality of the filtrate following backwashing. Filter to waste, delay start, sluggish start, and filter conditioning by coagulant during backwashing are all examples of waste to cope with initial filtrate quality problems. In addition, the use of coconut shells in filtration serves as a dual media filter. Designing a 'Dual media filter covered with crushed coconut shells' is more efficient, cost-effective, and long-lasting. It increases the filter's performance in terms of high filtration rate, increased filter run, reduced backwashing requirements, and high turbidity removal, making it more suitable for a variety of applications.*

Keywords: Water quality, Water quantity, Filtering process, Filter technology, Media filter, Cost-effective

I. INTRODUCTION

In the purification of surface water supplies, rapid sand filters are often utilized. To allow for operating flexibility, the filter area is separated into at least two independent components. Raw water normally requires some sort of pre-treatment, such as sedimentation. Due to rising demand, most traditional water treatment plants are overburdened, highlighting the need for a higher filtration rate. Rapid sand filters have limits that can be overcome by dual media and multimedia filters. Higher filtering rates, on the other hand, are possible. However, in India, the application of such approaches is limited due to the scarcity of filter materials other than sand. Capping existing rapid sand filters is a viable approach to enhancing rapid sand filter performance. Covering the filtering medium with appropriate caps, such as anthracite coal, bituminous coal, crushed coconut shells, and so on, is a method of capping. Capping entails removing a portion of the sand and replacing it with appropriate caps. Although inferior to the originally intended dual media filter, this enhanced filter outperforms ordinary Rapid Sand Filters in terms of both filtration rate and total filter run. The purpose of the proposed research was to evaluate the utilization of coconut shells as capping material. Several huge water storage tanks have been constructed across Pune. Thousands of people could become ill if contaminants get into these tanks. The public is expected to tidy up the area around the tanks

Although humans drink a lot of fresh water, some of it includes disease vectors or viruses that might create long-term health concerns if they don't fulfill specific water quality standards. There is a significant gap in the availability of drinkable water as of 2006 (and for at least three decades prior), owing mostly to overpopulation in less developed countries. In the year 2000, 37 percent of the population in developing countries lacked access to safe drinking water. The consequences of disease spread are significant. Water quality standards exist in several countries for water sold as drinking water.

II. MATERIALS

A. Gravel: Gravel of size 10 to 20 mm has been used in a filter. The depth of the gravel layer in the filtration unit is 6cm.

B. Sand: Sand of sizes 300micron, 600micron, and 3 to 6 mm is used in a filter at the base. The depth of all three sand layers that were maintained in the filtration unit is 5cm respectively.

C. Coconut Shells: Crushed coconut shells having a size of 5 to 20 mm were used as capping media above the gravel layer. The depth of the coconut shell layer in the filtration unit was 7cm.

D. Coconut shell charcoal: Charcoal obtained from burnt coconut shells was used in the filter unit. The size of the charcoal was 1mm. It is laid above a sand layer to a depth of 5cm.

III. METHODOLOGY

The test was carried out according to the procedures mentioned below.

1. Filter consisting of sand layer bed of 15cm thickness at the base, charcoal layer bed of 5cm thickness above the base layer, gravel bed of 6cm thickness above coal layer, and coconut shell layer of 7cm thickness at the top was spread in the filter.

2. The water obtained from the lake is stored in a container for a detention period of 5-6 hours. After sedimentation, the water was passed through the filter with the help of a pipe system.

3. The raw water container has been placed well above the filter unit.

4. The head of water above the filter media in the filtration unit of 10cm was maintained throughout the test period. The raw water is continuously fed to the filter through a pipe attached to the container.

5. The filtered water samples, Sample A, Sample B, Sample C and Sample D were taken at a frequency of every 1.5 hours.

6. These samples are tested for pH, turbidity, total solids, BOD, COD, and hardness.

Fig-1 Sand Filter with Coconut Shells

IV. RESULT AND DISCUSSION

The result obtained during the sampling is as follows:

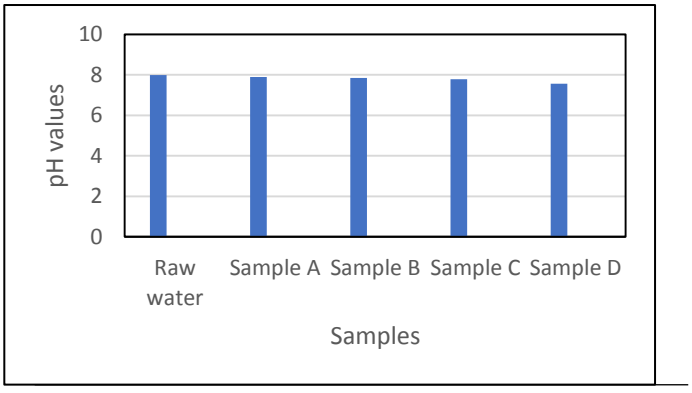
During the filtration process for every 1.5hr, the filtrate samples were collected and tested. The samples and raw water are tested for various parameters like pH, TDS, Hardness, Turbidity, BOD, and COD.

Table No.4.1 Test Result for pH, TDS, Hardness, Turbidity, BOD and COD

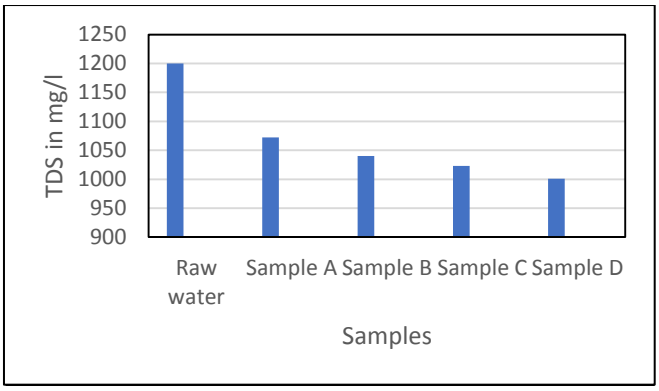
Tests	Raw water	Sample A	Sample B	Sample C	Sample D
pH	7.98	7.9	7.84	7.78	7.56
TDS (mg/l)	1200	1072	1040	1023	1001
Hardness (mg/l)	270	254	230	197	172
Turbidity (NTU)	7.8	5.2	4.1	2.0	1.1
BOD (mg/l)	16.97	12.4	11.2	11.0	10.40
COD (mg/l)	198	156	110	72	34

V. GRAPHS

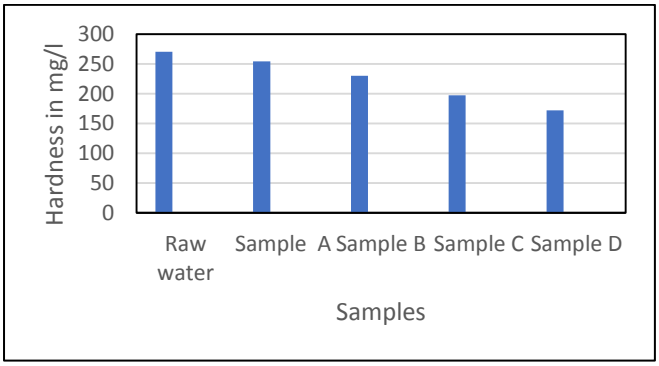
The following graphs are plotted to show that the filter, capped with coconut shells reduces the impurities of the water significantly.



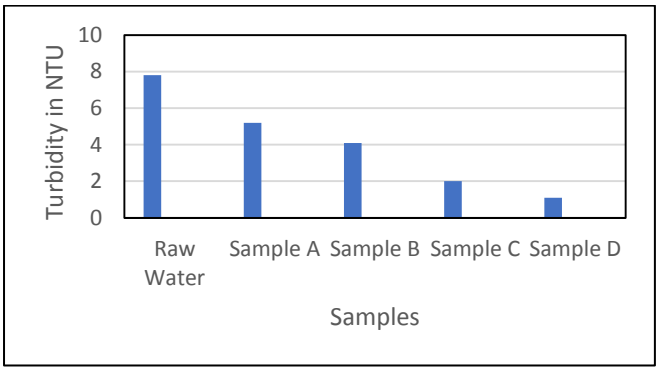
Graph no.5.1 pH vs Sample/1.5hr



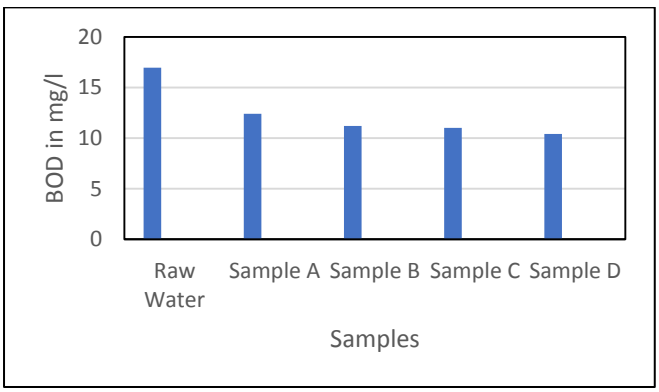
Graph no. 5.2 TDS (mg/l) vs Sample/.5hr



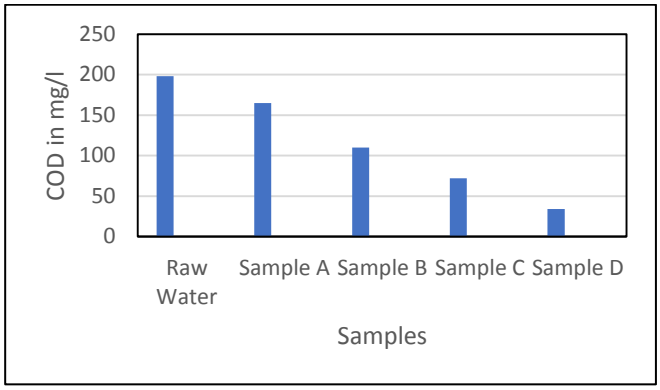
Graph no. 5.3 Hardness vs Sample/1.5hr



Graph no. 5.4 Turbidity vs Sample/1.5hr



Graph no. 5.5 BOD vs Sample/1.5hr



Graph no. 5.6 COD vs Sample/1.5hr

VI. ADVANTAGES

1) Low-cost water filter.

2) Can be made at home with recyclable materials.

3) Filters water with significant purification.

4) Simplicity of use and acceptability.

5) Provides a natural filter media through which particles can be filtered.

VII. CONCLUSION

1) The sand medium is set up with finer sands at the bottom and coarse materials working their way up to coconut shells. Crushed coconut shells are utilized as a capping material at the top of the filter, with coconut shell charcoal in the center.

2) According to test results, the pH is lowered to about consumable levels, turbidity is reduced by about 85 %, Total Dissolve Solids were eliminated by 83 %, BOD is reduced by 64 %, and COD is reduced by 82.8 %.

3) Because of the considerable number of metals present, the hardness was not controlled by the filter as intended.

4) The use of a developed filter made of capped coconut shells has proven to be simple, promising, and low-cost.

5) The filtered water can be used for irrigation, bathing, cleaning kitchenware, laundry, and among other things.

6) Further treatment is needed to make water suitable for drinking.

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