Low Cost Water Purification Technique

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Abstract— Clean water use being a prime concern in many communities of developing countries. Contaminated water plays significant role in taking numerous lives in these localities, for which a number of efforts are being made for accessing safe purified drinking water. Fortunately, efficient and cheap water purification systems are being utilized and being tried to be accessed worldwide for easy access to clean water. In the following project we had tried to develop a "Low Cost Water Purification Technique" using the basic ideas of Slow Sand Filter, some locally available filter material like charcoal, bone char, sand, manganese modified sand, clay, rice husk, banana residue ash, anthracite and try to improve the methodology using the UV Filter, RO Filter, and Activated Carbon Filter mechanism. Main focus was removal of turbidity from surface water by adsorption and oxidation followed by precipitation technique. Rice husk, which considered a waste, has a high level of silicon. This paper investigates the use of carbonized rice husk and wood charcoal in water purification. The carbonization was done using a handmade carbonizer. The preparation process starts with the production of a precursor that is rich in carbon through the pyrolysis of the rice husk in an inert atmosphere. The results show an important contribution of the use of carbonic materials, by giving a direct evidence of the permanence of sodium ion Na+ in activated carbon. The results also show that the utilization of wood charcoal and rice husks in the purification of water is quick, efficient and economically viable.

Keywords: Turbidity, Wood Charcoal, Rice Husk

I. INTRODUCTION

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. Surface water often is the only source, thus water contaminations are difficult to avoid due to rigorous and reckless use of Surface water. 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.

India's largest company Tata Group has developed a very cheap water filter known as "Swach", cost of which is less than Rs1000. It uses nano-technology for filtration and silver particles for eradicating bacterial contamination. Ultimately the aim of development of any low cost water filtration model should be to operate with minimum energy, minimum maintenance, cost effective, environment friendly, implementable with ease and can be developed from local artisans. This will subsequently inspire the people to put hygiene in to habit and of course will help in the social and economic growth of the country.

A series of adsorption experiment were conducted to establish the reduction of turbidity and other parameters. CRH and ARH demonstrated the potential of removing all impurities from experimental condition applied in this study. After chemical treatment it's been found out that adsorption capacity of rice husk and wood charcoal is increased. Treated rice husk attracted greater attention than untreated once, as a result of comparatively higher adsorption capacity favored by higher amount of active binding sites, improved ion exchange properties and enhancement of functional groups after chemical treatment. The adsorbents with high adsorption capacity, easy separation from aqueous solution, low cost, and recycling use are promising materials in the future. Ground-nut shell has been used as a potential low-cost adsorbent material for the removal of various pollutants from water. The Gravity Filter is one of the best techniques to remove turbidity, just by using fine sand and gravels, the turbidity can be removed to a higher extent without any extra effort or without any chemicals used.

II. OBJECTIVES OF PROPOSED WORK

1) To Study Low Cost Water Purification Technique.
2) To Study different Literature Review on Low Cost Water Purification Technique.
3) To remove turbidity by using different adsorption media.
4) To maintain the physical impurities such as color, turbidity etc. by using different adsorption media.
5) To construct home-made setup for water purification in rural and remote area.

III. METHODOLOGY

A. Materials used and Preparation of Adsorption Media

As per the Research studied, In the first method for removal of turbidity by adsorption technique, different adsorption media were used for turbidity removal are listed below which are locally collected at a very cheap cost. In the second methodology, ash obtained from banana residue was used for removal of turbidity by oxidation followed by precipitation as per studied.

1) Plane Sand

Fine sand and gravel are naturally occurring glacial deposits high in silica content and low in soluble calcium, magnesium and iron compounds are very useful in sedimentation removal. But here the media is used for turbidity removal from drinking water. As per mentioned specified sand was used in the filtration model previously developed with a gravel base of specified size to support the sand bed. Turbid water was passed through the sand and the filtrate was collected in a beaker. The rate of filtration was calculated and final turbidity was measured with turbiditimeter.

2) Wood Charcoal

Bituminous coal has been used before as an adsorbent and proved to be very effective in removal of turbidity and other

parameter. Due to non-availability of bituminous coal, we used wood coal as an adsorbent media for experimentation. Locally collected wood charcoal crushed to size 10mm and down was used for removal of turbidity from water.

3) Rice Husk

Rice-husk ash (RHA) as a filtration medium for water is fairly well known (Frankel, 1979); however, the use of RHA for designing a usable filter element for domestic filtration in rural homes is new. TRDDC, Pune has done extensive research in this area and has filed two Indian Patents for this application, (Sundaram et al., 1997), (Meher and Prasad, 1999). The patents describe the materials, the composition, and the processing details for the fabrication of the filter element and the container designs. The filter is called a pebble matrix filter (PM filter).

Rice husk ash (RHA) is an agricultural waste product that is abundant all over India, and costs almost nothing. It can be bonded with cement, moulded and shaped into any form, and does not require firing

3.1.4 Wood charcoal and Rice husk mixture

Rice Husk are been popularly used as a very effective filter media which helps the filtration of solid as well as liquid systems of colloids, fine, highly compactible particular solids. RH are been used for different applications depending upon the physical and chemical properties of the rice husk. Ex- ash content, silica content etc. Use of rice husk as fuel is being used in power plants. Apart from this, RH is a source of raw material for synthesis and development of new compounds.

Mixture of wood charcoal and raw rice husk in the ratio 3:2 by weight was taken for removal of iron from water as a trial without any prior evidence of being used as an adsorbent.

Fig. 1: Low cost water purification setup

1) Mix design of conventional M20 grade concrete paver block. Estimating quantity of waste plastic and crushed sand required for preparing one paver block.
2) As per table no.3.1 Casting of conventional M20 grade concrete paver block and paver block made of waste plastic and crushed sand in Block specimen of hexagonal shape of Area 31436.7mm2 (side: 110 mm, Height: 60mm)
3) Testing of different Block specimen for weight, Water Absorption, Rebound Hammer and Compressive Strength Test.
4) Results and Comparative study of conventional M20 grade concrete paver block to the paver block made of waste plastic and crushed sand.

IV. RESULTS

The following results are obtained in removal of iron by using different adsorption media as mentioned below. The rate of filtration and the effectiveness in removing iron are tabled here.

A. Sand Media

Parameter	Unit	Before filtration	After filtration	National standard
pH		6.99	6.99	6.0-9.0
Conductivity	S/m	780	785	1000
TDS	ppm	476	478	1000
Color		>550	20	15
Turbidity	NTU	391	09	05
Hardness	Mg/l	82	78	500

Table 1: Results of filtration in sand media

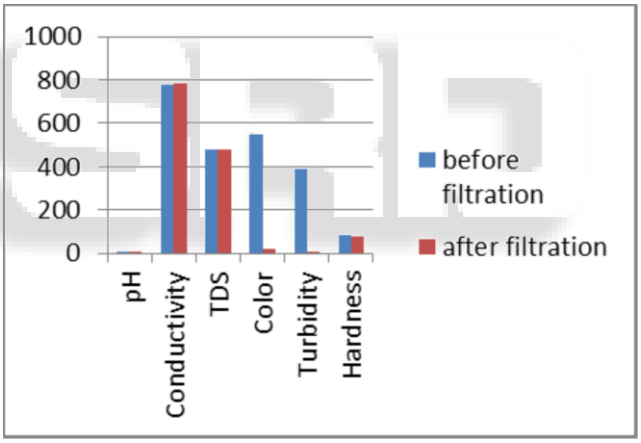

Fig. 2: Graph showing Results of filtration in sand

B. Wood Charcoal

Parameter	Unit	Before filtration	After filtration	National standard
pH		6.99	6.99	6.0-9.0
Conductivity	S/m	780	787	1000
TDS	ppm	476	478	1000
Color		>550	18	15
Turbidity	NTU	391	22	05
Hardness	Mg/l	82	76	500

Table 2: Results of filtration in wood charcoal

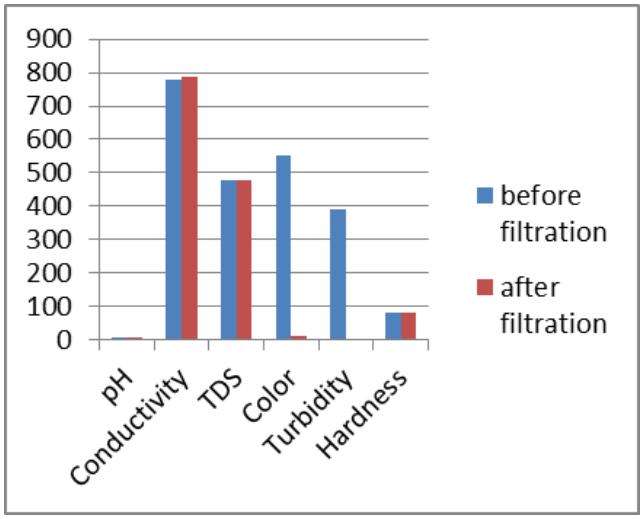

Fig. 3: Graph showing Results of filtration in Wood Charcoal

C. Rice Husk

Parameter	Unit	Before filtration	After filtration	National standard
pH		6.99	7.01	6.0-9.0
Conductivity	S/m	780	798	1000
TDS	ppm	476	479	1000
Color		>550	13	15
Turbidity	NTU	391	04	05
Hardness	Mg/l	82	72	500

Table 3: Results of filtration in rice husk

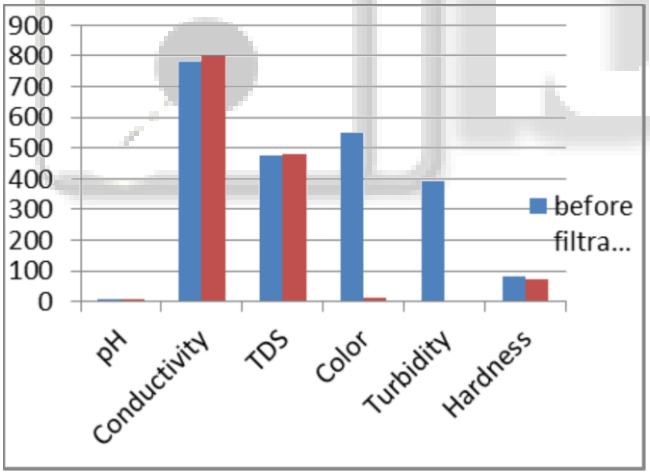

Fig. 4: Graph showing Results of filtration in rice husk

D. Charcoal and Rice Husk Mixture

Parameter	Unit	Before filtration	After filtration	National standard
pH		6.99	6.99	6.0-9.0
Conductivity	S/m	780	789	1000
TDS	ppm	476	477	1000
Color		>550	13	15
Turbidity	NTU	391	04	05
Hardness	Mg/l	82	80	500

Table 4: Results of filtration in rice husk and wood charcoal

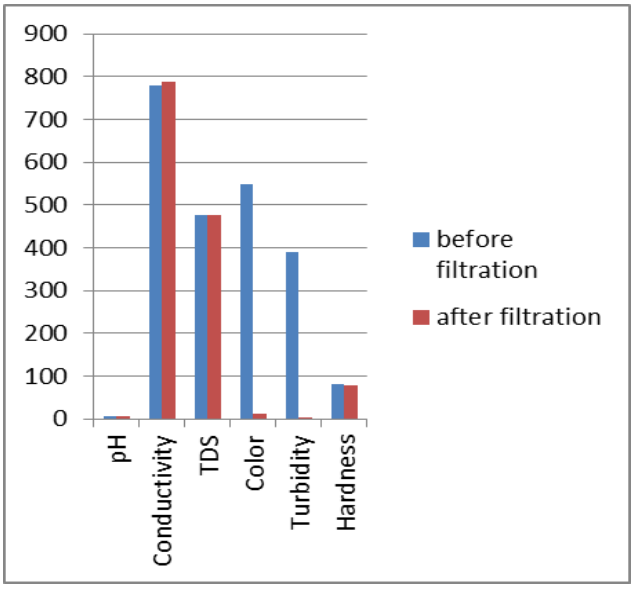

Fig. 5: Graph showing Results of filtration in Charcoal and rice husk mixture

V. CONCLUSION

1) However untreated rice husk gave better result for different contact time which showed the high possibility to be used in adsorption process by modifying the rice husk to obtain optimum efficiency
2) Application of rice husk is beneficial in many areas by reducing cost of adsorption process and also in the biomass waste treatment
3) Adsorption being the simplest and cheapest technique for turbidity, it has several Advantages, like longer filtration runs, shorter ripening time, and better filtrate quality. But the only limitation is back wash water requirement is essential for the filter media to run effectively.
4) Sand being the cheapest adsorbing surface is very effective in removal of dissolved iron from drinking water and the rate of filtration is also very high. The only demerit is subsequent development of bacterial layer due to rigorous use. Again back washing is needed time to time.
5) In case of wood charcoal, the removal is not so significant. This may be due to lager particle size of material being used. Smaller the size of particle larger will be the specific surface and better will be the removal.

VI. FUTURE SCOPE

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.

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