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Fabrication & Testing of Rapid Sand Filter Equipment

Dr. K. Mahammad Rafi[1] and T. Ramachar[2]

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Received: 7 December 2011 Accepted: 1 January 2012 Published: 15 January 2012

Abstract

Water is described as a universal solvent which is the most abundant and useful compound that nature has provided. Two main sources of water are: surface and underground water. Among the many essential elements for the existence of human beings, animal and plants, water is rated as one of the most important elements for human living. Man can survive for weeks without food but a few days without water.Sand has been used to purify water for over a thousand years; and it still remains the dependable methods of making water fit for drinking. The idea of water sand filtration can be seen when water taken from sandy river beds is generally pure, because it has percolated through the sand grains where harmful bacteria are removed.

Index terms—

1 Introduction

nsafe drinking water, along with poor sanitation and hygiene, accounts for nearly 10% of the total burden of disease worldwide. This includes an estimated 4 billion cases of diarrhea disease annually, causing 1.8 million deaths, mostly among children under 5 years of age. By affecting normal consumption of foods and reducing the adsorption of nutrients, diarrheal diseases are also an important cause of malnutrition, which can lead to impaired cognitive development and physical growth, reduced resistance to infection, and potentially, long-term gastrointestinal disorders. Contaminated water is also an important contributor to other potentially waterborne diseases, including hepatitis A and E, cholera, typhoid, and poliomyelitis.

2 II.

3 Literarture Review

The kind of treatment water needs strongly depends upon the composition and quality of the water. Water treatment contains two process steps: physical removal of solid particles, mainly minerals and organic matter and chemical disinfection; killing or deactivating micro organisms in water.

Since water contains no calories and can serve as an appetite suppressant and helps the body metabolize stored fat, it may possibly be one of the most significant factors in losing weight. In his book, titled "The Snowbird Diet" Dr. Donald Robertson says the body will not function properly without enough water and discusses the importance of drinking plenty of water for permanent weight loss: "Drinking enough water is the best treatment for fluid retention; the overweight person needs more water than the thin one; water helps to maintain proper muscle tone; water can help relieve constipation; drinking water is essential to weight loss." Water is a key component in determining the quality of our lives. Today, people are concerned about the quality of the water they drink. Although water covers more than 70% of the Earth, only 1% of the Earth's water is available as a source of drinking. Yet, our society continues to contaminate this precious resource. Water is known as a natural solvent. Before it reaches the consumer's tap, it comes into contact with many different substances, including organic and inorganic matter, chemicals, and other contaminants. Many public water systems treat water with chlorine to destroy disease-producing contaminants that may be present in the water. Although disinfection is

an important step in the treatment of potable water, the taste and odor of chlorine is objectionable. And, the disinfectants that are used to prevent disease can create byproducts which may pose significant health risks. Today, drinking water treatment at the point-of-use is no longer a luxury, it is a necessity! Consumers are taking matters into their own hands and are now determining the quality of the water they and their families will drink by installing a drinking

4 Disadvantages

? Due to the low filtration rate, slow sand filters require extensive land area for a large municipal system. ? Many municipal systems in the U.S. initially used slow sand filters, but as cities have grown they subsequently installed rapid sand filers, due to increased demand for drinking water.

ii. Rapid sand gravity filter

The rapid sand filter or rapid gravity filter is a type of filter used in water purification and is commonly used in municipal drinking water facilities as part of a multiple-stage treatment system.

Rapid sand filters use relatively coarse sand and other granular media to remove particles and impurities that have been trapped in a flock through the use of flocculation chemicals–typically salts of aluminium or iron. Water and flock flows through the filter medium under gravity or under pumped pressure and the flocculated material is trapped in the sand matrix.

Mixing, flocculation and sedimentation processes are typical treatment stages that precede filtration. Chemical additives, such as coagulants, are often used in conjunction with the filtration system The equipment consists of three boxes having side 25 cm of cube. The First glass box and second glass box consists of 3 cm thickness fiber box. In that fiber box contains double layer cloth mesh; on it 2 cm thickness of sand layer is placed. On the sand layer aluminum mesh is kept, 0.5 cm thickness of Gravel is placed on the aluminum mesh and Activated carbon of 0.5 cm is kept on it, 5 gm of aluminum oxide crystals are placed on activated carbon. Third glass box is used to store water. From third glass box a booster pump is connected for collecting the water.

5 b) Working of rapid sand filter (RSF)

The collected water is allowed in the top glass box of the system. The water passes through aluminum oxide and activated carbon. Then this water reacts with activated carbon which is negatively charged, by this oxidation will be done.

After this the water passes through gravel where large particles will be filtered then water will pass through aluminum mesh and then to sand membrane here small size particles will be filtered, then water will pass through the cotton cloth meshes here very small size particles are filtered from the water .

Then the water flows through the holes of first glass box and fell into the second glass box. Here the same process will be repeated as in the first glass box. Then the water flows from second glass box and fell into the third glass box. From third glass box the water is pumped by the booster pump and that water is collected and tested.

Also Reverse osmosis membrane (RO), (in which large molecules and ions are removed from solution by applying pressure to the solution) is also used for testing the water. The water passed through the RO membrane is collected and tested.

A taste chamber is used to add taste to water. The collected water is analyzed by using WHO standard analytical procedures.

The all connections are done with the help of 1 cm diameter pipes between boxes and Booster pump, RO membrane, taste cartridge etc. The raw water (RW) and the treated water (TW) are analyzed for water quality parameters and results are shown in below table 3.3.1 & table3.3.2.

From the results in table 3.3.1 the Electrical conductivity, TDS, Total Solids, Turbidity, Hardness, Alkalinity & Residual chlorine are within the limits specified by IS standards for the water treated by the system without RO membrane when compared to raw water. But DO decreases below the limit specified by IS system.

Also the water quality parameters of the water treated by RO alone are not within the limits. From the results in table 3.3.2, the Electrical conductivity, TDS, Total Solids, Turbidity, Hardness, Alkalinity & Residual chlorine are within the limits specified by IS standards for the water treated by the system when compared to raw water. But DO decreases below the limit specified by ISO system.

6 Conclusions

The following conclusions can be made from this research. The Rapid sand filtration method is the most suitable among several treatment processes, locally available materials were used in the construction, the depth and capacity of filter bed were increased which made it to be more efficient to an appreciable degree. In conclusion, despites the fact that water gotten from the tap has undergone some treatments, it still needs to be filtered for it to be safe for drinking. An efficient filter tank having more capacity using rapid sand filtration method with inclusion of activated charcoal and the filter bed length increased have been produced.

Figure 1:

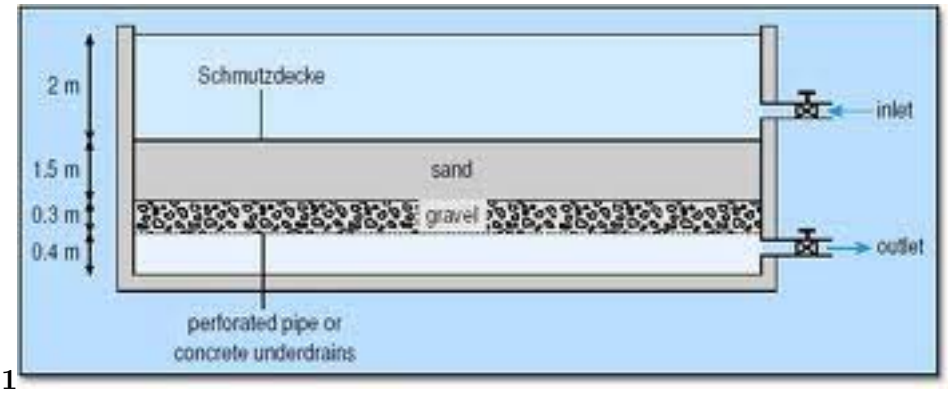

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Figure 2: Fabrication 1 .

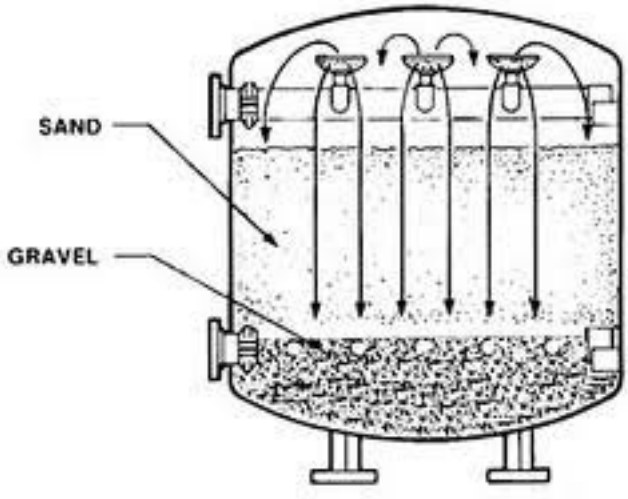

Figure 3:

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Figure 4: Fig 3 . 3 . 1 :

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Figure 5: Fig 3 . 3 . 2 :

Figure 6: Fabrication

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Figure 7: Table 3 .

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3.2 : Results of RO & RSF combined

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Figure 8: Table 3 .

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