iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** III **Month of publication:** March 2018

DOI: http://doi.org/10.22214/ijraset.2018.3349

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue III, March 2018- Available at www.ijraset.com

Modified Rapid Sand Filtration with Capping

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Abstract: ***Conventional rapid sand filters are commonly used in every water treatment plant. In India, the major source of water is rain fall. In 2014 India faced severe drought due to improper storage facilities and poor management. Hence, it is today's need to reduce the wastage of water and conserve it for future generations. This is also the major problem associated with conventional rapid sand filter. Along with this, other problems of the filter are stratification which mud ball formation, less effluent quality, high requirement of backwash water and wastage of media sand etc.We will try to design a rapid sand filter that can be achieved. However, this technique is limited in India due to unavailability of filter materials apart from sand. Capping of existing rapid sand filters can be done for improving the performance of rapid sand filter. This can be done using different capping materials like anthracite coal, bituminous coal, crushed coconut shells, PVC granules, PVC media, synthetic fiber etc.***

Capping is process in which upper sand bed layer of few cm is replaced with capping material. Some materials suitable for capping are anthracite coal, PVC granules, Polypropylene bids, and bituminous coal, broken brick etc. In the present work conventional rapid sand filter and capped rapid sand filter are compared.

Keywords: Rapid sand filtration, capping of filters, broken brick, anthracite coal etc.

I. INTRODUCTION

Water treatment including filtration and its importance to the health and welfare trace back 4000 years: "it is good to keep water in copper vessels, to expose it to sunlight and filter through charcoal." and, " heat foul water by boiling and exposing to sunlight and by dipping seven times into it a piece of hot copper, then to filter and cool in an earthen vessel." In these we can see disinfection, coagulation, sedimentation, and filtration – the same four basic steps are used in water treatment today i.e. a multiple barrier approach. Hence use of rapid filter has proved to be beneficial. Along with some advantages there are some drawbacks in rapid sand filter. Stratification of sand layers at time of backwash, mud ball formation, rapid increase in head loss, low effluent quality these problems are related to rapid sand filters. As the head loss builds up, the filter requires backwashing, and the filter run is reduced. This difficulty can be removed if filtration takes through from coarser to fine media by using rapid sand filter with capping. India is a second country which has a maximum population. As the population increases water demand also increases. So it is necessary to purify raw water."Rapid Sand Gravity Filter" is a best option to remove impurities from water. Arrangement and Working of Rapid Sand Gravity Filters is easy. But there are some Drawbacks. The main drawback is the time of Backwash is less. Due to backwash the Energy needed is high. Which affects on cost. So it is necessary to increase the backwash time. This Backwash time is increased by using suitable material in mechanism. Generally these specific materials are used on the top of all layers in mechanism, so these materials are known as capping materials. Capping materials are: Anthracite coal, Crushed Bricks, Coconut etc. In Rapid sand filtration sand is used as filter media same as used in conventional filter but process is somehow different for the modified rapid sand filter. This is so because in rapid sand filtration coarser sand is used with an effective grain size in the range 0.35-0.60 mm, and the rate of filtration is between 5 and15 m/h. because coarser sand is used, the pores of the filter bed are relatively large and the impurities contained in the raw water settled down into the filter bed. Thus, the capacity of the filter bed to store deposited impurities is much more. Conventional Rapid sand filters, used in India nowadays. BT it has many drawbacks such as mud ball formation, requirement of water is high for backwash etc. So overcome these problems this modified raid sand filtration will be best alternative.

II. MATERIALS AND METHODOLOGY

A. Methodology adopted for work

In conventional filters the requirement of water for backwash is more and also time required for filtration is more which doesn't prove to be effective in longer run. As mentioned above rapid sand filter with capping will provide the best alternative to this

conventional filter. Thus there is scope for studying various parameters of modified filter using different capping materials. The present study is focused on designing; constructing & comparative study of filters

B. Capping Material- Broken or Crushed brick

Fig. 1 Broken or crushed brick , specimen : Effective size: 0.15 to 0.35mm Specific gravity: 1.6 approx.

Filtration work is carried out by using capping of broken brick granules. Capping is done with different depth namely 25 cm and 10cm.for three different filtration rates run is taken and head loss and turbidity removal variation is measured.

III. EXPERIMENTAL STUDY

A. Experimental Set up

Set up is as per basic design of rapid sand filtration. As per the literature review the design of filters set-up is done. In this set-up two filters of regular rapid sand filter and another is modified rapid sand filter present.

Filter column of acrylic material having 12 cm diameter and 2 meter in length was selected. For filter column the depth of sand media and depth of base material is provided as used in conventional rapid sand filter i.e. 60 cm sand bed and 40 cm respectively. For modified filter sand depth is selected based on defined configuration. For measuring head loss are drilled exactly opposite for easy working. The port is drilled at 30 cm distance apart from each other. For that purpose head loss measuring tube that is level tube is connected to filter column. Head loss measuring tubes has height of approximately 3 m.

Filter columns are installed with the help of stand on flat surface and the plumbing connections are made by APVC pipes as shown in figure. There two overhead tanks of 30 liters are provided, one is having turbid sample and another is clear water for backwashing. The 50 liters of a tank is placed near set-up in which turbid sample is kept which can be flow by gravitational force. To The overflow outlet is provided to maintain constant head. The filter column top is closed by removable plastic cap having two holes for one inlet and another for vent pipe

B. Comparison of Performance of conventional and modified rapid sand filter.

Comparative study of filters will be done for different parameters like turbidity removal, head loss development, filter run length. On the basis of reading we can calculate the parameter such as head loss , backwash time etc .

IV. RESULT AND DISCUSSIONS

Designing and constructing a model of rapid sand filter and capped sand filter using a different capping material it is the main theme of this study. To keep capped material at various depths for filtration of water for better result.

To compare the performance of conventional rapid sand filter and capped rapid sand filter on the basis of total length of filter run, quality of effluent produced and back wash requirement can be calculated by reading and it will be result which filter is best suitable

V. CONCLUSIONS

Configuration of sand media arrangement - Keeping gravel depth 40 cm constant and changing the sand media depth with capping material. Capping material will be provided in 3 cm, 5 cm, 10 cm depth. There will be two capping media, Broken or crushed bricks and thermocal material.

Reading will be taken by changing the sand media depth, changing the flow rate, and initial turbidity. The final outcome will be head loss measurement, effluent turbidity, filter run length, and total output from filter.

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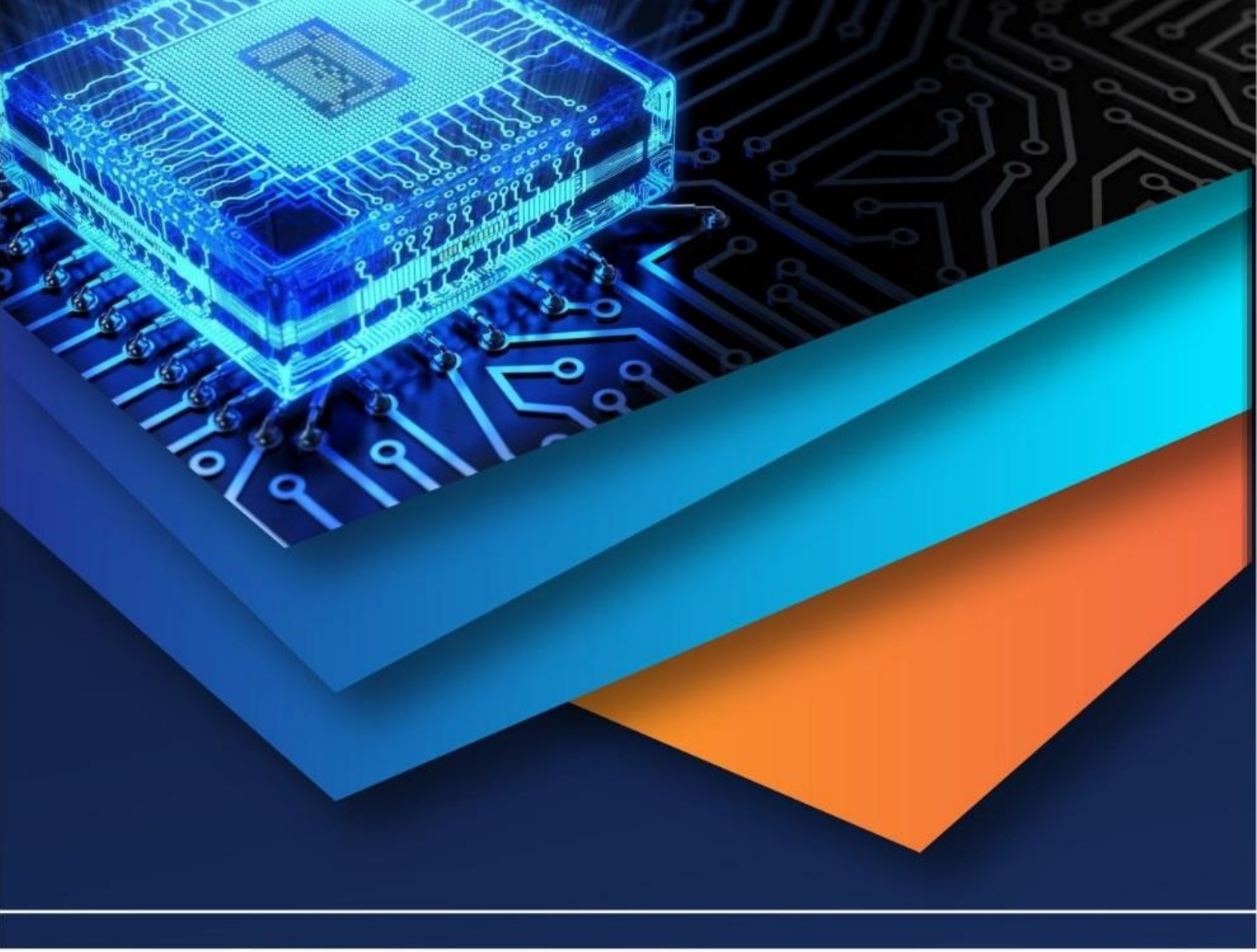

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