

Removal of Turbidity from Water using Low Cost Adsorbents

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By

Gurpreet Singh Kainth

110CE0058

GUIDE

Prof. Somesh Jena



**Department of Civil Engineering, National Institute of
Technology, Rourkela May, 2015**



NATIONAL INSTITUTE OF TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING
ROURKELA, ODISHA-769008

CERTIFICATE

This is to certify that the thesis entitled **“Removal of Turbidity from water using Low cost adsorbent”** submitted by **Gurpreet Singh Kainth** bearing roll no. **110CE0058** of **Civil Engineering Department**, National Institute of Technology, Rourkela is a genuine work carried out by him under my supervision and support. To the best of my knowledge, the matter embodied in this thesis has not been presented to any other University/Institute for the award of any Degree or Diploma.

Date: 12 May, 2015

Place: Rourkela

Prof. S. Jena
DEPARTMENT OF CIVIL ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY
ROURKELA, ODISHA-769008

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GURPREET SINGH KAINTH

(110CE0058)

Department of Civil Engineering,
National Institute of Technology, Rourkela

ABSTRACT

Turbidity is measured by the intensity of light scattered by the water sample. Higher the intensity produces higher turbidity. Turbidity actually refers to the cloudiness of a solution. It indicates the presence of TSS (Total Suspended Solids) like clay, silt, organic matter which are very harmful for mankind, biologically as well as chemically. They give an undesirable tastes and odours. Due to the adsorptive characteristics of colloidal solutions, disinfection of turbid water is not always possible. Turbidity refers to the cloudiness of a solution and its characteristics that are imparted by the suspended solid particles limiting the passing of light through water sample.

Usage of natural products to reduce turbidity in a water sample is a technique that has been repeated from years, and the material used are safe and effective, like Rice husk, Ground-nut shells, very fine sand(300micron). These filter media can reduce the level of turbidity in d best way as it can (more than 60%). The materials are generally named as Bio-adsorbent which can remove turbidity from any sort of water sample.

CONTENTS

| <u>CHAPTER NAME</u> | <u>PAGE NUMBER</u> |
|-------------------------------------|--------------------|
| CERTIFICATE | 2 |
| ACKNOWLEDGEMENT | 3 |
| ABSTRACT | 4 |
| LIST OF TABLES | 7 |
| LIST OF FIGURES | 8 |
| CHAPTER 1: INTRODUCTION | 9 |
| 1.1 ADSORPTION TECHNIQUES | 10 |
| 1.2 USING RICE HUSK AS AN ADSORBENT | 10 |
| 1.3 USING GRINDED GROUND-NUT SHELL | 10 |
| 1.4 SIGNIFICANCE | 11 |
| CHAPTER 2: LITERATURE REVIEW | 12 |
| 2.1 REVIEW OF LITERATURE | 13 |
| CHAPTER 3: OVERVIEW | 15 |
| 3.1 OBJECTIVE OF PRESENT STUDY | 16 |
| 3.2 SCOPE OF STUDY | 16 |
| 3.2 OUTLINE OF PRESENT WORK | 16 |

| <u>CHAPTER NAME</u> | <u>PAGE NUMBER</u> |
|-----------------------------------|---------------------------|
| CHAPTER 4: METHODOLOGY | 18 |
| 4.1 PROCEDURAL STEPS FOR MODELING | 19 |
| CHAPTER 5: EXPERIMENTAL SETUP | 24 |
| 5.1 PROCEDURE OF THE EXPERIMENT | 25 |
| CHAPTER 6: RESULTS AND TABULATION | 26 |
| 6.1 TABULATION | 27 |
| CHAPTER 7: CONCLUSION | 28 |
| 7.1 CONCLUSION | 29 |
| CHAPTER 8: REFERENCES | 30 |
| 8.1 REFERENCES | 31 |

LIST OF TABLES:-

| <u>TABLE NUMBER</u> | <u>TABLE NAME</u> | <u>PAGE</u> |
|----------------------------|--------------------------|--------------------|
| 5.1 | Observation Table | 27 |

LIST OF FIGURES:-

| <u>FIGURE NUMBER</u> | <u>FIGURE NAME</u> | <u>PAGE</u> |
|-----------------------------|--|--------------------|
| 1 | Rice husk and its powdered form. | 20 |
| 2 | Muffle Furnace | 21 |
| 3 | Carbonized Rice Husk | 22 |
| 4 | Gravity sand filter | 23 |
| 5 | Gravity sand filter with charcoal | 23 |
| 6 | Experimental Setup | 24 |
| 7 | Lab Setup | 24 |

CHAPTER 1
INTRODUCTION

1.1 Adsorption Techniques

A series of adsorption experiment were conducted to establish the reduction of turbidity. 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 is increased. Treated rice husk attracted greater attention than untreated once, as a result of comparatively higher adsorption capacity favoured 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 technique 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.

1.2 Using Rice Husk as an Adsorbent

Rice Hull Ash 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 are being used in power plants. Apart from this, RH is a source of raw material for synthesis and development of new compounds.

1.3 Using Grinded Ground-nut Shells

Ground-nut shells are also a very effective media in the filtration of turbid water. The Nano-meter size pores are very efficient in blocking the very minute dirty particles present in water and making it turbid.

1.4 Significance

In this we focused on the preparation of activated charcoal of rice husk and grinded particles of groundnut shell which are termed as waste. This cheap and abundant agricultural waste is converted into a very useful by-product that represents a source of adsorbent that will contribute to the waste water treatment problems.

CHAPTER 2

LITERATURE REVIEW

2.1 Review of Literature

1. **Shah *et al* (2012)** used the combination of Coal Fly Ash. He improved the overall treatment that reached upto 80%. He also found out that when FeCl₃ and fly ash are used together it was found

out that COD, Color, turbidity and TSP were removed. Combination of FeCl₃ and coal ash were found out to be more effective.

2. **Vigneswaran *et al* (1995)** he proposed that there are lot of Iron and Manganese present in the water which can be very harmful for the environment as well as for the human. They are need to be oxidised in which it can produce insoluble complexes with it. This involves the transfer of electrons from iron and manganese and other chemical that are treated as an oxidizing agents

3. **Hmaruzzaman M., and Gupta V .K. .(2011).** he proposed that as the rice husk is inexpensive and abundant material on earth and it can be used as the best adsorbent for the removal of various pollutants from water and waste water.
Pollutants such as dyes, phenols, pesticides and heavy metals as well can be removed from water carrying rice husk adsorbent

4. **L.G. Aajish , Dr. J. Thirumal(2014)** their objective of this study was to investigate the fluoride levels of the ground water and its removal by the application of activated carbon prepared from waste materials. Kerala, as a state, has mild problems with fluoride contamination, but locally it can be a large problem. The fluoride levels in this study that exceeded the WHO standards and the limits have to be brought under control. So methods are to be implemented for reducing the fluoride content thereby groundwater fluoride contamination problem can be reduced. Activated carbon is being used as an adsorbent there by reduces the fluoride and at present prescribed standard limit 1.5mg/L can be maintained.

5. **Tanji *et al.*, (2003)** he proposed a theory that to produce environmentally-friendly rice, chemical use should be reduced. One method of reducing the use of chemical fertilizers is through the use of green manure crops. The cultivation of green manure crops plays an important

role in maintaining the soil quality and sustainability of agricultural systems. However, the incorporation of green manure crops may be of concern because the decomposition of green manure and other soil organic matter may lead to strongly reducing conditions in submerged soil that may adversely affect rice growth and yield.

6. **Bhat and Sanghi(1987)** he proposed that the rice husk, is a product of the rice milling process, is a raw material for silicon carbide production, because it contains amorphous silica and carbon in a finely mixed form.
7. **V.P. Della et al. (2002)** he developed a procedure that obtained and had characterization of active silica with a high specific surface area than the rice husk ash. Relative amount of silica was increased after the burning of carbonaceous material at different times and at different temperatures.
8. **Nur Fatimah Abd Aziz, Rajesh Nithyanandam** his study is based on the result obtained on the study of sieved rice husk that must be treated first before being used. The RH contains a lot of impurities and release colored pigments. The untreated rice husk gave better result which showed the high possibility to be used for adsorption process by the rice husk to obtain optimum efficiency. His application gives benefits in economy area by reducing cost in adsorption process and also in the biomass waste treatment.

CHAPTER 3

OVERVIEW

3.1 OBJECTIVE OF PRESENT STUDY

The present study's objective is to:

1. Removal of turbidity from water using low cost adsorbents
2. To remove turbidity from the water and to reuse it as much as possible.
3. To use activated carbon that can remove many impurities from the water, these by-product can also do the same task, not in accuracy but can go upto a higher extent and can improve the quality in less cost as compared to any other media.

3.2 SCOPE OF STUDY

Water treatment is one of the best process for removal of turbidity from any area. When the waste water products from the process is toxic and contains heavy metals which will harm the surrounding. The clean water for our need is obtained mostly from river so a proper wastewater treatment is to be needed before being released to the river. Different processes need a different kind of water treatment. Therefore a few treatment processes are developed depending on type of waste water to be treated. Adsorption is a method that is preferable when compared with separations like membrane separation and coagulation or flocculation processes. This low cost adsorbent can be made from agricultural wastes such as fruit peel, sugarcane and peanut shell.

3.2 OUTLINE OF PRESENT WORK

An attempt has been made to study the characteristics of waste product's adsorption techniques. For generalisation of the experiment, first all the materials are collected from market and are been washed thoroughly so as to have a dust free environment. The effects of dust will hamper the solution and can give bad results. The analysis of every material is done to its best of its convenience and the results are carried out.

First the materials are obtained from local mills and market and are further proceeded for experiments to be performed.

This thesis comprises of seven chapters. The first chapter introduces the importance of the purification of water by using different natural materials that explains how the material works and how much it can adsorb.

In the second chapter, the literature review is presented. All the research papers relevant to this study were reviewed in detail and have been discussed briefly

The third chapter states the objective and scope of the study based on the detailed literature review.

The fourth chapter presents the actual methodology of how the materials works and its detailed modelling is also presented.

In chapter 5, the results obtained in the present investigation are tabulated. The effects of various parameters like materials taken and burnt, temperature in which muffle furnace is used, abe the apparatus and the whole experimental setup is discussed.

Chapter 6 states all the conclusions that are inferred from the results obtained.

Chapter 7 gives all sources of the research paper using which studies were carried out.

CHAPTER 4

METHODOLOGY

4.1 PROCEDURAL STEPS FOR MODELING

- Three 2.5 litre cylindrical bottle was taken having a hole at the end for the water to come out.

At the bottom of the bottle, fine sand of 300 micron is placed till 0.4 height of the bottle den fine gravels of 1.25 mm was placed over that and then 4.75mm gravels were placed on the top.

- In between every layer, filter paper was kept so as to separate it from each other and get a well setup apparatus.
- 2-3kg of Rice Husk is taken and washed with hot distilled water so as to remove the impurities and soil dust particles. Then it is dried under sun light to get a natural heat and good evaporation.
- After that, the RH was taken in 4 Crucibles of 100ml each and was burnt in Muffle Furnace at 800°C for 3 hours for good burning. And after that Furnace was

switched off, the crucibles were kept in it for the whole night to cool down and was taken out in the next morning for purification.

- 0.67 kg of groundnut shell was obtained from 2kg of ground nuts as a whole, and was washed with hot distilled water and dried under sun.
- Then it was grinded till it gets in powder form. And it is ready to use.



Fig.1 Rice husk and its powdered form.



Fig.2 Muffle Furnace



Fig.2 Carbonized Rice Husk

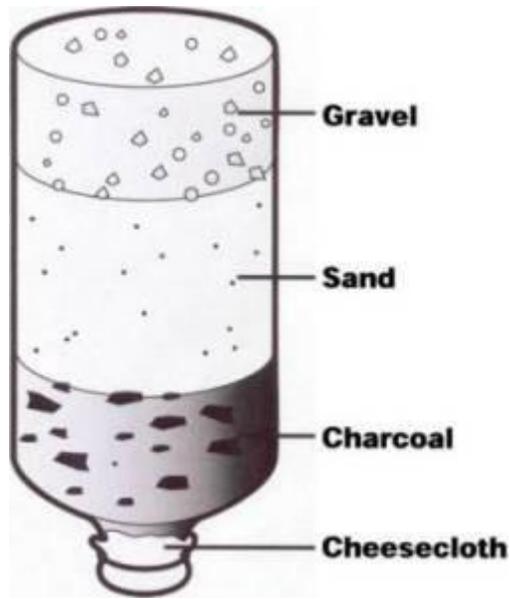
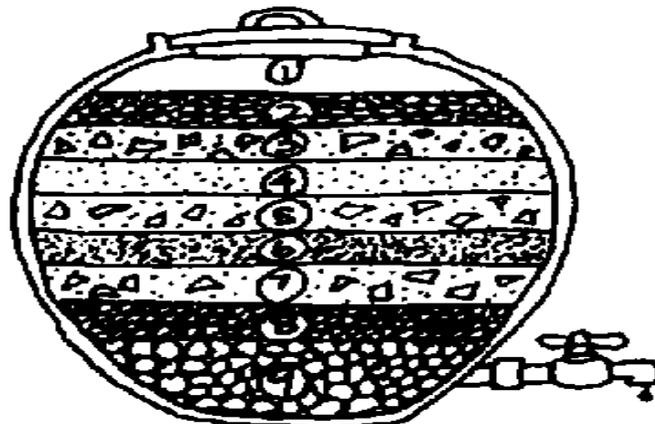


Fig.3 Gravity sand filter



- ① WATER
- ② FINE STONE
- ③ ROUGH PEBBLES & SAND
- ④ FINE SAND
- ⑤ ROUGH PEBBLES & SAND
- ⑥ FINE CHARCOAL
- ⑦ ROUGH PEBBLES & SAND
- ⑧ FINE STONE
- ⑨ ROUGH STONE

Fig.4 Gravity Sand Filter with Charcoal

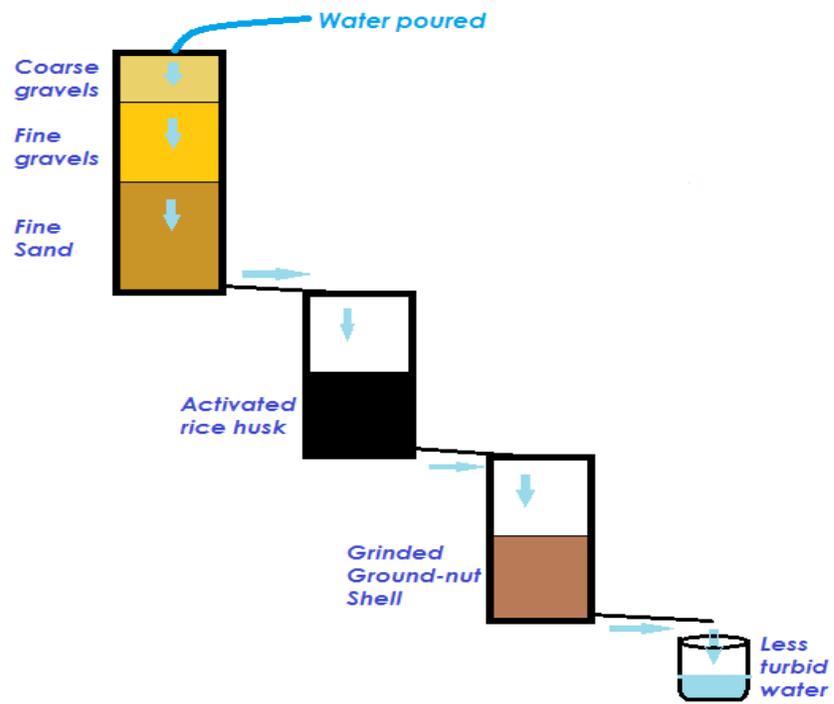


Fig.5 Experimental Setup



Fig.6 Lab Setup

CHAPTER 5
EXPERIMENTAL STEPS

5.1 PROCEDURE OF THE EXPERIMENT

A.

1. In first case we take three test samples of turbid water one by one and pour them in equal amount to each one of the setup one by one.
2. In the first test sample case of Gravity sand filter, the gravels and sand can remove a lot of organic matter and dirt present in water.
3. The coagulation of dirt present in the water are easily removed by Sand at the 1st attempt. From this we can suggest that Sand is the best for removing coagulations from water.
4. In the next test sample step we use the Activated rice husk which is very porous and has the ability to stop the coagulants effectively.
5. The same sample is poured in it and the result is calculated
6. Now the third test sample is poured in the grinded ground-nut shell.
7. In all of the 3 experiment same steps are produced and the results are tabulated

B.

1. Now in the second part, partially different procedure is applied.
2. Only one sample of the turbid water is first taken into consideration.
3. First the water sample is passed through the Gravity Filter then to the Activated Rice Husk and the at last to the Grinded Groundnut Shell.
4. Then the results are calculated

CHAPTER 6

RESLUTS

RESULTS

6.1 Tabulation

| Turbid Pond Water sample | Original Turbidity concentration | After passing through Gravity Filter | After passing through Activated Rice Husk | After passing through grinded groundnut shell |
|--|---|---|--|--|
| Passing the water individually | 73.8 | 13.4 | 53.4 | 18.2 |
| Passing turbid water one after another | 73.8 | 13.4 | 50.3 | 17.9 |

Table.1 Observation Table

CHAPTER 7
CONCLUSION

Conclusion:

This study showed us that, according to the results obtained in this study, the rice husk should be treated before using it as because it contains a lot of impurities and release color pigment once being crushed to smaller forms. 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. Application of rice husk is beneficial in many areas by reducing cost of adsorption process and also in the biomass waste treatment.

The gravity filter and Grinded Groundnut shell filter can remove turbidity to a greater extent.

CHAPTER 8
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