UTILIZATION OF CRUSHED GLASS AND CERAMIC WASTES AS A FILTRATION MEDIUM IN DRINKING WATER PLANTS

Submitted By

Mahmoud Sayed Ibrahim El-Sayed Ahmed

B.Sc. of Science (Chemistry), Faculty of science, Ain Shams University, 2005

A thesis submitted in Partial Fulfilment
Of
The Requirement for the Master Degree
In
Environmental Sciences

Department of Environmental Basic Sciences
Institute of Environmental Studies and Research
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APPROVAL SHEET

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Abstract

Filtration is one of the important operations carried out to produce drinking water. Sand filtration is a conventional method for drinking water filtration. This work aims at investigating the replacement of sand with crushed glass or ceramics with diameter size 0.8-1.4 mm. Samples of crushed glass and ceramics were washed, sieved to the nominal size. Filtration columns were filled with crushed glass, ceramics or sand at different height (30, 45 and 60 cm) and the feeding water after coagulation process (2.9, 4.8 and 6.5 NTU) at a flow rate (4, 6 and 8 $m^3/m^2/$ h). Filtration process is running and filtered water is collected and analysed for turbidity and pH. Results showed that all samples of feeding raw water turbidity were reduced after filtration using crushed glass, crushed ceramics and sand media. Turbidities after using crushed glass as a filtration media ranged from (0.51-1.88 NTU), crushed ceramics ranged from (0.69-2.11 NTU) and sand ranged from (0.48-1.86 NTU). Results of pH of filtrate water using crushed glass media and sand media was recorded the same before and after filtration. When crushed ceramics was used as a filtration media with entrance feeding raw water of pH 7.38, the filtrated water pH ranged from (7.42-7.61). From the results it can be conclude that crushed glass media and ceramics media has the capability to remove turbidity and provide quality effluents conform with international specifications (less than 1NTU), the filter containing crushed glass produced effluent turbidities and pH similar to those obtained with the sand filter.

Keywords: Filtration media, Crushed Glass, Crushed Ceramics, Turbidity.

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SSF	Slow sand filter
RSF	Rapid sand filter
ROF	Rate of filtration
XRF	X-ray fluorescence
S	Sand
G	Crushed glass
C	Crushed ceramic
ES	Effective Size
UC	Uniformity Coefficient
LOI	Loss of ignition
XRF	X-ray fluorescence

CHAPTER 1

INTRODUCTION

1.1. General

Filtration is the last step in the solids removal process. From a water quality standpoint, filter outflow turbidity will give a good indication of overall process performance. Filter outflow turbidity may be monitored and recorded on a continuous basis by turbidity meter. A continuous water quality monitors, such as turbidity meters, and pH monitors will give early warning of process unfortunate and will aid in making fast categorization of process performance. Sand filtration is the formal method for drinking water filtration **(Amirtharajah, 2003)**

1.2. Background

Water is one amongst the foremost substantial necessities to lifetime and most human activities involve the utilization of water in a way or another. It's currently universally accepted that providing a community with safe water, epidemics of water-borne diseases will be prevented. Untreated surface water has long been best-known to be the supply of abundant human malady. The first objective of any water theme is to provide safe water in enough amounts. To attain top quality potable water, the water ought to endure a series of treatment processes like screening, curdling, natural action, geological phenomenon, filtration and medical aid. The surface water is that the main supply for water in most developing countries. The most drawback in victimization surface water as supply of water is high share of clay and suspended solids. Filtration is that the foremost joint technique to induce eliminates clay and suspended solids. Filtration is that the most joint methodology to get rid of clay and suspended solids. In filtration method, water is sublimate by passing

through a bed of porous media that cause the retention of suspended matters inside it **(WHO. 2008)**. In surface water filtration, slow sand filters and fast sand filters are wide used for separation of suspended solids gift in water. Rapid sand filtration is that the hottest in surface water treatment for municipal water provides thanks to its lower space demand, higher production capability and better flexibility. For low muddy surface water, the contact flocculation-filtration is that the most value effective methodology, due to its simplicity in straightforward operation and maintenance by avoiding sedimentation unit. Throughout this method, the suspended solids are flocculated by chemical addition and sent to the filter **(Ives, 1992).**

Within the 1700s the foremost water filters for domesticated application were applied. These were fabricated from wool, sponge and charcoal. In 1804 the foremost actual municipal water treatment plant organized by parliamentarian Thom, was inbuilt material, Scotland. The water treatment was supported on slow sand filtration, and horse and cart diffuse the water. In 1854 it absolutely was determined that an Asiatic cholera epidemic unfold through water. The happening appeared lower severe in areas wherever sand filters were put in. British human John author found that the direct produce of the eruption was pump contamination by waste material water. He applied chlorine to purify the water, and this made-up the method for water medical care (Camp, 1995).

1.3. Problem Statement

With the quick population development and endlessly increased consumption, an outsized quantity of waste materials is generated. Among them, waste glass and waste ceramic materials. Recycling of crushed glass and crushed ceramic can save energy and decrease

environmental waste. Focus on glass recycling application will also increase the application field of waste glass and promote further development of glass techniques. The increasing awareness of glass recycling speeds up focus on the use of waste glass with different forms in various fields. Large amounts of domestic, industrial and mining waste are generated annually in each country. The use of recycled materials instead of virgin materials will reduce the demanding of virgin materials **(Finkle and Ksaibati, K 2007).**

Sand filtration is the conventional method for drinking water filtration. The replacement of sand with crushed glass or ceramics and utilizing such wastes to reduce the drain of non-renewable natural resources.

1.4. Filtration process description

Water remains the most important requirements of daily life and it must be accorded to its importance for the processing of citizens conform to the standard specifications. Filtration is the process of passing water through a porous medium to remove particulate and other impurities, including floc from the water being treated. These impurities consist of suspended particles (fine silts and clays), biological matter (bacteria, plankton, spores, cysts or other matter).The material used in filters for public water supply is normally a bed of sand, coal, or other granular substance **(Smethurst, 2010).**

1.5. Aim of the study

The main objectives of this study is to evaluate the feasibility of using crushed glass and crushed ceramics as filtration media in rapid filters for the treatment of drinking water, to monitor clarifier of Al-Amerea WTP and determine measurement in turbidity and pH , to see the efficiency in turbidity reduction using crushed glass , crushed ceramic media.