Using Crashed Bricks as Top Layer in Gravity Multimedia Filtration

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Received: 13 April 2016 Accepted: 2 May 2016 Published: 15 May 2016

Abstract

This research aims to eliminate the top sedimentation CAKE in gravity filtration for water purification in almost all water treatment plants due of blocking of large turbidity particles on top of first filter layer, it is strongly recommended to use a coarse materials that is lighter in density from sand, and can be float above the sand layer during the filtration circle back washing, our goal idea is to used crashed bricks due to its huge availability, cheep, high porosity , less specific weight, bricks well washed and crashed mechanically then sieved to perform the required size, lab tests was made using waters supplied from city main network mixed with controlled percentage of kaolin as turbidity. Chemical are used to coagulate suspended materials before the filtration stage, chemical used include alum with some catalyst, such as poly electrolytes.

Index terms— drinking water purification, filtration, water, crashed brick, sand, kaolin, turbidity.

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An integrated 5,50 m high filtration unit was constructed in the laboratory, it included four main units: an axial flocculating unit, a filtration unit , injection unit for pumping coagulants and clay materials, and a backwashing unit, a piezometric board is also included to give reading at each 10cm of filter height . Water is supplied to the system through a constant head tank by gravity action. filtration is done through two mediums ,a crushed brick layer2 to 5mm sizes(30to40)cm deep and a quartz sand layer 0-.60to 0.75mm (30to40)cm deep.

The lab experimental test, using drinkable water supply, with addition of kaolin (fine mud used as turbidity) to increase turbidity & find the best combination of variables, loading, to highest water yield together with highest efficiency, experiments were run to find the effect of filtration rate, type & depth of filtration materials, effect of coagulating material & catalyst in addition to flocculation time and velocity gradient. Results of above showed that:-1. Suggested crashed brick should be washed perfectly to clean away any salts that might be within the brick materials, then sieved to have homogenous particles.

1 II. Introduction

Water purification is the removal of contaminants from untreated water to produce drinking water that is pure enough for the most critical of its intended uses, usually for human consumption. Substances that are removed during the process of drinking water treatment include suspended solids, bacteria, algae, viruses, fungi, minerals such as iron, manganese and sulfur, and other chemical pollutants such as fertilizers.

Measures taken to ensure water quality not only relate to the treatment of the water, but to its Abstract-This research aims to eliminate the top sedimentation CAKE in gravity filtration for water purification in almost all water treatment plants due of blocking of large turbidity particles on top of first filter layer, it is strongly recommended to use a coarse materials that is lighter in density from sand , and can be float above the sand layer during the filtration circle back washing , our goal idea is to used crashed bricks due to its huge availability ,cheep ,high porosity &, less specific weight ,bricks well washed and crashed mechanically then sieved to perform the required size, lab tests was made using waters supplied from city main network mixed with controlled percentage of kaolin as turbidity. Chemical are used to coagulate suspended materials before the filtration stage, chemical used include alum with some catalyst, such as poly electrolytes.

conveyance and distribution after treatment as well. It is therefore common practice to have residual disinfectants in the treated water in order to kill any bacteriological contamination during distribution.

World Health Organization (WHO) guidelines are generally followed throughout the world for drinking water quality requirements. In addition to the WHO guidelines, each country or territory or water supply body can have their own guidelines in order for consumers to have access to safe drinking water.

Many microorganisms commonly found in source waters do not pose health risk to humans, As Filters represent the key unit process for particles removal in all surface water treatment. Optimization used prior to the filtration process will control loading rates while allowing the system to achieve maximum filtration rates. Using crashed brick as first layer in addition to the other filter media such as fine quartzite sand and gravel, may be considered as one of several treatment processes that can be applied in combination with others to produce potable water. Low turbidity (<20 NTU) and algae count in the order of 106 units/liter among other factors, III. History of the Gravity Water Filter 1835? London, England.

Queen Victoria recognized the increasing health dangers of the drinking water supply. Cholera and typhoid epidemics were commonplace.

She requested John Doulton (of later to become Royal Doulton), to produce a water filter with his ceramic making capabilities. Using various earth and clay materials, he created the first gravity water filter stoneware, Doulton water filters. With her satisfaction in the filter, Queen Victoria bestowed upon Doulton the right to apply the Royal Crest to each of his units. 1862?John Doulton's son, Henry Doulton introduced the Doulton Manganour (new, efficient purifying medium which could be readily renewed), carbon water filter. With Louis Pasteur's new findings about bacteria in this same period, a more advanced understanding of bacteria made it possible for the creation of a porous ceramic which could filter out tiny organisms. Gravity fed water filtration! And the Berkey?? We're getting there? 1901? King Edward VII knighted Henry Doulton and honored his company use to the word ROYAL in reference to its products. Hence the name "Royal Berkey", one of the larger gravity water filter units available today. Doulton's water filters gained popularity and wide spread use by hospitals, laboratories and residential water filtration throughout the world as far away as Africa and the Middle east.

Throughout the decades, the Doulton company modified the ceramic filters by adding small, pure silver particles (anti-microbial), which made the filter elements self-sterilizing and they registered the trade name "British Berkefeld". Once these improvements were made, the gravity filters became popular with, and trusted by relief organizations such as UNICEF, the Peace Corps, Red Cross and used in over 140 countries throughout the world.

1998?Through a distribution partnership with British Berkefeld, the US based company, "New Millennium Concepts", began distributing their products locally. NML pushed the envelope of the product and created the "Black Berkey" purification element. Black Berkey purification elements are more powerful than any other gravity filter element currently available. They were tested with 10,000 times the amount of pathogens required for standard protocol and removed 100% of the pathogens (tested under an electron microscope), setting a new standard in water purification.

2 IV. Processes for Drinking Water Treatment

A combination selected from the following processes is used for municipal drinking water treatment worldwide:

? Pre-chlorination -for algae control and arresting any biological growth ? Aeration -along with pre-chlorination for removal of dissolved iron and manganese ? Coagulation -for flocculation ? Coagulant aids, also known as polyelectrolyte -to improve coagulation and for thicker floc formation ? Sedimentation -for solids separation, that is, removal of suspended solids trapped in the floc

? Filtration -removing particles from water ? Desalination -Process of removing salt from the water ? Disinfection -for killing bacteria.

3 Global Journal of Researches in Engineering ( ) Volume XVI Issue III Version I

Technologies for potable water treatment are well developed, and generalized designs are available that are used by many water utilities (public or private). In addition, a number of private companies provide patented technological solutions. Automation of water and waste-water treatment is common in the developed world. Capital costs, operating costs available quality monitoring technologies, locally available skills typically dictate the level of automation adopted V. Effect of Filter Depth on the Removal Efficiency

It is well known that, the filter depth has a direct relation with the filter efficiency, i.e., increasing the filter depth will increase the filter efficiency. Effect of filter depth on the removal efficiency.

The new investigations are, when the filter depth is shorter than 0.4 m, no significant efficiency is observed. For filter depth ranging from 0.4 -0.8 m, a significant increase is observed in the filter efficiency.

4 VI. Effect of Filtration Rate on the

Removal Efficiency VII. Effect of Media Particle Size on Removal Efficiency

The Media particle size strongly affects the filter efficiency.

1 st -High effect of grain size on the performance of direct filtration. Removal efficiency comes down to insignificant value at using particle of size >5mm.

2 ND -Particle size of 0.1-2 mm is recommended. At some cases of pre-treatment work, particle size greater than 3 mm may be of use.

5 VIII. Effect of Alum Dose Concentration on the Removal Efficiency

Several factors may Govern the optimum dose of alum such as, size of Turbidity particles, turbidity level, and the G potential of Coagulation, surface loading, etc. many studies shows the effect of coagulant dosage on the performance of direct filtration, some stated that, there exist an optimum dose at which the filter produces high effluent efficiency.

6 IX. Filtration Mechanism

Filtration depends mainly on kind of particles, and the filter media. In addition to Rate of filtration, Dosage and type of coagulants Used In general One or more of below factors affect the filtration:-1 st -deposit mechanism, as the particles bigger than the size of media porosity will be settled over the media, also the suspended solid take a specifies path depend mainly on porosity but even though some of the particles pass through the media, as there are some factors affecting the mechanism such as direct distortion, Brownian movement or van der wave forces, 2 nd -fixation mechanism, which is the sedimentation of particles over the filter Surface as part of slow filtration flow, or vibration of particles because of different electrical charges ,or van der waals forces. 3 rd -detachment mechanism, as part of above forces and particles being catch either over the surface /or in side media porosity, the filtration rate may increase, and the flow may change from laminar flow to Turbulent, so particles may separated again and move deep or even pass through the filter media, this can be solved using stronger polymers, and variable filtration flow, To solve above we can do either 1 st -increase particles size inside the media be injecting polymers inside the filter. 2 nd -reduce particle size inside the passing solution by pumping water from down to up.

3 rd -Reduce filtration rate. Inside each layer. Which can be done using radial filtration?

As deep filter media used to inshore removal of collides, then continues increase in head losses till the filter reach its blocked stage. And then Back wash should be done.

7 XI. Laboratory Tests Performed

An integrated 5,50 m high Direct filtration unit was constructed in the laboratory, it included four main units: an axial flocculating unit, a filtration unit , injection unit for pumping coagulants and clay materials, and a backwashing unit, a piezometric board is also included tot give reading at each 10cm of filter height . Water is supplied to the system through a constant head tank by gravity action. filtration is done through two mediums ,a coarse media layer with 2 to 5mm sizes (30to40)cm deep, and a quartz sand layer 0-.60to 0.75mm (30to40)cm deep.

The first stage included the laboratory procedure, using the constructed filtration system, Baghdad water supply was used, with the addition of

8 X. Theoretical Analysis of Filtration a) Filtration Unit

As this study is very important, and to get best results, a complete filtration unit is constructed at the lab. Filter depth is according to real gravity filters with surface area of 0.0246m2, and filtration rate up to 750 l/h . a serious of tests was made with different filtration media and depth to achieve the best results.

Alla experimental test are perfumed using constant rate filtration as the water level will stay constant throughout test time, which in another words the filtration rate will be variable all the time depending on the deposit of turbidity within filter media voids, parameters. This relation theoretically should be linear, but experimental tests give parabolic elation due to : at the beginning of filtration cycle the filter media is clean and the deposit will be settled within the porosity randomly ,with time the deposit will be more regular, this unsymmetrical relation is due to the value of "beta" 16. Relation between maximum water production can be achieved theoretically compared with real water production are shown below, maximum percentage is 74% , from group test NO.1. 17. Results also indicates the advantages of using valuable filtration rate compared with fixed rate filtration ",filtration rages from 3.6 to 14.0 m3/m2/hr". 18. All gravity filters have its own standard coefficient which is called filtration coefficient "lumda". during those experimental test we tried also to calculate the values of this coefficients" which ranged from 1 to 0.66 "

157 # 9 XIV. Recommendation

158 Only crashed brick is used in this study, it is highly recommended to check the possibility of crashed stone, crashed concrete, and even palm tree leaf. [1] [2] [3]

Figure 1: 1

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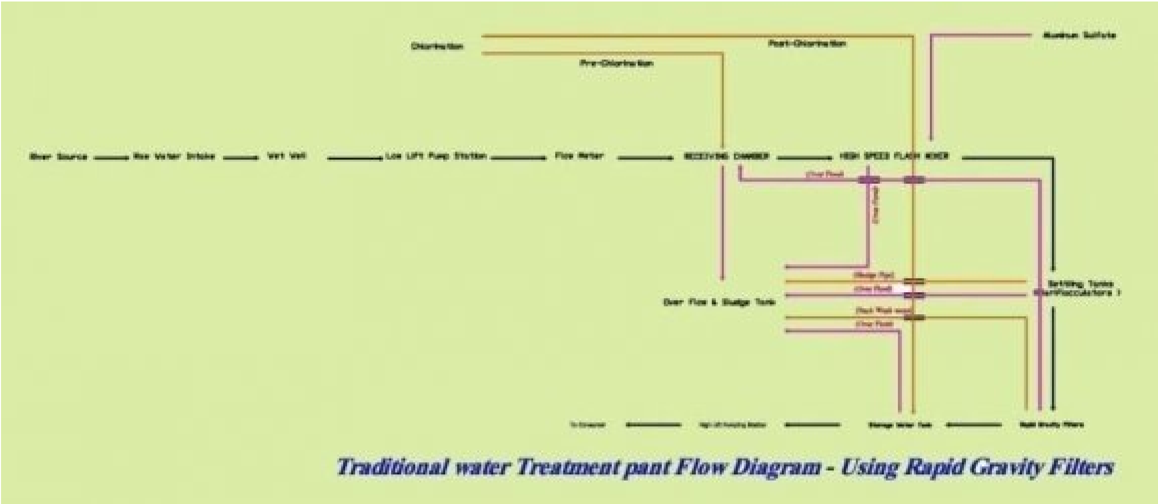

Figure 2:

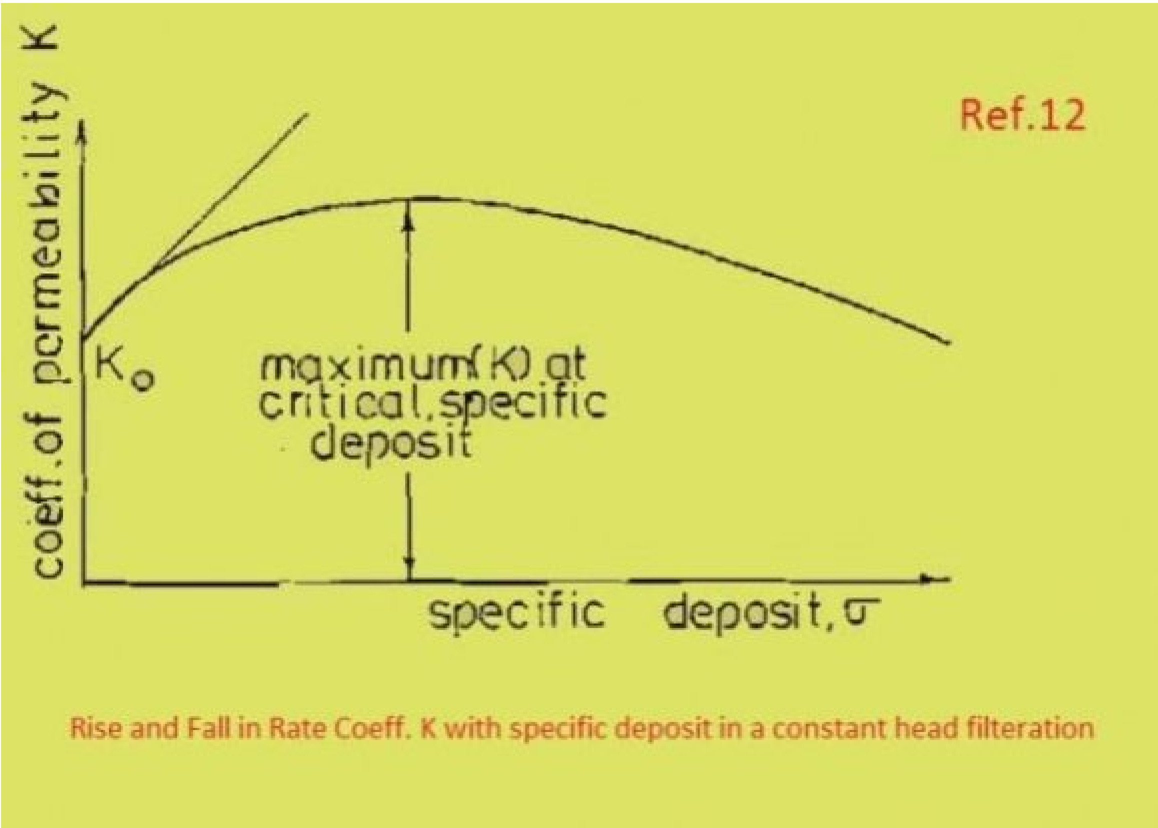

Figure 3:

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Figure 4: 5 .

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