Comparison Study of Commercial RO System With Natural Fibre filtration System

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Abstract- *In underdeveloped countries many people, who are living in rustic areas river water is contaminated by various factors and as many people are affected by water borne diseases. Hence there is need of cost-effective filtration methods to purify river water. The objective of this study is to use natural Fibre filtration system which will be able to reduce the undesirable qualities of the river water. The jute Fibre is extracted by retting, it is used to purify the river water and to treat the microorganisms present in the water and also used to remove micron size particles from water as that of commercial RO system. The water samples are collected in various places of Erode town. Physical and chemical characteristics are tested on samples in the lab. Lab scale model is fabricated using to filtrate the contaminates or salts. This model is the useful one for public became this system not remove all salts like RO.*

Keywords- Commercial RO system, Natural Fibre cartridge filter, Activated Carbon, Physio Chemical test.

I. INTRODUCTION

Only 1% of the water resource is available as fresh water such as surface water- rivers, lakes, reams, and ground water for human consumption and other activities. Toxic chemicals from drinking water transfer to plants and entire in the food chain and affect public health. Pathogens present in the drinking water directly affect the mammals causing drinking diseases. Drinking water treatment is the process of removing contaminants from river water and household drinking, both effluents and domestic. It includes physical, chemical, and biological processes to remove physical, chemical and biological contaminants. Its objective is to produce an environmentally safe fluid waste stream and a solid waste suitable for disposal or reuse and to produce a disposal effluent without causing harm to the surrounding environment, and prevent pollution. A water filters removes impurities by lowering contamination of water using a fine physical barrier, a chemical process, or a biological process.

II. EFFECTS OF CONTAMINATED WATER

Water-borne diseases are infectious diseases spread primarily through contaminated water. Though these diseases are spread either directly or through flies or filth, water is the chief medium for spread of these diseases and hence they are termed as water-borne diseases.

Most intestinal diseases are infectious and are treated through faecal waste pathogens which include virus, bacteria, protozoa, and parasitic worms are disease producing agents found in the faces of infected person. These diseases are more prevalent in areas with poor sanitary conditions. These pathogens travel through water sources and interfaces directly through persons handling food and water. Since these diseases are highly infections, extreme care and hygienic should be maintained by people looking after an infected patient. Hepatitis, cholera, dysentery, and thyroid are the most common water-borne diseases that affect large populations in the tropical regions.

Typhoid, cholera, paratyphoid fever, bacillary dysentery is caused by bacterial infections. Infectious hepatitis (jaundice), poliomyelitis is caused by viral infections. Pathogens can cause a variety of gastro-intestinal diseases, which can be fatal to babies and to other vulnerable populations. WHO data shows water pollution is one of the greatest causes of mortality that can be linked to environmental factors. Boiling water can destroy most pathogens; however, this requires fuel, a commodity often in short supply in poor households.

Toxic contaminants are fish or other foods are less likely to cause acute poisoning but can have serious long-term effects, depending on the pollutants and the doses. Understandably, fishing communities along rivers are particularly at risk since they have a steady diet of the local fish over many years.

TREATMENT METHODS FOR CONTAMINATED WATER:

1. Reverse Osmosis

Water pressure is used to force water molecules through a membrane that has extremely tiny pores, leaving the larger contaminants behind. Purified water is collected from the "clean" side of the membrane and water containing the concentrated contaminant is flushed down the drain from the "contaminated side". The average RO system is a unit consisting of a sediment chlorine per filter, the reverse osmosis membrane, a water storage tank, and an activated-carbon post filter.

2. Distillation

Distillation is the reverse of boiling. To remove impurities from a water by distillation, the water is usually boiled in the chamber causing water to vaporize, and the pure (or mostly pure) steam leaves the non-volatile contaminants behind. The steam moves to a different part of the unit and is cooled until it condenses back into liquid water. The resulting distillate drips into a storage container.

3. UV system

Water passes through a clear chamber where it is exposed to Ultra Violet (UV) Light. UV light effectively destroys bacteria and viruses. However, how well the UV system works depends on the energy dose that the organism absorbs. If the energy dose is not high enough, the organism's genetic material may only be damaged rather than disrupted.

4 .Water deionizers

Water deionizers use both Cation and Anion Exchange to exchange both positive and negative ions with H+ or OH-ions respectively, leading to completely demineralized water. Deionizers do not remove uncharged compounds from water, and are often used in the final purification stages of producing completely pure water for medical, research, and industrial needs.

5. Ozonation

Ozone is a naturally occurring component of fresh air. It can be produced by the ultraviolet rays of the sun reacting with the Earth's upper atmosphere (which creates a protective ozone layer), by lightening, or it can be treated with an ozone generator. The ozone molecules contain three oxygen atoms whereas the normal oxygen molecule contains only two. Ozone is a very reactive and unstable gas with a short half- life before it reverts back to oxygen. Oxygen is the most powerful and rapid acting oxidizer man can produce, and will oxidize all bacteria, and yeast spores, organic material and viruses given sufficient exposure.

6. Activated Alumina

Activated alumina is granulated form of alumina oxide. In this process, water containing the contaminant is passed through a cartridge or canister of activated alumina which absorbs the contaminant. The cartridge of activated alumina must be replaced periodically. Activated alumina devices can accumulate bacteria, so treated water may have higher bacteria counts than raw water.

MISCELLANEOUS TREATMENTS:

1.REMOVAL OF COLOUR, ODOUR AND TASTE FROM WATER

The special treatments which may be given to the water under special conditions for removing colour, taste and odour from it, are described below:

A] AERATION

Under the process if aeration, water is brought in intimate contact with air, so as to absorb oxygen and to remove carbon dioxide gas. It may also help in killing bacteria to a certain extent.

B] BY USING SPRAY NOZZLES

In this method, water is sprinkled in air or atmosphere through special nozzles which breaks the water into droplets, thus permitting the escape of dissolved gases. This function effectively at a pressure of 10 to 14 m head of water.

C] BY PERMITTING WATER TO TRICKLE OVER CASCADES.

In this method, the water ions made to fall through a certain height (1 to 3 m) over a series of steps with a fall of a about 0.15vto0.3 m in each step. The structure so formed is known as freefall aerator.

D] BY AIR DIFFUSION

In this method, compressed air is bubbled through the water, so as to thoroughly mix it with water. During its upward movement through the water body, it gets thoroughly mixed with the water combined in the tank, thereby completing the aeration process.

E] BY USING TRICKLING BEDS

In this method, the water is allowed to trickle down the beds of coke. Aeration, though helpful in removing iron and manganese bedsides removing volatile gases, such as carbon dioxide and hydrogen sulphide, yet cannot be relied upon to remove or even reduce the tastes and odourof all kinds.

F] TREATMENT WITH ACTIVATED CARBON

Activated carbon is a specially treated carbon, which possesses the property of absorbing and attracting impurities, such as gases, liquids, and finely divided solids. It can be manufactured by heating or charring wood or sawdust or some other similar carbonaceous material in a closed vessel, and then slowly burning it. Activated carbon may also use in the granular form as a filter media. This process of rejuvenation may have to be carried out at intervals of 1 year, depending upon the quality of water being treated. The use of activated carbon may thus serve the following advantages:

- When used in powdered form being coagulation, it aids in coagulation.
- It reduces the chlorine demand of treated water.
- It removes the organic matter present in water.

TREATMENT WITH OXIDISING AGENT

The colour, odour and tastes from the water may also remove by oxidizing the organic matter responsible for them. The oxidizing agents commonly used are potassium permanganate, chlorine ozone etc. chlorine Also helps in removing the organic matter, provided the sufficient dosage are used. Chloride dioxide gas, ozone, etc., may also be used as oxidizing agents for obtaining good tasty water, but their use has not been found economical.

REMOVAL OF SALT AND DISSOLVED SOLIDS FROM WATER; i.e. DESALINATION

The water which contains common salt or sodium chloride dissolved in it, has a peculiar salty or brackish taste, and therefore, it is named as salt water or brackish water. Since the salt waters have a brackish taste, they cannot be used for drinking, unless the salt content is removed or reduced. the process of removing this salt form water is known as desalination, and the resultant water which is free from salt is known as fresh water.

CLASSIFICATION OF SALTY WATER

METHODS OF DESALINATION:

1) Desalination by evaporation and distillation
2) Electrodialysis method
3) Reverse osmosis method
4) Freezing process
5) Solar distillation method

III. IMPORTANCE OF STUDY

The importance of drinking treatment is generally to allow human effluents to be disposed of without danger to human health or unacceptable damage to the natural environment. By treating the drinking water, it helps to keep the environment safe and clean.

This filter cartridge filtration helps to have great water quality. It deeply removes the chlorine from the water and make it healthy for a drink.

Activated carbon is commonly used to absorb natural organic compounds, taste and odour compounds, and synthetic organic chemicals in drinking water treatment.

It is an effective absorbent because it is highly porous material and provides a large surface area to which contaminants may absorb

Jute Fibre filter cartridges reusable, biodegradable and provides high filtration efficiency. Wide range of micron retention. Long life cost effective high dirt holding capacity consistent quality easily replaceable. The jute Fibre material has better effect of purifying PAHs in water and it is used to remove micron size particles from water and water-based liquids.

Chrysopogon zizanioides (vetiver) is an efficient biological means of primary filtration and can be used as a low-cost primary filter of water run-off in poorer areas-where it is not treated and discharged into natural water courses. The natural Fibre and activated carbon can be easily available to the people of rural areas.

Thus, our project reveals that the cost-effective natural treatment of drinking water by using natural fibre to the rural people.

OBJECTIVE OF THE PROJECT

The main objectives of our project are to provide filtered drinking water to the rural people in a cost-effective manner.

The grinded roots of chrysopogonziznioides is used to absorb many heavy metals, nitrogen and phosphorous from water and thus to help in wastewater treatment.

Jute fibre cartridge filter removes the molecular particles present in the drinking water.

Natural Fibres control the action of bacteria and other pathogenic organisms.

The filter using activated carbon removes the dead bacteria and pathogenic organisms.

IV. METHODOLOGY

The methodology consists of seven important steps which are given below.

1. Collection of samples water
2. Physical and Chemical characteristics study
3. Fabrication of experimental setup
4. Aeration treatment
5. Adsorption process
6. Filtered water collection
7. Efficiency and Conclusion.

Collection of sample water:

The sample are collection at Erode town. To collection of 10 samples in each place.

Physical and chemical characteristics study:

In before filtration of water have study the physical and chemical characteristics study of water. the study is based on the tests like Hardness, Dissolved oxygen, Turbidity, Chloride, Total dissolved solids, Sulphate, pH, Calcium, Iron, Magnesium.

Aeration treatment:

Aquarium motor is used for this aeration process and rotated speed is 8rpm. In this aeration process in any solid particles are settled down and the air particles are mixed in water. this process is mean aeration process.

Adsorption Process:

In process is very important process in this filtration. Because of the unwanted matter in water that is are adsorbed by the filter cartridge. In this natural filtration is four cartridges are presented.

Filtered water collection:

Finally, the filtered water is collected form the filter. The filtered water is suitable for drinking purpose. This water is to take for the final test and to test the all parameters.

Efficiency and conclusion:

The natural filter is comparing to commercial filter. Its compare to the efficiency of water, speed of purification of water, cost, durability of the using materials.

V. MATERIALS AND PROPERTIES

WATER TREATMENT MATERIALS

- Filter cartridge.
- Aquarium internal filter motor.
- Natural Fibres (chrysopogon zizanioides, Corchorus).
- Activated carbon.

1. FILTER CARTRIDGE:

A cartridge filter is a piece of tubular filtration equipment that can be used across various industries for an array of filtration requirements. A cartridge is encased within a housing or a casing and used to remove unwanted particles, pollutants, and chemicals from liquids. The cartridge is exposed to water, liquid or solvent that needs filtration, and it flows inside the housing and passes through the filter element. Cartridge filters can also remove submicron particulates.

2. AERATION PROCESS USING AQUARIUM FILTER MOTOR:

Aquarium filter motor remove physical and soluble chemical waste products from aquaria, simplifying maintenance. Furthermore, aquarium filters are necessary to support life as aquaria are relatively small, closed volumes of water compared to the natural environment. It increases the quality of water. In this motor the sponge is attached to it, as water is sucked up through the intake tube with a speed of 8rpm, solid wastes particles are trapped in the pores of the sponge so the water being turned to the tank is clean. This type of filter is available in the variety of size so it can be used as either a main filter for a small tank or as a supplemental filter for a large tank.

3. NATURAL FIBRES:

The water purification in this project is by filtration via ion exchange process using plant Fibres. By using the

natural Fibres, it's treats the colour of water and the cause of odours from the drinking water.

a) CHRYSOPOGON ZIZANIOIDES (VETIVER)

It is recently discovered attribute of vetiver as its capacity of purify water, and thus help in wastewater treatment. Chrysopogon zizanioides, a species widely present in India, can absorb many heavy metals, nitrogen and phosphorus from water.

b) CORCHORUS (JUTE FIBRE)

The effects of purifying the PHAs in water is to apply a plant material which is jute fibre to enrichment the microorganisms for purification the PHAs. It is used to remove micron size particles from water and water-based liquids. It is reusable and biodegradable. Wide range of micron retention.

c) STRYCHNOS POTATORUM (NIRMALI SEED)

The natural strychnospotatorum (Nirmali seed) is widely used as coagulants to clarify turbid waters. In recent years natural and synthetically prepared organic Strychnos potato rums have been increasingly used in the coagulation of suspended matter in water and wastewater treatment.

4. ACTIVATED CARBON:

It is used to absorb natural organic compounds, taste and odour compounds, and synthetic organic chemicals in drinking water treatment. Activated carbon is an effective adsorbent because it is highly porous material and provides a large surface area to which contaminants may absorb.

5.CONSTRUCTION:

- Glass tank.
- Aquarium motor.
- Jute fibre cartridge.
- Activated carbon.
- Chrysopogon zizanioides cartridge.
- OcimumTenuiflorum cartridge.

The water is Stored by a glass tank. The tank is filled with of 30lit water. Then the water is pumped to the cartridge filter with the help of an aquarium motor. The aquarium motor is first connected with filter cartridge. And it is winded by a jute fibre. The 1-inch radiation and outlet of first filter cartridge connects the next filter cartridge This cartridge is filled with the Activated carbon. the filtrate water is getting out filter is passes through the pipe to the third filter. The third filter is filled up of chrysopogon zizanioides (vetiver) in ¾ of the cartridge. This filter is connected to the final filter that is made up of OcimumTenuiflorum (tulsi) material. Water is passing the downward to the outlet and collect the felted water from the tank. The Natural fibre membrane RO system full setup has been showing in figure 5.1

Figure 5.1. Construction of Natural Fibre.

SAMPLE COLLECTION

The sample were collected from in and around Erode. They are listed below in the table1. Minimum ten sample are Collected in each place.

Table 1. Location of Samples Taken

SAMPLES	LOCATION	LATITUDE	LONGITUDE
1	Vairapalayam	N 11°21'42.8''	E 77°43'28.9''
2	Chathram	N 11°21'45.7''	E 77°43'16.3''
3	B.P. Agraharam	N 11°21'50''	E 77°42'31.7''
4	Karungalpalayam	N 11°21'15''	E 77°44'20.6''
5	Thirunagar colony	N 11°23'30''	E 77°41'31.7''

This is to determine the variation in water quality parameters. The water samples collected by method of sampling techniques.

TESTING OF SAMPLES

The tests to be conducted for analysis of the water sample characteristics are given below. This test is having be taken before and after purification of water sample.

PHYSIO CHEMICAL TEST

1. Hardness
2. Turbidity
3. Total dissolved solids
4. pH
5. Iron
6. Dissolved oxygen
7. Chloride
8. Sulphate
9. Calcium
10. Magnesium

INDIAN STANDARDS FOR DRINKING WATER

Table 2 Essential Characteristics of water quality standards as per IS 10500: 2012.

S. No	Characteristics	Water quality standards as per IS 10500: 2012.
1	pH	6.50 to 8.50
2	Odour	Unobjectionable
3	TDS (mg/l)	500.00
4	Turbidity (NTU)	5.00
5	Hardness (mg/l)	300.00
6	Chloride (mg/l)	250.00
7	DO (mg/l)	5.0 - 6.0
8	Sulphate (mg/l)	200.00
9	Iron (mg/l)	0.30
10	chlorine (mg/l)	0.20

COMMERCIAL RO SYSTEM

The worldwide need for clean, pure and healthy drinking water is extremely high. By using RO water purifier for commercial use, establishments like offices, schools, hotels, restaurants are able to provide customers and employees with high-quality and pure water that are devoid of all sediments, contaminants and harmful substances. While schools, colleges, and commercial buildings make use of these systems for drinking purposes, Food and Hospitality industry, on the other hand, make use of commercial RO water purifiers for cooking as well as drinking purposes.

As a water purification process, Reverse Osmosis technology help process water through a membrane. The RO membrane helps separate dissolved chemicals and contaminants ensuring that only clean water passes through thus, making water safe for consumption

The Reverse Osmosis water purification process helps eliminate 99% of the bacterial contaminants and chemical, biological & dissolved impurities. It works best for purification of water with high TDS level. Also, many Commercial RO water purifiers today are equipped with UV lamp which further helps eliminate harmful micro-organisms and other viruses.

VI. CONCLUSION

Now It's Comparison of Commercial RO filter with Natural filter. This comparison study is collection of samples around the East of Erode District. Natural filter is best then the comparing to the commercial RO filter. Because of using the organic materials. Like as a Natural Fibres (chrysopogon zizanioides, Corchorus). These types of natural fibres are available nearby area. In a Cost comparison Commercial RO filter is minimum fifteen thousand (Rs 15,000) and Natural filter is taken to around three thousand (Rs 3,000) only. This is very minimum amount so this type of filter is used as even low-class family. The Natural filter member are changes in regular interval of time. this filter member is life time is very short. while comparing the test results of the treated sample, the quality of water has been improved. The treated water sample fulfils the requirements of the Indian standards for drinking water. This Natural filter may be suggested for economical home treatment of drinking water to the rural people.The natural filtration system imparts good results when compare the commercial filter in various parameters like pH (6.78), odour (nil), TDS (312ppm), chloride (102ppm), DO (9.6ppm), sulphate (49.36ppm), Iron (0.23ppm) with treasonable cost. Hence this project may be suitable for community with few modifications in future. Out supreme court notified that RO machine removed all good nutrients. Which induce the good nutrients which induce the malnutrition and calcium deficiency leads to lit of health issues project is the good initiative and innovation solution with the affordable cost which helps the poor people and brings health's India.

TABLE 2. COMPARISON STUDY.

CHARACTERISTICS	MEAN VALUES OF ALL FILTERED WATER SAMPLES	COMMERCIAL RO SYSTEM VALUES
pH	6.78	7.2
Odour	Odourless	Odourless
TDS (mg/l)	312	250
Turbidity (NTU)	3	Nil
Hardness (mg/l)	220	150
Chloride (mg/l)	102.88	45.8
DO (mg/l)	9.6	5.5
Sulphate (mg/l)	49.36	18.4
Iron (mg/l)	0.28	0.05
Chlorine (mg/l)	Nil	Nil

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