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[ijirset@gmail.com](mailto:ijirset@gmail.com)

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# Treatment of Tavare Kere Water using Coconut Shell & Rice Husk as Filter Media

**Preeti Sajjan, Doddappa Appa Patil, Dr. Srinivas Kustagi, Rameshwari Patil**

P.G. Student, Environmental Engineering, Department of Civil Engineering, P.D.A College of Engineering,  
Kalaburgi, India

Assistant Professor, Department of Civil Engineering, P.D.A College of Engineering, Kalaburgi, India

Professor, Department of Civil Engineering, P.D.A College of Engineering, Kalaburgi, India

Assistant Professor, Department of Civil Engineering, P.D.A College of Engineering, Kalaburgi, India

**ABSTRACT:** Providing Safe & Clean Drinking water proves to be major issues include all over the World and Particularly in Rural Areas. The global issue of safe & clean drinking water, particularly in rural areas, is addressed by designing and constructing a cost-effective BioFilter model. The filter product is crafted from locally available materials & filled with activated carbon layers from coconut shell, rice husk, sand, and pebble. The filter is placed at the top, allowing water to sediment & filter's effectiveness in achieving clean drinking water is being evaluated for its efficiency in removing contaminants.

**KEYWORDS:** Coconut shell, activated carbon, rice husk, activated Carbon, BioFilter Model, Sand and Pebbles

## I. INTRODUCTION

Water is a crucial resource for human well-being, but many countries, including India, face challenges in purifying it due to pollution from domestic, natural, industry, agricultural waste, pesticides, and radioactive material leakage. A novel and eco-friendly water purification method is being investigated, focusing on use rice husks. Rice husks are a valuable agricultural biomass material with high adsorbing capacities, containing lignin and 95% SiO<sub>2</sub>. They can trap up to 95% turbidity and bacteria in water due to their high external surface area.

This method is simple, efficient, and economically viable, allowing for water purification using a green path. Rice husk is also used in material science & Portland cement production the statement is based on its high specific surface area & activated carbon presence. Carbonized rice husks have varying physical and chemical properties, with increased temperatures leading to more friability and less hygroscopic properties. Carbonization is a thermal decomposition that eliminates non- carbon species, creating a fixed & porous mass of carbon in an inert atmosphere. Recent study have shown that carbonized rice husks are efficient adsorbing materials statement is based on their large surface area. This strategy achieves comprehensive utilization of rice husks & coconut shells, exhibiting tremendous economic & environmental benefits.

Water quality & quantity issues are global challenges, worsened by climate change and inadequate sanitation. Inappropriate management and exposure to chemical toxicants through food chain contribute to water pollution, affecting fresh water resources like lakes, rivers, and subsurface water. Major causes include domestic and industrial effluent waste, leakage from water tanks, marine dumping, domestic sewage, population growth, & weak management systems.

Untreated sewage discharges into freshwater, reducing dissolved oxygen levels and causing disease-causing bacteria and viruses to enter surface and subsurface water, posing health risks, damages to plants and animals, and impacts on human health.

## A. OBJECTIVES

- To determine Physio-chemical characteristics of surface water
- To determine WQI

- To promote bio degradable filter media

## II. STUDY AREA

Geographical area selected for sample collection is Tavare Kere in Shahapur taluk, Yadgir District, Karnataka State in India. Tavare Kere is geographically located at latitude  $16^{\circ} 41'0''$  and longitude  $16^{\circ} 41'0''$  water samples were collected from different places of lake by sampling technique.



Fig 1. Yadgir district map

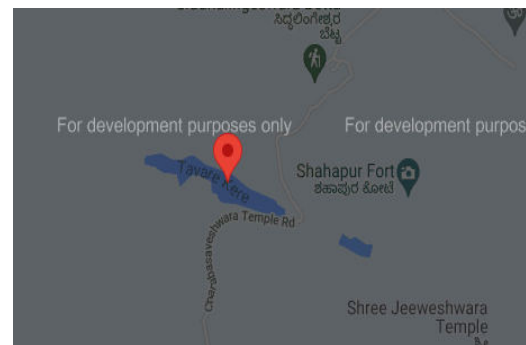


Fig 2. Tavare kere map

## III. METHODOLOGY

The proposed project comprise of cost effective Ecofriendly Filter which consists of sand and pebbles as filter media, Activated Carbon coconut shell and Activated Carbon Rice husks which acts as a Natural Absorbents. The filter consists of a filter body which is made up of Glass.

### A.MATERIALS

#### 1 Rice husk Activated Carbon

Rice husk activated carbon can be utilized in two purification processes: as a filter medium and as a coagulant. The rice husks are collected, washed with water then it is sun dried and Heated at Temperature of  $250-400^{\circ}\text{C}$  in a muffle furnace to form Carbon and is used as Absorbent in Filter, first layer passes through 600micron IS sieve and retained on 300micron IS sieve and second layer passes through 300micron IS sieve and retained on 150 micron IS sieve layers are placed one below the other with the thickness of 3cm



Fig 3. Rice Husk



Fig 4. Rice Husk as Activated Carbon



## 2. Coconut shell activated carbon

Activated Carbon from coconut shells have a high volume of Micropores for filtration. Coconut shell Activated Carbon acts as excellent absorbent in removing many pollutants in water as it has larger inner surface area hence it can absorb the contaminants. Coconut shells are also an environmental friendly and a renewable resource for purification of water. In this filter coconut shell is heated at temperature of 400C in a muffle furnace to form Carbon & is used in Filter for purification.

The carbon which passes through 1.18mm IS sieve and retained on 600micron IS sieve is placed in First layer & in the Second layer the sand which passes through 600micron IS sieve and retained on 300micron IS sieve layer is placed with thickness of 3cm & activated carbon of size 20mm IS sieve and 4cm thickness coconut shell activated carbon also placed is placed over sand layer



**Fig 5.Coconut chips**



**Fig 6. Coconut chip Carbon**

## 3. Filtration of Sand Layer

Filtration sand is sieved, washed, oven dried for 24 hours and it is placed in two layers. The sand which passes through 1.18mm IS sieve & retained on 600micron IS sieve and 0.9m thick fine sand is placed in First layer and in the Second layer the sand which passes through 4.75mm IS sieve and retained on 2.36mm IS sieve and 10cm thick coarse sand layer is place



**Fig 7. Sand layer**



**Fig 8. Sieve sizes of sand**

#### 4. Pebbles Layer

The pebbles are placed at the bottom in one layer, with the first layer passing through 40mm IS sieve & retained on 20mm IS sieve is placed, Second layer which passes through 20mm IS sieve and retained on 10mm IS sieve is placed below the Filtration Sand Layer and 10cm thick drainage pebble layer is placed. Pebbles used in filters are sieved washed thoroughly & are oven dried for about 24 hours and then these materials are placed into the filter



Fig 9. Coarse aggregates 1<sup>st</sup> layer



Fig 10. Coarse agg 2<sup>nd</sup> layer

#### B. SAMPLING.

The suitability of water for particular use depends on its quality. The management of water is also linked to its quality. The water standards are also based on the water quality. Hence water quality monitoring is one of the first steps in the rational development & management of water resources. The monitoring comprises all activities to obtain information about the water system. The first & most important step of any monitoring activities is sample collection (sampling).

The objective of sampling is the collection of representative portion of material, from an environment (water, air, sediment or biota), small enough in volume to be conveniently transported & handled in the laboratory. This means, the relative concentration of the components of interest should be the same in the samples, when they are analysed, as they were originally present in the environment. The results of any chemical or biological analysis depend on the samples offered to the analytical laboratory. So the samples are handled and, if necessary, treated in such a way that no significant changes in composition occur that may interfere with proper analysis.

#### C. METHODOOGY

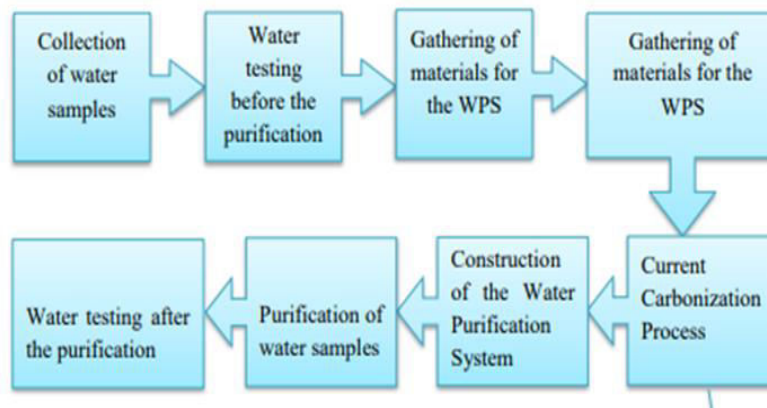


Fig 11. Flow chart of purification

The project involves collecting 2 liters of raw river water sample for physicochemical and microbiological testing. Escherichia coli (E. coli) is a large & diverse group of bacteria found in the environment, foods, and intestines of people and animals. Water testing is the continuous sampling of various liquid streams and the analysis of their quality.

After the water testing, 10 kg of coconut shells and 2 kg of coir were collected for the construction of a Water Purification System. The materials used for the system included four pieces of 2 inch pipes, a sterile water jug, a fine net, a cheese cloth, a flex tape, and a neoprene rubber. Coconut shells are carbonized through a process that includes building a fire, packing a metal pot with hardwood, cooking the pot on an open fire for 3 to 5 hours, cleaning the charcoal with water, grinding it, combining calcium chloride and water, using bleach or lemon juice as an alternative, stirring together the solution and charcoal powder, and cooking it for another 3 hours to activate it.

Then researchers constructed the Water Purification System using coconut fibres and activated charcoal from coconut husks, reusable water gallons, fine net, and cloth. They will use the Observational Design for physical characteristics of water samples before & after purification, the Experimental Research Design for chemical and microbiological characteristics, and test the feasibility of the Water Purification System with coconut husk and activated charcoal by comparing it to other alternative water purifiers/purification systems.

#### **D. MODELLING**



**Fig 12. Experimental set up of filter media**

Filter is made up of glass material of size 70X15X15 cm. The component parts of Filter are outlet is about 15cm, Pebble Layer is about 20cm it includes two layers, first layer is coarser is 10cm & second layer is about 10cm, fine aggregate layer is about 20cm and it also includes two layers, firstly layer is 10cm and second layer is 10cm, Activated Carbon layer is about 5cm thick, Activated Carbon Coconut Shell layer is about 3cm, Activated Carbon Rice husk layer is about 2cm, and top open space is about 5cm. These samples are tested in laboratory for finding the impurities present in it. Depending upon the impurities present in the water samples filter media is selected & the filter is modeled. Water is subjected to filtration by passing through the filter & is allowed for settling. The filtered water is collected & again the laboratory tests are conducted to know the reduction of impurities in the water.

#### **E. PARAMETERS TO BE DETERMINED ARE:**

1. pH
2. Total Hardness
3. Calcium Hardness



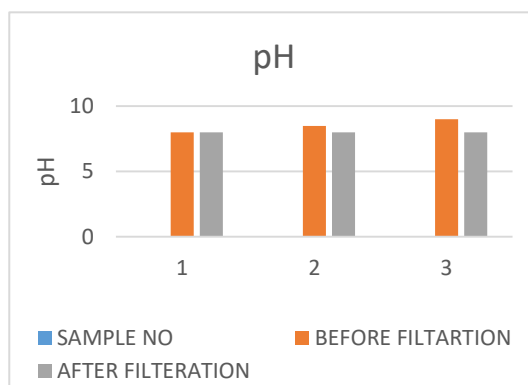
4. Magnesium Hardness
5. Chloride Test
6. Total Solids
7. Alkalinity
8. Dissolved oxygen

#### IV. RESULTS AND DISCUSSION

The collected water sample underwent testing for various parameters before Filtration & after Filtration like pH, Total Hardness, Chloride test, Total dissolved solids, Alkalinity Dissolved oxygen. The following results are obtained.

SAMPLE NO	PARAMETER	BEFORE FILTARTION	AFTER FILTERATION
1	pH	8	8
2		8.5	8
3		9	8

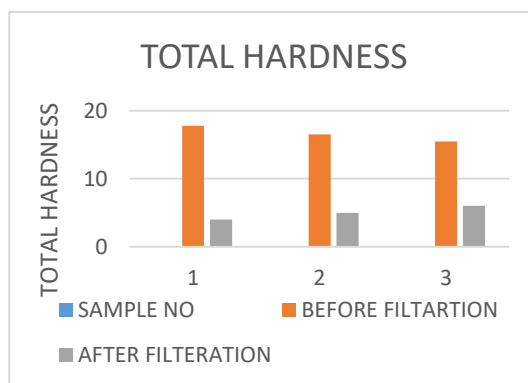
Table 1.pH values before & after filtration



Graph 1.Variation of pH before & after filtration

SAMPLE NO	PARAMETER	BEFORE FILTARTION	AFTER FILTERATION
1	TOTAL HARDNESS	17.8	4
2		16.5	5
3		15.5	6

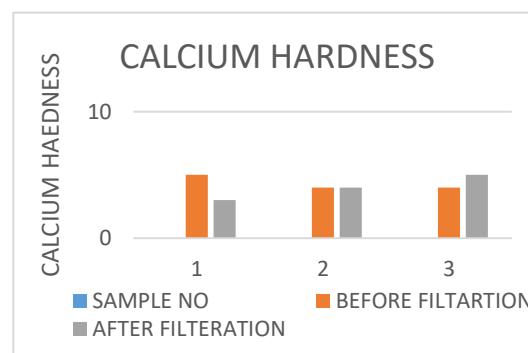
Table 2.Total Hardness values before & after filtration



Graph 2.Variation of TH before & after filtration

SAMPLE NO	PARAMETER	BEFORE FILTARTION	AFTER FILTERATION
1	CALCIUM HARDNESS	5	3
2		4	4
3		4	5

Table 3.Calcium Hardness values before & after filtration



Graph 3.Variation of Ca-H before & after filtration

SAMPLE NO	PARAMETER	BEFORE FILTARTION	AFTER FILTERATION
1	MAGNESIUM HARDNESS	12.8	1
2		12.5	1
3		11.5	1

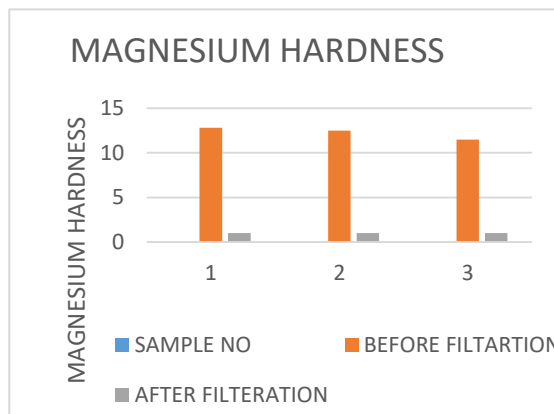


Table 4.Mg Hardness values before & after filtration

Graph 4.Variation of Mg-H before & after filtration

SAMPLE NO	PARAMETER	BEFORE FILTARTION	AFTER FILTERATION
1	CHLORIDE	14	1
2		15	1.5
3		13	2

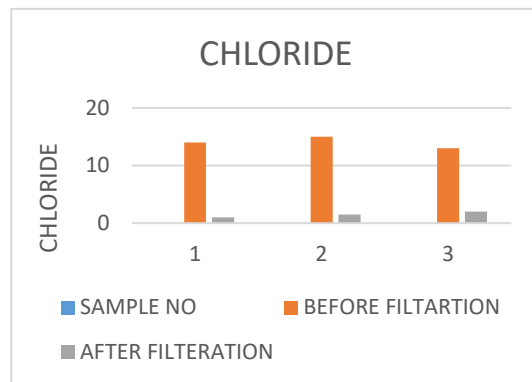


Table 5.Chloride values before & after filtration

Graph 5.Variation of Chloride before & after filtration

SAMPLE NO	PARAMETER	BEFORE FILTARTION	AFTER FILTERATION
1	TOTAL SOLIDS	0.1	0.1
2		0.1	0.5
3		0.1	0.1

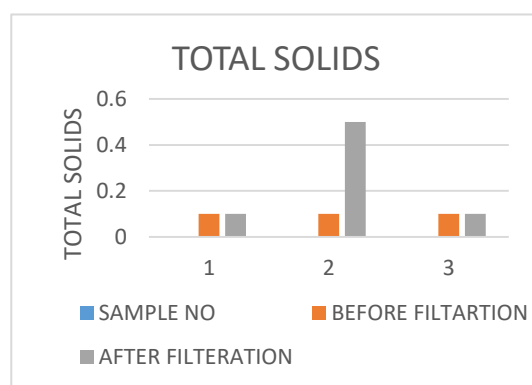


Table 6.Total solids values before & after filtration

Graph 6.Variation of Chloride before & after filtration



SAMPLE NO	PARAMETER	BEFORE FILTARTION	AFTER FILTERATION
1	ALKALINITY	1	1.2
2		1.5	1
3		2	0.8

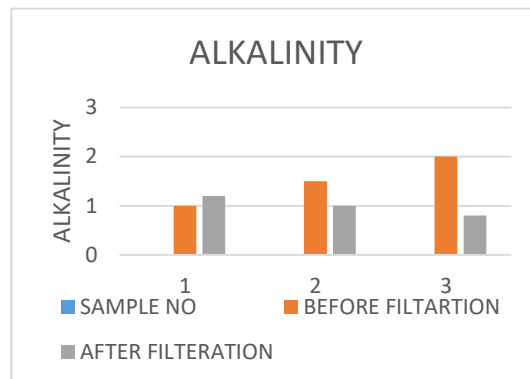


Table 7. Alkalinity values before & after filtration

Graph 7. Variation of Alkalinity before & after filtration

SAMPLE NO	PARAMETER	BEFORE FILTARTION	AFTER FILTERATION
1	DISSOLVED OXYGEN	1.5	2
2		0.5	1
3		1	3

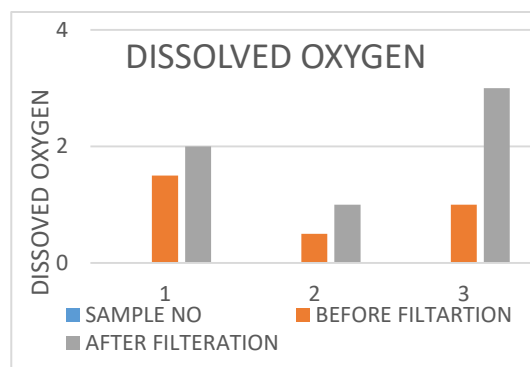


Table 8. Dissolved oxygen before & after filtration

Graph 8. Variation of DO before & after filtration

PARAMETER	Initial Reading	BIS Std (Sn)	1/Sn	E (1/Sn)	K=1/(E1/Sn)	Wi=K/Sn	IDEAL VALUE(V0)	MEAN CONC. VALUE (Vn)	Vn/Sn	Qn=Vn/Sn*100	WnQN
pH	8.5	8.5	0.12	0.137	7.274	0.856	7	8.5	1.0	100.0	85.574
Total Hardness	664	600	0.00	0.137	7.274	0.012	0	664	1.107	110.667	1.342
Calcium Hardness	173.3	200	0.01	0.137	7.274	0.036	0	173.3	0.867	86.650	3.151
Magnesium Hardness	490	100	0.01	0.137	7.274	0.073	0	490	4.9	490.0	35.641
Chloride	697.5	1000	0.00	0.137	7.274	0.007	0	697.5	0.698	69.750	0.507
Total Solids	2	2000	0.00	0.137	7.274	0.004	0	2	0.001	0.100	0.000
Alkalinity	40	600	0.00	0.137	7.274	0.012	0	40	0.067	6.667	0.081
Dissolved Oxygen	2	8.5	0.12	0.137	7.274	0.856	0	2	0.235	23.529	20.135
										POOR WATER ©	Sum=146.

Table 9: WQI before filtration

PARAMETER	Initial Reading	BIS Std (Sn)	1/Sn	E (1/Sn)	K=1/(E1/Sn)	Wi=K/Sn	IDEAL VALUE(V0)	MEAN CONC. VALUE (Vn)	Vn/Sn	Qn=Vn/Sn*100	WnQN
pH	8.5	8.5	0.12	0.137	7.274	0.856	7	8	0.600	60.000	51.344
Total Hardness	664	600	0.00	0.137	7.274	0.012	0	200	0.333	33.333	0.404
Calcium Hardness	173.3	200	0.01	0.137	7.274	0.036	0	160	0.800	80.000	2.910
Magnesium Hardness	490	100	0.01	0.137	7.274	0.073	0	40	0.400	40.000	2.910
Chloride	697.5	1000	0.00	0.137	7.274	0.007	0	29.06	0.029	2.906	0.021
Total Solids	2	2000	0.00	0.137	7.274	0.004	0	1	0.001	0.050	0.000
Alkalinity	40	600	0.00	0.137	7.274	0.012	0	60	0.100	10.000	0.121
Dissolved Oxygen	2	8.5	0.12	0.137	7.274	0.856	0	4	0.471	47.059	40.270
										GOOD WATER (B)	Sum=97.980

Table 10: WQI after filtration

SLNO	PARAMETER	Before filtration	After filtration	BIS Standards
1	pH	8.5	8	6.5-9.5
2	Total Hardness	664mg/l	200 mg/l	200-300mg/l
3	Calcium Hardness	173.3mg/l	160 mg/l	75-300mg/l
4	Magnesium Hardness	490mg/l	40 mg/l	10-100mg/l
5	Chloride	697.5mg/l	29.06 mg/l	10-20mg/l
6	Total solids	2mg/l	1mg/l	250-350mg/l
7	Alkalinity	40mg/l	60mg/l	200mg/l
8	Dissolved Oxygen	2	4	6.5-8mg/l

Table 11: Comparison with BIS standards

### V. CONCLUSION

The study examines the impact of activated Carbon Coconut Shell and Activated Carbon Rice Husk on reducing contaminants in water using a BioFilter Model and water passing through it.

The study found a significant decrease in Total Hardness, Chlorides, and Total Dissolved solids after filtering, leading to important conclusions:

1. The project aims to reduce pollutants in water to BIS water standards for drinking purposes using a sand filter made of activated carbon coconut shell and rice husk.
2. The filter reduces total hardness, chlorides, and total dissolved solids, making water safe for drinking, and increases dissolved oxygen.
3. The filter is cost-effective and eco-friendly, and the water quality index obtained is safe for usage.

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