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Comparision of Household Grey water Treatment using Slow Sand Filter and Slow Sand Aided with Activated Charcoal Filter

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Abstract:- The purpose of this project is to prepare a cheap, cost efficient, simple, affordable and sustainable treatment of grey water for household purposes. Activated charcoal and sand filters were evaluated for the purpose of grey water filtration. The treated grey water can be used for non-potable purposes such as irrigation, car washing, urinals and toilet flushing, fire protection, etc. To achieve this objective samples were collected from households and series were collected from households and series of treatments such as pH, TDS, Alkalinity, BOD, COD were carried out. We have compared the results of effluent (chemical and physical properties) from slow sand filtration and slow sand filtration aided with Activated Charcoal filter. Thus, from the results an attempt has been made to prepare a household model for the treatment of Grey water by using activated charcoal and then reusing it for various purposes. This project will help to understand a new approach of an environmental friendly household filtration techniques.

Keywords:- *Grey water, Household, Activated charcoal, Sand filters.*

I. INTRODUCTION

Water is essential for the humans and also for other life forms. Water can be classified as Fresh water, Salt water, Black water, Grey water. Fresh water is used for household activities and after this it becomes wastewater. Household wastewater comprises of black water and grey water. Black water is the wastewater coming from toilet containing pathogens (faces, urine, water and toilet paper from flush toilet).Grey water is all the house wastewater except grey water.

Water scarcity has become increasingly common all around the world, as the countries has hit the limit of what it can use. The World Economic Forum has also ranked water crises among its top three global risks since 2012. According to WEF water availability could decline by as much as two thirds by 2050.Hence, the process of purifying and recycling of water is the need of the present. Increasing interest in the reuse of the grey water may reduce the use of portable water by up to 50%.

Research has been done to reuse the wastewater efficiently and help to reduce the water demand.

II. OBJECTIVES

- The main objective of this grey water filtration using slow sand filter with activated charcoal is to meet the need of water for household purposes (urinal and toilet flushing, irrigation of lawns, washing of vehicles and windows, fire protection.
- Grey water has relatively low nutrient and pathogenic content and therefore it can be easily treated to a high quality water using simple techniques such as sand/gravel filters or using activated charcoal, etc.
- With Grey water filtering and recycling, it is possible to reduce freshwater consumption as well as wastewater production.
- To compare the results of effluent (chemical and physical properties) from slow sand filtration and slow sand filtration aided with Activated Charcoal filter.
- The objective of this project is to prepare a cheap, efficient, affordable and sustainable grey water treatment system or slowsand filter for filtration of grey water for household.

III. METHODOLOGY

A. Analytical Method Used In Laboratory

All the samples of grey water which were being collected as per sampling program were analysed at the college laboratory of Gharda Institute of Technology, Lavel. The important parameter like pH, Turbidity, Alkalinity, Total Dissolved Solids (TDS), COD of the influent and effluent of the grey water were analysed.

- Test for pH:pH is measured by using digital pH meter PM 100.
- Test for Chemical Oxygen Demand (COD):Chemical Oxygen Demand (COD) is measured by using COD digester 2015 M(S).
- Test for Bio-chemical Oxygen Demand (BOD):Bio-chemical Oxygen Demand (BOD) is measured by using BOD incubator.
- Total Dissolved Solid (TDS):The method is to measure the amount of solids present in grey water sample in dissolved form by TDS meter.

B. Preparation Of Activated Charcoal

Coconut shells make a good source of activated charcoal because of its absorbent properties.

- Strip a number of coconut shells free from any remaining meat or fibres. Wash them dry completely to remove dirt.
- Crush the coconut shells in Jaw Crusher.
- Build a medium size fire in a safe area.
- The crushed coconuts from the Jaw Crusher should be held in an enclosed 25 litres metal vessel having lid with number of holes for explosion of air and oil from coconut shell.
- Cook the metal vessel on open fire for 3 to 5 hours to make charcoal.
- After cooling the charcoal wash it thoroughly.
- Then make a mixture of $CaCl_2$ and water in 1:3 ratio and make the charcoal wet in the solution and keep it for 1 day.
- Then heat the activated charcoal for again 3 hours and the charcoal is ready.

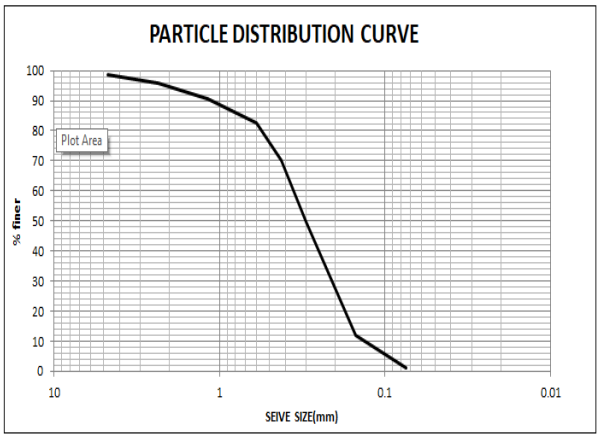

Fig 1:- Preparation of Activated Charcoal

According to the test conducted and the graph plotted above, the sand in the filtration unit has its

D_{10}=0.148mm, D_{30}= 0.21mm, D_{60}=0.36 mm. .Hence the effective size of sand (D_{10})=0.148 mm and the coefficient of uniformity (Cu)=D_{60}/D_{10}= 2.43 .

C. Filtration Unit Details

Materials: Activated charcoal, coarse aggregates, fine aggregates, coarse sand , fine sand.

- *Filter 1*

Drainage layer - Coarse Aggregates(4.75mmretained and 3cm depth)

First layer - Coarse Aggregates (2.36mm retained and 3cm depth)

Second layer - Fine Aggregates (1.18mm retained and 1cm depth)

Third layer - Coarse Sand (300 micron and 10cm depth)

Top layer - Fine sand (150 micron and 2cm depth)

- *Filter 2*

Drainage layer - Coarse Aggregates (4.75mm retained and depth 3cm)
First layer -Coarse Aggregates (2.36mm retained and depth 2cm)
Second layer - Fine Aggregates (1.18mm retained and depth 2cm)
Third layer - Coarse Sand (300micron and depth 2.5cm)
Fourth layer - Fine Sand (150micron and depth 2.5cm)
Top layer - Activated Charcoal (2 cm depth)

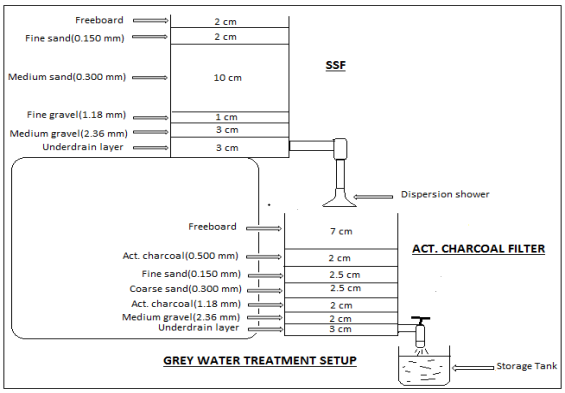

Fig 2:- Grey Water Treatment Setup

IV. ADVANTAGES OF ACTIVATED CHARCOAL

Activated carbon are specially treated material which undergoes the chemical process to increase the adsorption capabilities of the material. Various material are used for the activated carbon which includes coal(anthracite , bituminous, sub-bituminous and lignite), coconut shells, wood(both soft and hard). Some materials have also been evaluate like wall- nut shells, olive stones and palm kernels.

In our project we have used the coconut shells as the activated carbon material as there is a abundance of coconut farming in konkan area. The activated carbon using coconut shell will be economical in preface as the filter media with the slow sand filter at house hold level also.

V. RESULT AND DISCUSSION

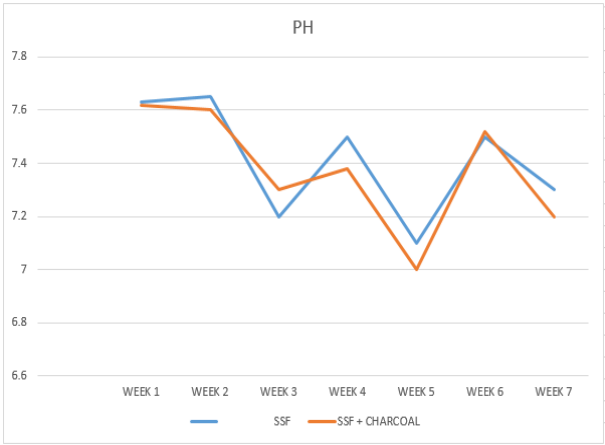

Fig 3:- Result and Discussion

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Figure -3 shows the pH of the influent and effluent grey water from the treatment system was relatively decreases with an average of 7.4 pH in the SSF treatment and with the average of 7.2 pH in the combined treatment of both SSF and activated charcoal treatment.

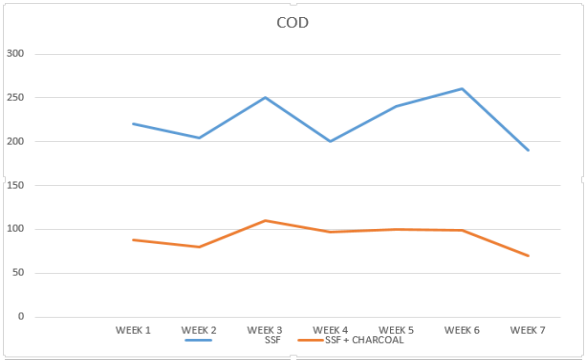

Fig 4:- COD

Figure-4 shows the COD of the influent and effluent grey water from the treatment system was relatively decreases with an average of 223.42 mg/l in the SSF treatment and with the average of 92 mg/l in the combined treatment of both SSF and activated charcoal treatment.

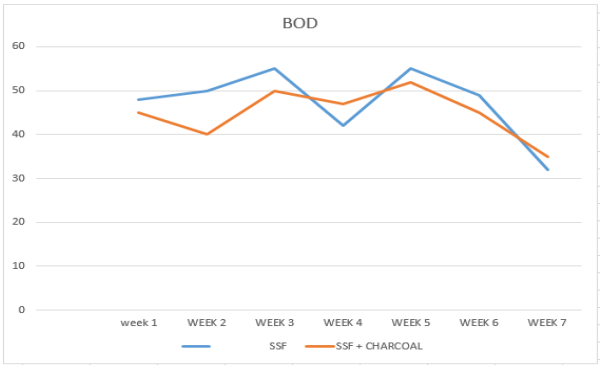

Fig 5:- BOD

Figure-5 shows the BOD of the influent and effluent grey water from the treatment system was relatively decreases with an average of 47.28 mg/l in the SSF treatment and with the average of 44.85 mg/l in the combined treatment of both SSF and activated charcoal treatment

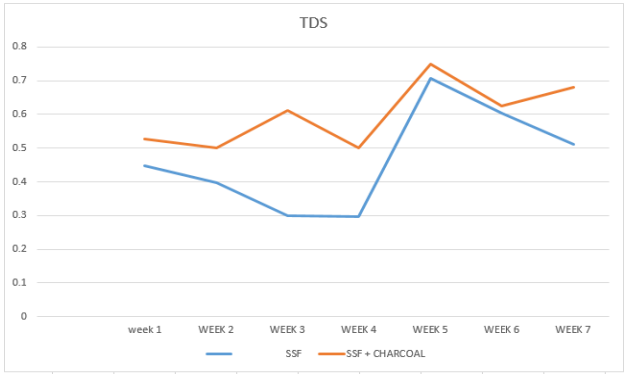

Fig 6:- TDS

Figure-6 shows the TDS of the influent and effluent grey water from the treatment system was relatively decreases with an average of 0.446 ppt in the SSF treatment and with the average of 0.599 ppt in the combined treatment of both SSF and activated charcoal treatment.

VI. CONCLUSION

According to the results the slow sand filtration added with actiavted charcoal is more efficent than only the sand filtration system could be adopted for household treatment.

The efluent can be used for the different household activities like toilet flushing, car washing, gardening, fire protection, etc. The carbon activated charcoal filterate water was free from odour, impurities and turbidity.The activated charcoal replacement was found be last longer than any other material used in the filter media which was achieved by high degree of adsorption. Activated charcoal has a good scope as coconut shells are largely available in coastal areas.

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