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Developing a Twofold Intermediate Filter using Stone

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Abstract: *Energy Consumption Water purifiers also consume energy, both in their production and operation. Systems that use processes such as reverse osmosis or ultraviolet filtering to cleanse water rely on electricity that often comes from coal-powered plants. This means that purifiers indirectly contribute to increased carbon emissions. You can't pick and choose what gets filtered. Depending on how you look at it, a whole house water filtration system may be everything you wanted, or too much of a good thing. Meaning, you can't pick and choose what water outlets are purified. Impurities in the water are divided in to colloidal matters such as suspended solids and dissolved solids.*

I. INTRODUCTION

Rapid sand filter is high rate filtration technique is commonly use in developing countries for treating large quantities of drinking water. It is relatively sophisticated process usually requiring power operated pumps for backwashing or cleaning a filter bed and flow control of the filter outlet. In rapid sand filter finer media at top and coarser media at bottom. In this media while water is passing through finer media suspended solids are retained on finer media. The Pores are clogged due to this filtration rate is decrease and it does not give filtration thought the depth. To have a effective filtration throughout the depth dual media filter is used. Dual media consists of more than one material that is in addition to sand, anthracite coal is used. But the availability of anthracite coal is less and its cost is high.

II. WHAT ISPUMICE?

Pumice is a light, porous, volcanic stone with a large surface area. It is easily and cheaply found in nature or some kinds of waste. Pumice is composed of highly micro vesicular glass pyroclastic with very thin, translucent bubble walls of extrusive igneous rock. Pumice is commonly pale in color, ranging from white, cream, blue, or grey, to green-brown or black. It is formed when volcanic gases exsolving from viscous magma nucleate bubbles, which cannot readily decouple from the viscous magma prior to chilling to glass. It is a common product of explosive eruptions and commonly forms zones in upper parts of silicic lavas. Pumice has an average porosity of 90%, and initially floats on water. Pumice has been widely tested and used in water treatment as an adsorbent, filter bed and support media, thus pumice stone would be a suitable candidate as an adsorbent.

Table 1: Analysis of geology of pumice.

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Constituent	Percentage Present (%) SiO_2
Al2O3	61.5
CaO	15.49
MgO	5.9
Fe2O3	2.65
K2O	8.4
LOI (lost of ignition)	1.65

2.1 Benefits Of Pumice For Water Filtration

- Improved filtration rate.
- Better filtration bed expansion.
- Less energy consumption.
- Less intensive backwash requirement.
- Low cost filter refurbishment.

2.1 Objective

A. Objective of the Work

1. To study different conventional filter media systems.
2. To search for efficient and economical replacement for conventional filter media.
3. To develop experimental setup of dual media filter.
4. To design a water filter using pumices stone for an Apartment.
5. To develop pumice stone filter for individual house.
6. To test and study the quality of raw inlet water.
7. To test and study the properties of filtered water from the developed model.

B. Scope of Project

1. This study concerns analysis of reinforced concrete moment resisting open frame, open frame with braces and open frame with shear walls only, using Staad Pro program. The effect of brick infill is ignored.
2. This study involves a theoretical 12 storey building with normal floor loading and no in fill walls.
3. The comparison of fundamental period, base shear, inter-storey drift and top-storey deflection is done by using Response Spectrum analysis, which is a linear elastic analysis

III. LITERATURE REVIEW

Study Performance of Pumice as a Filter Bed Material under Rapid Filtration Condition. BY - Burhanettinfarizoglu, Bulentkeskinler Publishing Year :- (April-2003)

In this paper deep bed sand filters are used extensively in drinking water and wastewater treatment. In this study, sand and pumice were used as a filtration media under rapid filtration conditions and performance results for both were compared. Turbidity removal performance and head losses were investigated as functions of filtration rate, bed depth and particle size. Under the same experimental

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conditions such as 750 mm bed depth, 7.64m3/m2.h flow rate and, 0.5-1.0 mm grain size, turbidity removal rates for sand and pumice were found to be 85-90% and 98-99%, respectively. Furthermore, the head loss for sand and pumice were found to be 460 mm and 215 mm, respectively. The results obtained have shown that pumice has a high potential for use as a filter bedmaterial.

Comparison of Single and Dual Media Filtration in a Full-Scale Drinking Water Treatment Plant. BY - A. Zouboulis, G. Traskas , P. Samaras. Published Year :- 2017

In this paper drinking water treatment plant processes include mainly the stages of coagulation–flocculation, sedimentation, and gravity filtration through granular media. The aim of these methods is the aggregation of suspended solids and colloids in order to form settlableflocs, which can be removed more easily in the sedimentation basins. According to the literature, it was expected that the dual-media filter bed would operate more effectively, because they can function as a progressive sieve, which can trap the larger solids within the coarser (top) anthracite layer, whereas the smaller particles would be trapped deeper within the (bottom) sandlayer.

Effect of Supernatant Water Level on as Removal in Biological Rapid Sand Filters. By – J. C. J. Gude, K. Joris, K. Huysman Published Year :- 2015

In this paper current groundwater treatment facilities, mostly relying on aeration-filtration configurations, aim at the removal of iron (Fe), ammonia (NH4þ) and manganese (Mn). However, recently water companies expressed the ambition to also reduce arsenic (As) concentrations in these rapid sand filter.

3.1 Problem Statement

1. In areas where bore well water is available and there is no supply of corporation water or filtered water. Because of using bore well water it affects health of people and also people suffer from skin diseases.
2. Water filter needs electricity for operation and working and it needs continuous supply for water filtering.
3. Installation and operational cost is high of water filter.
4. The maintenance cost is high for water filteration system.

IV. METHODOLOGY

First of all literature survey is being carried out to study the how to improve dual medial filter by advance material in way of removal of turbidity as well as TDS. It has been observed that the pumice stone having absorbent property. So we can carry forward our research in this field. Then the materials which we have to used for the dual media filter is selected and the properties of those materials are studied. After completing the study we are going to fabricate the experimental setup and then perform the test.

The working processes of the selected methods are as follows:

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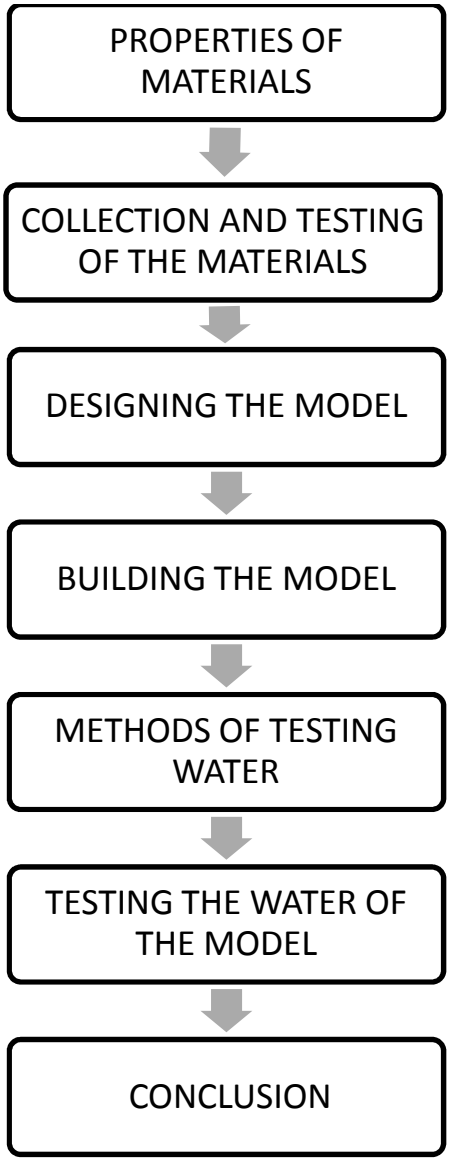

4.1 Materials and Properties of Materials

A. Pumice Stone Pieces

- Density – 0.25gm/cm^3
- Depth – 500mm
- D10 –0.8-1.4
- Cu-1.4-1.8

B. Sand

- Specific gravity –2.36
- Depth –300mm
- D10 –0.45-0.6
- Cu –1.42-1.7

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Fig.4.1. Pumice Stone

Fig. 4.2. Sand

The role of gravel layer in a filter system has several functions. It supports the sand permit the filtered water to move freely. Also used as base media in filter system.

- Size –4mm
- Depth –100mm

Standard Value of Dual Media Filter-

Table 2: Standard value of dual media filter

Description	Dual media filter Range	Typical value
1. Sand		
Depth (mm)	150 – 500	300
D10	0.45 – 0.6	0.5
Cu	1.42 – 1.7	1.6
2. Antracite coal		
Depth (mm)	400 – 600	500
D10	0.8 - 1.4	1.00

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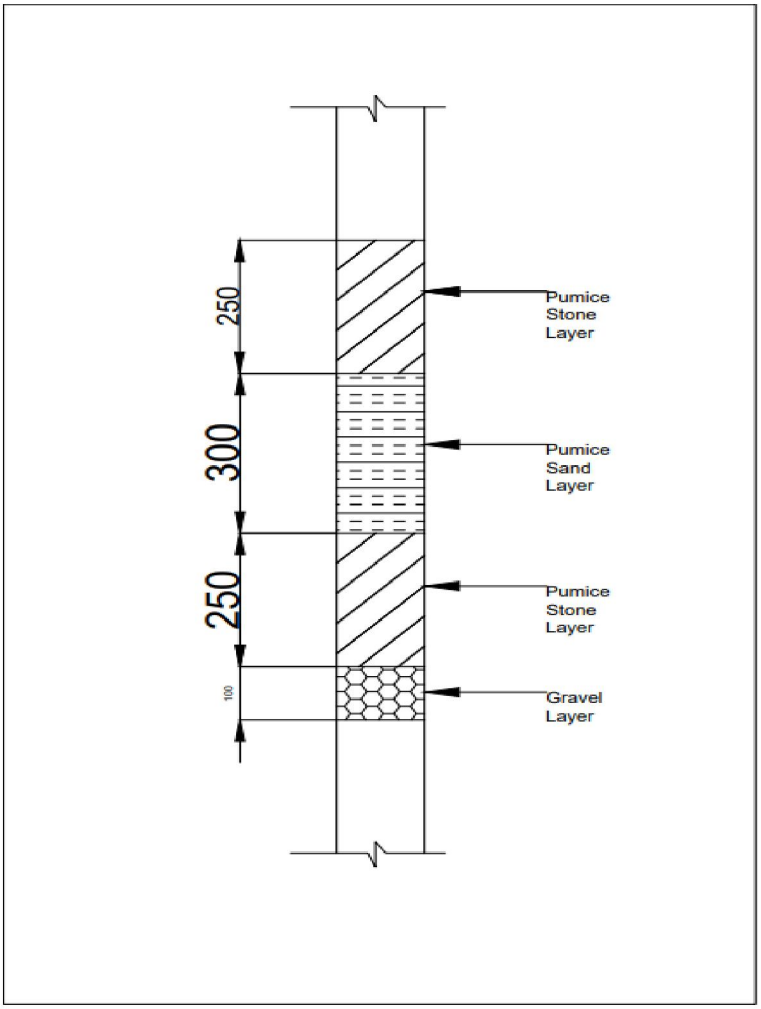
Cu	1.4 – 1.8	1.6

Filtration Rate of Dual Medial Filter – 80 – 400lit./m^2/mins.

4.2 Diagram of Filter Media



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