

Development of a Series Filtration Water Treatment Method for Small Communities

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Abstract: Nowadays, water quality has become the major issue as best quality water is needed for their daily lives. There are many types of treatment to improve water. Water treatment technologies have evolved over the past few centuries to protect public health as more than a billion people on this earth have no access to clean potable water that is free of pathogens. India is one of populated countries in world with poor people who are unable to afford a clean portable water quality. The series filtration system of treating surface water using local materials for filter media was studied for the purposes of determining:

The efficiencies of the single media and dual media to remove microorganisms, colour and turbidity.

Keywords: Natural filtration, Coconut husk, Coconut shell.

1. INTRODUCTION

Areas of the developing world are populated with poor people who are unable to fulfill the basic needs for Clean water and India is one of them. Water treatment plant is being designed for proper filtration of water. Treating it properly after all treatment process or trying to manage the good condition in water. Rain water is an important source to feed the ground water aquifer, which is done directly or by harvesting and recharging. Purification is always a need from the ancient age of civilization. The importance of purification is for reducing the risk of pollutants from the recharging run off rain water and for avoiding the various diseases. So the central and state government are taking effort to provide adequate and safe drinking water to society by constructing water treatment plants in India. In India rapid sand filter are mostly used to removed the suspended and colloidal particles from water in filtration process for the faster rate by setting out the different sand beds in constructing it. The use of sand filter as a technique consider not expensive and commonly use to remove contaminants from water and waste water treatment in industries. The filtration process undergoes

degradation at initial and last phase which affect the initial quality of filtrate after back washing. There are some waste to deal with initial filtrate quality problem as filtrate to waste, delay start, slow start and filter conditioning by coagulant during backwashing. Also the use of coconut shells in filtration is act as a dual media in the filtration. Designing 'Dual media filter capped with crushed coconut shells' and coconut husk proves to be more efficient, economical and durable. It improves the performance of filter in terms of high filtration rate, increase filter run, considerably reduce backwashing requirements, high turbidity removal and thus making it more applicable for drinking purpose and for further uses. Slow sand filters or rapid sand filters or using local materials as filter media are considered to be an attractive alternative for producing potable water in rural communities in India. These are as rarely have qualified technicians to operate a conventional coagulation rapid sand filter effectively. The availability of land, labor, local materials, no chemicals required and climatologically conditions in India favour the use of slow sand filters which would be an inexpensive method of treating surface water.

2. APPROACHES

To achieve the filtration result some steps are stated as to accomplish the task.

The steps are as follows-

1. Pilot scale model of filter was constructed using glass columns with an inside area of 0.15m X 0.15m along with associated piping and valves. The pilot model was installed at College lab as shown in Figure 1 where the clarified water was used for the performance evaluation of dual media filter.



Fig.1. Series Filtration

Table 1. Water quality parameters of collected sample

S. No.	PARAMETER	STANDARDS IS 10500:2012 (min - max)	INITIAL READINGS	FINAL READINGS
1	COLOUR	Hazen(units)	MUDDY	COLOURLESS
2	PH	6.5 TO 8.5	8.4	7.3
3	TURBIDITY (NTU)	5 TO 10	366.6	5.3
4	TDS(Mg/l)	500-2000	1216.6	698.3
5	TOTAL HARDNESS (mg/l)	200-600	364	284.3
6	ALKALINITY (mg/l)	200-600	513.3	96.3

4. CONCLUSION

The purpose of this research is to bring new low cost technology and make a model of rapid sand filter using coconut husk and coconut shell as a capping media, which can be used in small scale like house hold and reuse the muddy water. Different filter media such as coarse gravel and fine gravel is also been used. The analysis of the performance shows a gradual decrease in different parameters use for characteristic analysis of muddy water. This shows the series filtration method are a good approach of water treatment. We observed that the model of rapid sand filter is, significantly assist in the removal of turbidity, alkalinity, TDS, hardness, and will improve the pH quality of the effluent. This project will help to understand a new approach of an environmental friendly filtration technique. The above testing results of parameters made some following conclusions-

1. Coconut husk when used as a filter media in the filtration process gives good efficiency.
2. There was considerable reduction in turbidity, total solid, pH and hardness.
3. There was considerable reduction in the color intensity.
4. The reduction in turbidity is up to 90%.
5. The Decrease in the total solids was up to 89%.

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2. The sand media of desired effective size and uniformity coefficient was prepared by sieving the washed and sun dried stock sand. The coefficient of uniformity of sand and effective size was 0.6mm.
3. Filter layer consisting of gravel bed of 15 cm thickness, sand layer of 20 cm thickness ,crushed coconut shell layer of 15 cm thick and coconut husk layer of 20 cm was spread in the filter unit.
4. The water obtained from the lake stored in a large container for a detention period of about 3-4 hours .The supernatant water after sedimentation process was passed through filter.
5. Influent water is fed into the filter with the help of a dispenser of 70liters capacity has been placed well above the filter unit.
6. A head of water above the filter media in the filtration unit of 10 cm was maintained throughout the test period .the raw water was fed to filtration unit continuously through dispenser placed above the filtration unit.
7. Effluent sample are tested for turbidity, pH, total solids, TDS, Colour.
8. The experimental has been carried out up to 8 hours.

3. RESULTS

The collected sample from the experimental setup of series filtration has been tested in lab. The comparison of parameters of water before filtration and after filtration is shown in the table1.

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BIOGRAPHIES



Mr. Saurabh Upadhyay is pursuing M.Tech in Environmental Engineering from Babu Banarsi Das University ,Lucknow. He has completed his B.tech degree in Civil Engineering from Hindustan university Chennai 2015.



Dr. Arif Siddiquie is currently working as an Associate Professor in Department of Civil Engineering at BBDNITM, Lucknow. He has been awarded PhD in Environmental Impact Assessment (EIA) in the year 2009 from Baba Saheb Bhimrao Ambedkar (A Central) University Lucknow and also holding a M.Tech. degree in Environmental engineering from Department of Civil Engineering Integral University, Lucknow. Besides teaching and research assignments he has also worked as a consultant to the Indian Minister of State Maneka Gandhi in the Ministry of culture and Ministry of Statistics & Programme Implementation Govt. of India, Shastri Bhawan, New Delhi, India where he developed a state-of-the art on foreign funding sources for non-profit sectors in India. He has also published various research papers in various reputed national and International journals.