

Development of a Series Filtration Water Treatment Method for Small Communities: A Review

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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. LATEST RESEARCH TRENDS

There are many research papers and study materials regarding the development of water filtration techniques. Some of them are discussed here.

Pratibha et.al. [1] state in their research paper that coconut shell carbon was activated by coconut shell. Carbon was converted into activated carbon by chemical activation using different activating agents like CaCl_2 , H_2SO_4 , H_3PO_4 , KOH , and ZnCl_2 and thermally activated. Batch adsorption desulphurization operation was carried out at room temperature for adsorption for selection of final activation agent for continuous process. Characteristics of coconut shell activated carbon was studied such as P.H, Moisture Content, Ash content, Volatile matter content, Fixed carbon, Iodine Number, BET surface area, Scanning Electronic Microscope (SEM).

Mota Manoj H et al. [2] studied the effect of capping of RSF by the use of coconut shell as a capping media by pilot scale study. This study has shown that rapid sand filter are very common in all conventional water treatment plants. Major problem associated with it is stratification; it restricts the complete use of sand bed. Almost all rapid sand filter beds are suffering by problems like high backwash water requirement, unsatisfactory Effluent and mud ball formation. A pilot scale model of filter is constructed using glass columns with an inside area of $0.15\text{m} \times 0.15\text{m}$ along with piping and valves. The co-efficient of uniformity of sand used was 1.7 and effective size was 0.6mm . the co-efficient of uniformity of co-efficient of uniformity of capping media used was about and effective size of 1.91mm . Capping is the

process of covering the filter media by caps of crushed coconut shell, bituminous coal, anthrax filter, etc. higher rate of filtration is possible along with less backwash requirement and higher filter run. Backwash requirement for capped RSF caps is less as compared to conventional RSF by 33%. Crushed coconut shell as capping media can increase the filter run by 80%.

Shilpa S. Ratnoji et.al.[3] explained in their paper that in India, the quality of raw water available for drinking purpose varies significantly resulting in modifications to the conventional water treatment scheme consisting of aeration, chemical coagulation, flocculation, sedimentation, filtration and disinfection. Different alterations in these stages could lead to improvised levels of water quality. A novel solution to reinstate the sand filtration process is by utilizing activated carbon (AC) derived from coconut shell. A pilot scale study of filtration unit with different grades (on size basis) of coconut shell activated carbon (CS-AC) such as WTD816, WTE830 and WTE124 was carried out. These AC's were assembled at different depths independently as well as in combination. This work examined reduction and removal of iron, turbidity, biochemical oxygen demand (BOD) and chemical oxygen demand (COD) in river water by making different arrangements of CS-AC in the filtration unit. Also its comparison with sand, a conventional practice in water treatment plants in India was done to reduce these parameters. Finer grade activated carbon (AC-III) showed the maximum iron removal (95%). It also showed reduction in COD, BOD and to some extent turbidity in all types of arrangement which was not so in case of traditional sand filtration process. This technique is advantageous and it also helps in utilization of an agricultural waste.

Ranjeet Sabale et.al.[4] mentioned two pilot filter columns in their paper. One is conventional RSF and other is capped RSF. Conventional filter has sand as filter media; capped RSF has PVC granules as filter media. Conventional rapid sand filter and capped rapid sand filter are compared. Sand media having characteristics as effective size (E.S.-0.35 to 0.60mm), uniformity coefficient (U.C.-1.30 to 1.70), specific gravity -2.67, limiting head loss-1.80 to 3.0m, depth of sand -60cm, depth of gravel support -40cm, etc. A rapid sand has many advantages like easy operation, more filtration rate, easy backwashing, and output. Due to improper backwashing, major problems shown in the filter media is mud-ball formation. Stratification of sand media takes place at the time of backwashing process. Sand grains having small size come at top layer which reduces the porosity. Filtration process is affected due to the increase in head loss in shorter run time. Capping of rapid sand filter is suggested by the researchers to overcome to these problems. Capping is the process in which upper sand bed layer is replaced with few centimeters of capping material. Capping proves efficient techniques for improving performance of RSF. Capping with PVC granules with 3cm depth gives turbidity removal up to 92%.

Miss. Koli Asha et.al.[7] mentioned about Rapid sand filter in their paper. According to them, Rapid sand filters are very common in all conventional water treatment plants. Most of the rapid sand filter beds are suffering by the problems like stratification, mud ball formation and unsatisfactory effluent and high backwash water requirement. Dual media and multimedia filters can overcome the limitations of rapid sand filters. Alternatively, higher filtration rates even can be achieved. The attempt is made to the study of dual media filter using anthracite coal as a filter media along with filter aid along with conventional sand media by pilot scale study. Comparative study shown that higher rate of filtration is possible along with higher filter run and less backwash requirement.

3. CONCLUSIONS

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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BIOGRAPHIES



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