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Comparative Analysis of Locally Available Adsorbents For purification of Water

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Abstract - *It is a well known fact that clean water is absolutely essential for healthy living, about one-fifth of people on earth lack the access of safe drinking water. Fortunately, efficient and cheap water purification systems are being utilized and being tried worldwide for easy access to clean water.*

In this following project, we have tried to develop a "Low Cost Water Filter" for purification of water and is designed for 5-6 litre water capacity. The filter media consists of different layers like Pebbles, Sand, Corncob and Adsorbents (Rice Husk, Fly Ash, Activated Carbon, and Blended Activated Carbon) 4 cm each.

The main focus in this project is the removal of toxics, bacteria and other pollutants which contaminate the water. This is from water using adsorption technique. The water is also tested for various parameters like Acidity, Alkalinity, Turbidity, Total Dissolved Solids and pH .

*From this study it can be concluded that **FLY ASH** is effective adsorbent. The removal efficiencies of Acidity, alkalinity, Turbidity are 42.85%, 21.22%, 97.24%, and Rice Husk is effective in maintaining the pH upto 10.32%.*

***Key Words*: Adsorbent, Corncob, pebbles, Filtration, Rural Areas, Treated Water.**

1. INTRODUCTION

Water is a clear, pellucid, transparent fluid which forms the streams, lakes, oceans and rain, is the major constituent of the fluids of living thing's chemical compound, and the most widely used of all solvents. Water is a liquid at standard, but it often co-exists on earth with its solid state , gaseous state, and steam (water vapour). Water covers 71% of the Earth's surface. It is vital for all known forms of life. On Earth, 96.5% of planet's water is found in seas and oceans, 1.7% in ground water, 1.7% in glaciers and the ice caps of Antarctica and Greenland, a small fraction in other large water bodies in the form of Rivers, lakes, and reservoirs.

1.1. SOURCES OF WATER POLLUTION

Water pollution occurs when undesirable effluents disperse in a water system and so water quality change. Water pollution has many sources like thermal and acid effluents from volcanic areas and are not common on the earth, domestic sources that are primarily sewage and laundry wastes and waste generated in houses, apartments, and other dwellings. In rural and some suburban areas, domestic wastes are handled at the individual residence and enter the environment through the soil either in partially treated or untreated fashion. In urban areas, domestic wastes are collected in sewage pipes and transmitted to control location either for treatment or discharge into a watercourse without treatment. Some industries generate wastes high in organic matter, and these wastes can usually handled by methods similar to those used for domestic wastes, such industries include dairy and food-processing plants, meatpacking houses. Other industries, however, generate wastes that are low in organic matter but high in toxic chemicals such as metals, acids or alkalis. These include chemical plants, mining facilities, and textile mills. All these above sources contribute to water pollution to the greater extent.

1.2. NEED FOR PURIFICATION OF WATER

Purified water is essential for living a healthy life as such everyone should have access to it. Drinking water conditions have great impacts on people's everyday life, especially in the rural and remote areas where access to safe drinking water is very crucial. Unsafe drinking water may result in fatal diseases. Statistics shows that these diseases resulted in ninety percent of all deaths of children under five years old in developing countries, due to low immunization of children to infections.

Despite of fulfilment of requirement of drinking water standards, the municipal water in used in developing countries is being improved and cost efficient water filtration techniques are being developed commonly used to improve taste or to eliminate any undesired matters. Various types of filters have been designed to be more suitable for the rural areas of the countries, but the cost as well as the filter effectiveness is still not satisfactory and further improvement is still required.

Drinking water is being the biggest issue nowadays in India. Most of the people in the rural areas are not able enough to use water filters or buy mineral water bottles. To overcome this problem many efforts have been done due to which cleaning water may become an affordable

commodity. Every house hold should be able to develop its own drinking water purification system; this should be the aim of development of any low cost water purification technique.

Filtration is a process which improves the water quality by the removal of suspended solids, colloidal matter and the reduction of number of bacteria, colour, odour etc. In the present study using locally available adsorbents, sand and gravel, a filter is designed which removes the physical and chemical impurities from water.

1.3. OBJECTIVES

The scope of this project is to study the existing water filtration methods, and use the knowledge to design a "Low cost water filtration technique". This water filtration system will focus on cutting down the cost while maintaining filter effectiveness. By providing affordable water filters for the rural and remote areas, will greatly improve people's quality of living, and reduce the risk of any waterborne diseases therefore saving lives.

The objectives of this project.

1. In the present study an appropriate household filter is designed.
2. The initial water quality is analysed, then Rice Husk, Fly ash and Activated Carbon are used as adsorbents in the filtration process.
3. The filtered water quality is analysed and the effectiveness of each adsorbent is known and the efficiency of filtration is checked.
4. To study the effectiveness of filter media's used for purification.
5. To achieve the maximum removal of Turbidity in water sample for chosen area.

2. FILTRATION MODEL DEVELOPMENT

In the proposed study a simple square shaped filter is designed and fabricated by using "Acrylic Sheet" of thickness 6mm as shown in figure 2(a) with the following dimension.

Length= 66cm.

Filter Dimension Overall= 25 x 25cm (square).

Filter media thickness= 25cm wide, 16cm height.

Water collection chamber= 25cm wide, 25cm height.

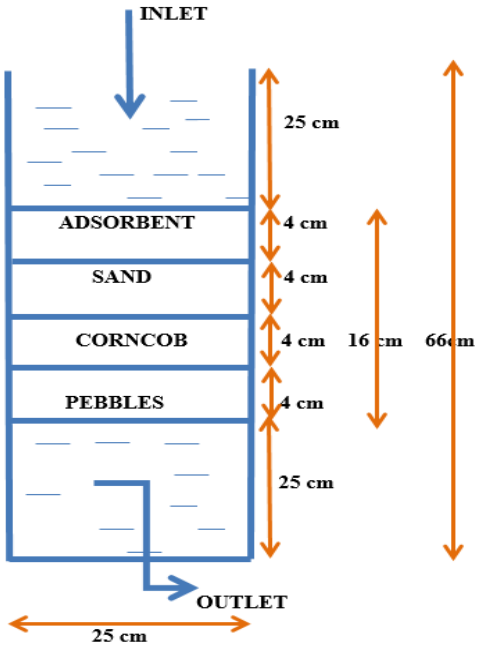

Fig 2(a): Line Diagram of Filter

1. The filter media is supported on a 6mm thick acrylic sheet having the holes of 5mm diameter.
2. Watercollected in the bottom chamber is collected out from the tap which is located at 2cm above from the bottom.

In the proposed design of the model, synthetic water of known fluoride concentration was passed through the inlet pipe of diameter 2mm at the top. Inside the filter, different adsorption media of 16cm, (4cm each) thickness were placed. Then after filtration, the filtered water was collected at the bottom of the filter through tap in a beaker and the filtered water is checked for the various parameters like Acidity, Alkalinity, Turbidity, Total dissolved solids, pH, Hardness, and Fluoride.

3. MATERIALS USED AND PREPARATION OF ADSORPTION

Different adsorption media used are listed below which are locally collected at a very cheap cost.

3.11. Pebbles

Fig 3.11: Pebbles

Pebbles are collected from the Tungabhadra river bank which is located in harihara city. Then the pebbles required for 4 cm layer are washed with the distilled water for about 2 to 3 times, and are dried in the sunlight about 15mins. For experimentation the pebbles passing through 40mm and retained on 20mm IS sieve were used in this study.

3.12. River Sand

Fig 3.12: River Sand.

Sand is also collected from the Tungabhadra river bank which is located in harihara city. The sand required for 4cm layer is washed with the distilled water and dried to sunlight for about 15mins. For experimentation the sand passing through 4.75mm and retained on 600µ IS sieve were used.

3.13. Rice Husk

Fig 3.13: Rice Husk

Rice Husk is taken from the rice mill which is located at the PB road Davanagere. The powder form of the rice husk is removed by washing it in distilled water for about 3-4 times.

3.14. Fly Ash

Fig 3.14: Fly Ash.

The fly ash is collected from the sugar industry which is located in Kukkuwada village near Davanagere. For the experimentation the fly ash passing through 2.36mm retained on 1mm is taken, it is washed with the distilled water and dried to the sunlight.

3.15 Activated Carbon

Fig 3.15: Activated Carbon.

The Activated carbon is collected and crushed into smaller size and used as an adsorbent.

4. METHODOLOGY

In the present study the stock solution is prepared containing 2 mg/l fluoride concentration. To this synthetic sample, artificially turbidity is induced by adding turbid matter and colouring matter. The total influent water volume is 7 litres.

After preparing synthetic water, containing fluoride, it is fed to the filter. During the study period both influent and effluent is tested for significant water quality parameters such as Acidity, Alkalinity, Turbidity, Total dissolved solids and pH, along with the rate of filtration. Removal efficiencies of adsorbents risk husk , fly ash and activated carbon are compared. All the parameters are tested according to standard Methods for the Examination of water and Wastewater by APHA(2001).

The prepared inlet synthetic water is fed to the filter media having the different layers of 4cm each such as pebbles, Corn cob, Sand, and the top most layer is the Adsorbent such as Rice Husk, Fly Ash, Activated Carbon which is changed and compared for the different parameters.

Then the filtered water is collected from the tap, which is located at 2cm above from the bottom and the outlet water is tested for the above mentioned parameters.

5. RESULTS AND DISCUSSIONS

5.1. Acidity

parameters	Removal Efficiencies of Adsorbents in Percentage (%)		
	Rice husk	Fly ash	Activated Carbon
Acidity	20	**42.85**	16.67

Table 5.1

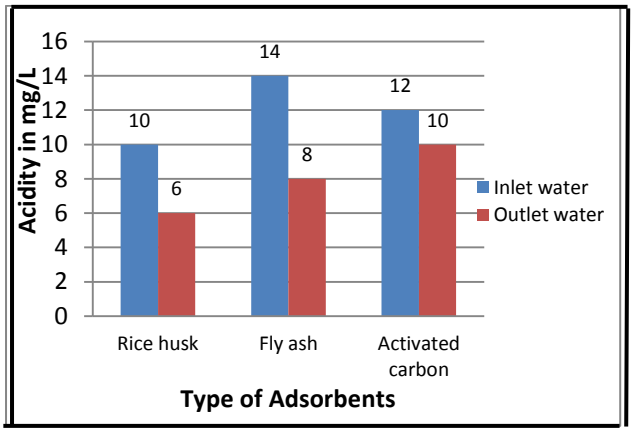

Chart 1: Comparative graph for acidity test.

Fly ash is effective in removing the Acidity up to 42.85% when compared all other adsorbents.

5.2. Alkalinity

parameters	Removal Efficiencies of Adsorbents in Percentage (%)		
	Rice husk	Fly ash	Activated Carbon
Alkalinity	2.22	21.22	**55.81**

Table 5.2

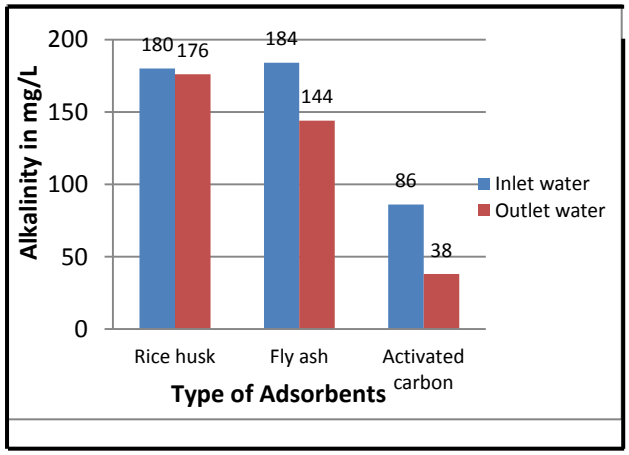

Chart 2: Comparative graph for Alkalinity test.

Activated Carbon is effective in removing Alkalinity up to 55.81% when compared to other adsorbents.

5.3. Turbidity

parameters	Removal Efficiencies of Adsorbents in Percentage (%)		
	Rice husk	Fly ash	Activated Carbon
Turbidity	85.39	**97.24**	68.24

Table 5.3

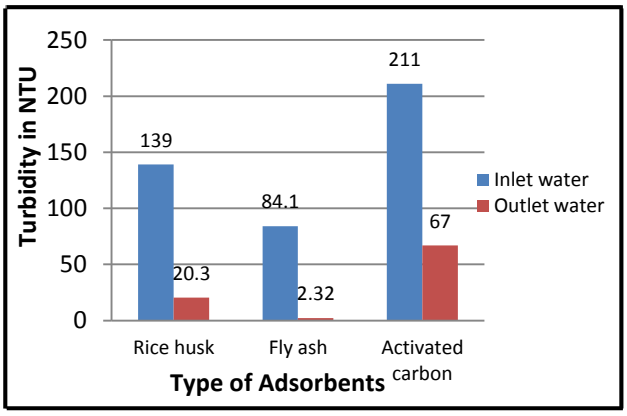

Chart 3: Comparative graph for Turbidity.

Fly Ash is effective in removing the Turbidity up to 97.24% compared to other adsorbents.

5.4.Total Dissolved solids

parameters	Removal Efficiencies of Adsorbents in Percentage (%)		
	Rice husk	Fly ash	Activated Carbon
Total Dissolved Solids	-23.19	-35.25	**-0.17**

Table 5.4

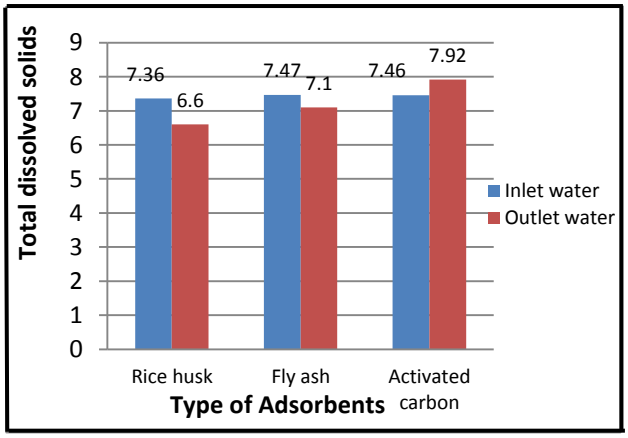

Chart 4: Comparative graph for Total dissolved solids.

Total dissolved solids are increased in the treated water because of minerals and minute particles present in them. Among all the adsorbents the TDS is slightly decreased in the Activated Carbon.

5.5.pH

parameters	Removal Efficiencies of Adsorbents in Percentage (%)		
	Rice husk	Fly ash	Activated Carbon
pH	**10.32**	4.95	-6.68

Table 5.5

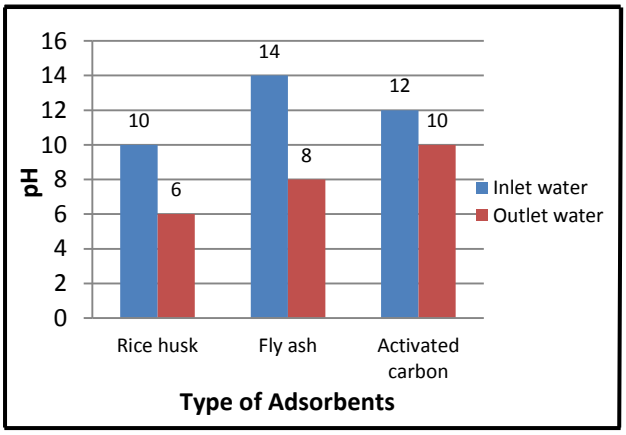

Chart 1: Comparative graph for pH.

In all the adsorbents the pH is maintained well within the range (6.5-8.5). Efficiency is more in Rice Husk compared to other adsorbents.

5. CONCLUSIONS

1. Fly ash is effectively removes the Turbidity and maintains the Acidity.

2. Rice Husk is effective in maintaining the pH.

3. Activated carbon is effective in removing th Alkalinity.

From this study we can conclude that compared to other two adsorbents Fly Ash removes all parameters effectively. The filtration capacity of the filter can be improved by adding 0.0001µ filter paper.

It can also be concluded that the filter designed is effective in removing many water quality parameters without consuming any power.

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REFERENCES

[1] Gurpreeth Singh, "Removal of turbidity from water using low cost adsorbents ",. May 2015

[2] Dr. M. Hussain, et al,. "Fly ash and maize husk fly ash as an adsorbent for removal of fluoride",. International journal of scientific engineering and applied science, November 2015, vol-1, Issue 8(ISSN:2395-3470).

[3] Athish kumar, Millind R. Gidde, "Design and study of low cost household drinking water treatment process for rural areas",. International journal of science and technology, May 2014, (ISSN 2321-919x).

[4] N. Gupta et al,. "Defluoridation of ground water using low cost adsorbents like bagasse dust, aluminium treated bagasse, fly ash, bone powder and shell powder",. Bonfring international journal of industrial engineering and management science, May 2014.

[5] Shilpa. S et al,. "A study of coconut shell- activated carbon for filtration and its comparison with sand filtration",. International journal of renewable energy and environment engineering, July 2014.

[6] Adie D. B et al., "Comparative analysis of filtration using corn cob, bone char and wood chippings",. International journal of applied science and technology, March 2013. Vol 3 , No 3, March 293.

[7] Ranu Pachauri, "Preparation of filters for water purification using rice husk ash",. July 2013.

[8] Lopamudra priyadarshini, "Development of low cost water purification technique ",. 2013.

[9] S. Chidambaram et al,. "Fluoride removal studies in water using natural materials",. 2013.

[10] N. Gandhi et al,. "Removal of fluoride from water and wastewater using by using low cost adsorbents",. International journal of chem tech research, Dec 2012.

[11] Vigneswaran S, Sundaravadives M, "Traditional and house hold water purification method of rural communities in developing countries",. Encyclopedia of life support system, 2008.

[12] Shrivatsava Brajesh k and A.vani, "Comparative study of defluoridation technologies in India",. Asian J.exp.sic, 2009.

[13] Jamode. A.V et al,. "Defluoridation of water using inexpensive adsorbents",. The journal of Indian institute of science, 2004.

[14] N.Azbaranda.turkman, (2000) "Defluoridation in drinking water",. Wat.sci and technol.

[15] Millind. R. Gidde et al,. "Comparative adsorption studies on activated rice husk and rice husk ash by using methylene blue as dye",. International congress and environmental research.