RESEARCH ARTICLE OPEN ACCESS

RAPID SAND FILTER USING COCUNUT SHELL AS A CAPPING MEDIA

Sudhir Kapgate Ass. Professor Department Of Civil Engineering[1] UG Student Department Of Civil Engineering Amol G Gore[1], Gaurao S Kale[2], Sagar I Wanjari[3] , Kunal P Wanode[4], Rushikesh B Balpande[5] ,Nagpur Institute Of Technology , Nagpur

ABSTRACT:

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' 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.

INTRODUCTION

The Rapid sand filter is an adaptation of traditional slow sand filter, which has been used for community water treatment for almost 200 years. The rapid sand filter is smaller in size and adopted for intermittent use, making it suitable for households. The filter container can be made of concrete or plastic and is filled with layers of specially selected and prepared sand and gravel. Rapid sand filtration is an essential unit process in the water purification process. It captures and removes coagulated and flocculated material and other suspended matter not removed during the preceding treatment processes. The pores in the filter bed gradually become clogged and the media progressively collects deposit through the continuous use and life of the filter. During normal operations cleaning is initiated by excessive head loss, deterioration in filtrate quality or when the predetermined time for a filter run has elapsed. Air scour, to remove deposit from filter media by vigorous agitation, and wash water, to remove this deposit from the filter bed, are applied.

LITERATURE SURVEY

Introducing and filter capping for turbidity removal for potable water treatments plant of mosul/Iraq - This paper proposes sand filter capping technology in which the top portion of a rapid sand filter is replaced with anthracite coal in order to achieve the improved performance if introduced in water treatment plants. Improved rapid sand filter for performance enhancement –This paper focuses on a cheaper and easily available capping material for better operation of rapid sand filtration. So in these work PVC granules are used to check its suitability.

OBJECTIVE:

1. Sand filter remove pathogens and suspended solids from water using biological and physical, that take place in a sand column covered with a bio film.

2. To reduce water pollution, improve water quality, reduce the cost of providing clean water and improve ecosystem.
3. Maintaining water quality to acceptable levels.
4. Improving water system efficiency and resource conservation.
5. Storing and delivering water where and when it is needed.
6. To make use largely, easily and naturally available materials like coconut shells and fibers in filtrations.
7. To study and suggest various application of capped dual media filter with coconut all possible outcome.

In this project the design and the material needed to complete the project model are as follows

1. Materials –

(A) Sand – The standard sand in laboratory is used as a filter sand. It features for angularity, size, sphere shape parameter and hardness for the most efficient filtering of water. The filter sand is first washed, dried and then screened by sieve analysis.

(B) Gravels - Filter gravel is used as a support media to Filter sand and coal in water filters. For maximum efficiency, filter gravel must possess the necessary attributes of hardness and be rounded rather than angular. The filter gravel like filter sand, contains hard durable particles with a slow breakdown rate. This helps to prolong filter media life.

(C) Coconut shells - The coconuts about two sacks full are collected and cut. Afterwards they are sundried for one month and then sized in pieces manually by hammer. These particle shells are then topped as capping above sand bed.

2. Development of models –

The working model of 'The conventional rapid sand Filter with 'Coconut shell capped dual media filter is prepared.

3. Sieve Analysis :-

Sieve analysis for stratification in conventional rapid sand filter helps to determine the particle size distribution of course and fine aggregate. This is done by sieving the aggregates as per IS: 2386 (part1) – 1963. Different sieves as standardized by IS code are used. Aggregates are sieved through them and collected different size particles left over different sieves. A set of IS sieves of sizes 40mm, 20mm, 9.5mm, 4.75mm, 2.36mm,1.18mm, 600micron, 425micron, 300micron is used for sieve analysis. 300micron, 425micron and 600micron are used for fine aggregates. For course aggregate sieve sizes used are 20mm and 9.5mm. The aggregates retained on sieves are thoroughly washed to remove silt and then allowed to dry in sunlight. Sieve analysis helps to achieve proper gradation of particle size in bed layers.

Fig .Sieve analysis for fine and coarse aggregates

4. Filter Design :-

The filter designed is the trapezoidal shaped column resting on tripod provided with the pipe fittings is required. The dimensions are as follows –

1.Height of filter is 45 cm.

2. Diameter is of 30 cm.

3. Volume i.e. capacity is 20 liters.
4. Size and depth of bed layers.

Sr. No.	Material Used	Size	Thickness
1	Gravels	20MM	8 CM
2	Coconut shells	10MM	7 CM
3	Filtered Sand	600Micron	5 CM
4	Fine sand	300Micron	5 CM

Size and thickness of layer

LAYOUT OF FILTER:-

Different parts of filter layout are discussed with respect to their construction, purpose and working as below :

a)Under Drainage: The filtered water is taken out from rounded drain pipe provided at bottom of the filter. The reduced diameter of filter at bottom is fitted with net at outlet of filter under the sand layers.
b) Overflow pipe: At the top of filter beds, board pipe is fitted to overflow the backwashed water after backwashing.
c) Side Tube: To know and measure the head loss during the working operation of filter, the vertical side tube is attached in design. It is kept transparent to make the head of the water in filter visible
d) T-junction:-T junction is provided between drain pipe and side tube of filter. The fittings and connections are made such that the filtered water and backwashed water should not be interfered during backwashing. Also during filtration processing water should enter the side tube to avail head loss measurement. While backwashing, the reverse water flow must not be entered in side tube hence T junction is provided to close its approach.
e) Supporting stand: The whole working model of filter designed is supported on the tripod stand on some height from ground.
f) Finally the working of model is ensured by pouring sample water through layers until clear water is received.

RESULT AND ANALYSIS

S.N.	Parameters	Initial sample	Capped dual media filter
1	Colour	Muddy	Colour less
2	Odour	Odourful	No odour
3	turbidity	40 to 50 NTU turbid water	About 96% turbidity remove
4	Hardness	Hard water	Moderate hard water
5	PH	Desirable pH	Desirable pH
6	Filtration rate	-	About 54lph
7	Head loss	-	Comparatively low head loss
8	Backwashing requirement	-	Once in week
9	Filter run	-	Comparatively high
10	Efficiency	-	High
11	Economy	-	Economical
12	Ecofriendly	-	Less durable

13	Durability	-	

Conclusion:

Conclusions presented here are based on the results and observations made when various investigations were done on the full scale plant and in situ chemical method of filter rehabilitation. These conclusions pertain to the specific objectives of this study.

- After the filtration process carried out the filter water.
- The totally operation of the filter media the water change our quality.
- The result are shown after fully process muddy colour water change to pure water, this water used for drinking purpose.

We Projectee recommends the use of RSF with coconut shells as capping media technology to be adopted.

Reference:-

[1] S. M. Al-raw, Introducing and filter capping for turbidity removal for potable water treatment plants of mosul/Iraq.
[2] Andrew Wt Wong, University Of Waterloo, Monica B. Emelko, Ph.D., University Of Waterloo, Timothy Walton, Simple filter capping approaches for enhanced biological filtration performance.
[3] Ranjeet Sabale, Sahil Mujawar, Improved rapid sand filter for performance enhancement.
[4] Shilpa S. Ratnoji, Nimisha Singh, A study of Coconut shell - activated carbon for filtration and its comparison with sand filtration.
[5] K. Gunasekaran, P. S. Kumar, M. Lakshmipathy, Mechanical and bond properties of coconut shell