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European Journal of Advances in Engineering and Technology, 2022, 9(4s):76-86
International Conference on Tech Trends in Science & Engineering (ICTTSE) 2022
Suryodaya College of Engineering & Technology, Suryodaya Polytechnic, Nagpur, Maharashtra, India

Research Article ISSN: 2394 - 658X

Home Made Water Purifier Using Natural and Waste Materials

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ABSTRACT

In this project we had tried to develop a "Water Purification Technique in low cost" according to principal of Slow Sand Filter, some locally available filter material like cotton, charcoal, sand, sugar-cane husk, pebble, etc. and try to improve the methodology using the UV Filter, RO Filter, and Activated Carbon Filter mechanism. Main focus was removal of iron from surface water by adsorption and oxidation followed by precipitation technique.

Primary intentions under waste water to eliminate the pollutants that can influence the human being as well as existing healthiness. Beneath an area heat to ejected the particles, various types of poison's gas as like nitric, phosphoric and ammonium-ions, stench. In the primary study of economical water purifier construct waste and natural materials that are charcoal, zeolite, coconut shell / fibre, alum, Sea shells with or without crushing, stones and corn cob. Using various test for water quality for suitable of human being bodies as well as living things and also check the ph value and turbidity of the best quality of water.

Key words: Home made Wateer Purifier

INTRODUCTION

In some of the rural areas of India, women use cotton cloth layers for water filtration. This method is very cheap, cost effective in removal of sediments or any suspended solids, but may be not completely suitable for drinking purpose. Some places people are using simple plastic bottles with open end, inside which a layer of bone char followed by a layer of sand and a layer of pebble on both sides of the bone char layer is being used through which water will be passed for filtration. This kind of filtration process is capable of removing sediment and microbes effectively from water.

India ranks 2nd in population and year latter it ranks first the drinking water need of the people dramatically increased but the water in India for drinking will be very poor quality and not have any proper purification in villages and small town areas. In most of area and villages used, ground water for drinking purpose by excavating boring well or traditional wells also the rivers water is used for drinking purpose which is very un-pure, contaminated contain very harmful bacteria.

India covers only 18% of world's population and 4% of water resources moreover 50% Indian people consume bad quality of water. The water will be contaminated by chemical like arsenic and fluoride contained by 1.96 million dwellings. A safe water supply is the backbone of the healthy economy; it is woefully prioritized under globally.

It is estimated that waterborne diseases have an economic burden of approximately USD 600 million a year in India according to UNICEF. Especially for drought and flood areas in some of smaller villages (villages of Ladakh, Rajasthan etc.) which is not easily have access to larger cities (Mumbai Delhi etc.). It is not possible for village people to purify

water or bye new purifier or set very big water treatment plant because of maintenance will be more required i.e. it is very necessary build household water filter which is made from locally made naturally available materials.

EFFICIENCY OF WATER FILTER

Following are some of requirement fulfil for ideal water filter:

- It removes bacteria with very efficient way
- Ideal water filter required to removes both dissolved and un-dissolved Impurities completely from the dirty water.
- Ideal purifier filter water filter and remove anything instantly and there is no time long put putting water to output of water.
- Ideal purifier does not require any costlier process like Ultra violet ray, Reverse osmosis is costlier than natural process.
- Ideal water filter doesn't consume any resources for it operation thus the operation cost is very low.
- Zero Investment and maintenance cost also simple and easy to use, people cannot face any difficulty to use.
- Ideal purifier takes any kind of Impure water and purify it examples like, water from kitchen, bathroom moreover.

OBJECTIVES

- Determine the physical characteristics and chemicals in water.
- Produce a filter from coconut husk fibre, charcoal, and zeolite, and membrane that improve quality of water
- It is very cheap and made from easily available materials.
- To check the quality of water passing through that filter.
- To removes oil and some soaps coming from domestic waste.
- Recycling and reuse of water properly.
- The material will be not cost more for any person and easily available in villages.
- Removing of harmful bacteria.
- Necessary minerals in the water remain in the water.

ADVANTAGES OF HOME-MADE WATER FILTER

Humans are made from 70% of water i.e. body required good quality and pure water for drinking purpose also the mineral which is very essential for the human body also coming from water also we say water is very important than the food. But in today's era it is very crucial that the drinking water with pure quality will not meet today especially in villages area due to that various diseases come with contaminated water. moreover water will be not treated, purified and filter it make our body sick, in present time we have modern technologies but also villages facing that issue of improper or nor purification system it is due to some of improper management of water in small villages and they cannot afford standard purifier which is very expensive.

LITERATURE REVIEW

Shweta Chauhan (2015), conducted a study on **"Purification Of Drinking Water With The Application Of Natural Extracts"** This work has been carried out to improve the quality of drinking water of municipal supply of Thatipur, Gwalior (M. P.) region with the application of plant extracts of Moringa oleifera, Arachis hypogaea (peanuts), Vigna unguiculata (cowpeas), Vigna mungo (urad) and Zea mays (corn). During this work, examination of treated and untreated sample water for heavy metals and microbial counts was analysed. The result shows the significant decreased, up to 92% in the reduction of microbial counts. Treatment with these natural extracts also helped in the coagulation of the heavy metals like lead, copper, nickel etc. present in treated water samples. It has been examined that seeds and leaves extracts were also more effective in clearing and in sedimentation of suspended organic and inorganic matter present in water samples. In control water samples, total bacterial count (TBC) was found to be more than 1000 cfu/ml but the total bacterial count in the treated samples was reduced to 10 cfu/ml. 95% of heavy metals were also removed in treated samples. This work evaluates the use of plants, which are an economical and eco - friendly. Preparation of plant extracts (seeds and leaves) of Moringa oleifera, Arachis hypogaea (peanuts), Vigna unguiculata (cowpeas), Vigna mungo (urad) and Zea mays (corn). Firstly, leaves and seeds were collected from V.R.G college garden, then after drying them fine powder was obtained with the help of grinder, then extracts were collected.

Application of plants extracts
Plant Extracts (seeds and leaves) were applied in water sample.
Treatment A = Control (water sample without any treatment).
Treatment B = Combine plant extracts (seeds and leaves) of Moringa oleifera, Arachis hypogaea (peanuts), Vinga unguiculata (cowpeas), Vigna mungo (urad) and Zea mays (corn) at the concentration of 0.01%, 0.1%, 0.2% and 0.3% were added in 100 ml of each water sample. This work concluded that application of combine seeds and leaves plant extracts can be highly recommended for domestic drinking water for purification and this technique can be applied for water purification in developing countries, where people are used to drink contaminated turbid water. It will also improve the both health and wealth. This technology will encourage small - scale enterprises to be established in the rural areas.

Politeknik sultan Idris Shah (2018), he worked on **"Water filter manufacturing the usage of coconut husk fiber, zeolite, charcoal and membrane for rainwater harvesting"**. Water great for the samples taken from five unique places is elevated after passing via the filters. There are a number of parameter which is regarded to be extended that pH, turbidity, color, organic oxygen demand, complete suspended solids, nitrate, zinc and sulphate. From this project, it is observed that rainwater consist a quantity of chemical compounds such as zinc, nitrate and sulphate. All samples had been harvested thru roof. There are many sources of impurities may want to be on the roof such as birds drop, materials of roof and leaves. Unclean reservoir may want to be the best location for micro organic growth. This should lead to excessive BOD reading.
This chapter describes the data and analysis related to the results of measurements of rainfall before and after passing through a water filter production using coconut husk fiber, charcoal (active carbon), zeolite and membrane for rainwater harvesting from the tests was conducted. Data the parameters pH, biological oxygen demand (BOD), suspended solids, turbidity, color and its parameters through tests of zinc, sulphate and nitrate using a spectrophotometer is shown in table and graphical forms. This data is important for the data and analysis concerning the design of this model. The rainwater sample is taken which are 5 samples of rainwater before filtered and 5 samples of rainwater after filtered. In terms of producing a filter, filters that have successfully produced can improve the quality of rainwater.
Nevertheless there are some errors that occur in rainwater samples before and after the filtered. Therefore, the improvement in the filter material should be done. Therefore, the production of filters from natural ingredients can be said to be one good idea and has proven effective in treating and improving the quality of rainwater for use in daily life.

Giridhar V S S Mittapalli (2016), he also study conducted on the **"Use of Alum for Turbidity Removal in Synthetic Water"** In this the effectiveness of alum used to be evaluated at room temperature with initial pH (6 - 7.4). Turbidity is a principle physical characteristic of water. It is caused by suspended matter or impurities that interfere with the clarity of the water. These impurities may include clay, silt, finely divided inorganic and organic matter, soluble coloured organic compounds, plankton and other microscopic organisms. Excessive turbidity in drinking water is aesthetically unappealing and may also represent a health concern. Turbid waters, containing colloidal particles are normally treated by coagulation-flocculation followed by clarification.
Generally, alum is the first coagulant of choice because of its lower cost and its widespread availability. The coagulation performance of Alum, an inorganic chemical coagulant was tested on synthetic high turbid water (90-140 NTU). Supernatant turbidity in NTU and initial pH of raw turbid water was measured using Elico, Water Quality Analyzer PE 138. Out of three glass beakers one was used as a control i.e, no coagulant dose and alum doses 10mg/l and 20 mg/l were tested for 250 ml raw turbid water. After coagulant dosage, the sample was thoroughly mixed manually using a stirrer for about 2 minutes and was allowed to settle for 10 minutes at room temperature. After coagulation process, the supernatant was filtered using filter paper and the treated water using two different alum doses were analyzed for variation in pH and turbidity. % Removal of turbidity and change in pH was calculated for desired turbid samples using the above procedure.
For 2 coagulant doses 10 mg/l and 20 mg/l in 250 ml synthetic high turbid water by means of adopting guide agitation at very low settling Results confirmed that coagulation technique ought to cast off turbidity effectively the use of highly low stages of Alum. Studies expose that turbidity elimination relies upon on pH, coagulant dose, also as initial turbidity of water. The absolute best turbidity removal affectivity was 46.15 p.c. over the utilized vary of turbidity. The outcomes of the cutting-edge learn about can be used as a baseline information for drinking water cure facilities which uses Alum as a coagulant. The coagulation experiment using alum indicated that coagulation process effectively removed turbidity from synthetic high turbid water using 10-20

Maxim Tyulenev (2016), he also conducted a study on **'Coal producers waste water purification'** The analysis of dependence provided in graphics has showed that the change of oil products concentration C from filtering path L with high accuracy (R2 is not lower than 0.91) is approximated by expression:- $C = C0 \cdot e\text{-}0.016$lwhere, C0 - initial concentration of oil products in the waste waters discharged for purification, L - filtering path.

Karmen Margeta (2013), yet as he additionally conducted a study on **'Natural Zeolites in water treatment - however effective is their Use'** he work represented was partly supported by the Ministry of Science, Education and Sports of the Republic of Republic Croatia through the bilateral project. The distinctive natural process and surface assimilation properties, high consistence and glorious thermal stability of Zeolites create then terribly appropriate for several applications, additionally in water treatment processes.
Many different studies have incontestable their effectiveness in reducing the concentrations of contaminants (metals, anions and organic matter) in water. The complexness of aquatic systems demands special attention within the choice and preparation of materials for water purification. The chemical behavior of natural zeolites in several binary compound environments, that was additionally a topic of recent geochemical and technological studies, to boot proven their pertinency, though watching of ph and it's changes, remains vital for his or her use of real environments. Further research should be focused on the optimization of the surface modification procedures to boost their efficiency and to reinforce the potential of regeneration.

Moreover, detailed characterization of natural and altered zeolites is needed to lifted to understand the structure- property relationship. Numerous and excellent research results in the last 10 years have shown that natural zeolites have practical use, which is confirmed by a large number of patents, especially forthe two naturally occurring zeolite minerals: clinoptilolite and modernite . The number of patents is substantial for both zeolite types, which gives a clear notice thatthe interest of researcher in natural zeolites is strongly encouraged by the commercial sector covering the use in households or in industrial/large-scale processes and treatments.

Praveen D Dathan (2018), conducted a study on "**Water Filter exploitation Natural Materials"** The study is targeting the filtration of grey water. This filtration is finished by preparing a filter product of fine-grained succulent, pine bark, sand and coarse combination. the utilization of pine bark enhances the purification by preventing organism action and reduces cloudiness. but the applying of the pine bark can increase the concentration of acidity. thus on trim the acidity, coarse combination is employed as another layer. succulent is employed for reducing the chemical vary eight demand of the grey water. Finally, a sandy layer is provided as a supporting layer for fine-grained succulent. Thickness and rate of every layer was mounted by column study methodology.
As per the column study, we've honour inclination to tend to mount a 3cm layer thickness and a 10cm layer thickness for succulent and pine bark severally. The share reduction for cloudiness and chemical vary eight demand for mixed filter were obtained as seventy a mixture of and unit of an immediate severally. Thus, the filter was created by considering the experimental results.
An experimental study was conducted to analyse the waste water characteristics. The filter was designed by trial and error methodology. The materials that were used here ar pine bark, cactus, things of roof tiles as coarse combination and sand. the speed entirely totally entirely whole utterly altogether completely different of various} materials was seen at different thickness. the applying of pine bark proves the reduction of cloudiness, E coli but it finally ends up in increase in acidity. Therefore, a singular material i.e. roof tile things was introduced for reduction of acidity. The applying of succulent helped among the reduction of COD and cloudiness. Effective thickness was seen exploitation column study and it whole was over that 10cm thick pine bark layer and 3cm thick succulent layer can give any economical result at higher rate. The combined proportion reduction for cloudiness, COD, E coli is obtained as seventy a mixture of, 30%, and eighty a mixture of severally. The reduction of COD is because of the addition of succulent and cloudiness is reduced because of pine bark and roof tile coarse combination. A combined layer filter was created that's capable in reduction of COD, cloudiness and E coli.

METHODOLOGY

Following material consists to make layer in the various bottles:-

Cotton - The cotton ball layer helps to keep the other layers of your filter from falling out into your water.

Coconut husk - Coconut husk have been shown throughout recent history to be extremely effective for removing contaminants, tastes and odors from drinking water.

Fine charcoal – Charcoal is utilized to eliminate contaminants and polluting influences, utilizing concoction adsorption dynamic charcoal carbon channels are best at eliminating chlorine, silt, unpredictable natural mixes (VOCs), taste and smell form water.

Fine sand - Sand filtration is used for the removal of suspended matter, as well as floating and sinkable particles.

Fine aggregate – fine aggregate is used for the removal of suspended matter, as well as floating and sinkable particles with faster rate.

Coarse aggregate - Coarse aggregate is used for the removal of large suspended matter, as well as floating and sinkable particles with faster rate.

Cotton cloth - Cotton filter cloth is used for purifying liquids like oil and water to remove dust and dirt from them. ... They are used for filtering dirt and dust from liquids like water and oil. Among many types of filter cloths available on the market, cotton is often preferred for its cost-effective.

Seashell - A seashell as bio-filter used in Wastewater Treatment. The predominant odorous compounds found were hydrogen sulphide, methyl mercaptan, and dim ethyl sulphide.

Charcoal – charcoal carbon filters are most effective at removing chlorine, particles such as sediment, volatile organic compounds (VOCs), taste and odour. They are not powerful at eliminating minerals, salts, and broke up inorganic substances.

Coco peat – Coco peat is a waste product generated when coco coir (fibrous material) is removed from coconut husks. Coco peat is used as low cost filter medium.

Sugar cane husk – Iron and manganese are commonly present in groundwater supplies used by many water systems. The presence of iron and manganese in the drinking water is not harmful to human bodies. Be that as it may, higher focus causes staining, re-coloring, turbidity and awful taste issues.

Pebble- Sand and pebble filters are able to trap particles within the water through physical means alone.

Gravel – Sand and gravel filters are able to trap particles within the water through physical means alone.

Alum:-

Alum is also known as aluminum sulphate and aluminum is commonly called alum generally a mixture of impure water with 48% filter by alum and it's injected into incoming raw water at a rate 18 to 24 parts per million. In this alum promote coagulation of fine particles which helps to resolve problems of color and turbidity, the small muddy fine particles odd microbs inside water can be settle down by alum.

Rise husk:-

Using rise husk in present work low cost method evolved for the removal of iron and manganese from ground water using sugarcane husk based activated carbon. Ground water resources for drinking and daily uses coming from bore well and well also play a vital role in purifying water.

a. Take a water sample from –

i. Kitchen waste water
ii. Bore Water
iii. Bath and Washing water
iv. Well Water
v. River Water

b. Take this sample and pass through the bottles A, B, C, D and E from the open portion of the bottle alternately.

c. Test the different sample of water given by passing through bottles A, B, C, D and E.

d. Samples were collected using sterilized 1 lit. plastic bottles from both the influent and the effluent outlets of the filters . Samples collected for microbiological analysis.

Fig. Sample water from different sources

Experimental Description

a. Consider five bottles having a volume of 1 lit, upper part of these bottles are cut in such a way that to form a cylindrical shape.

b. These bottles having one side are open and another side is closed, on the closed part of the bottle, hole is made to see as the net.

c. These five bottles are named as A, B, C, D and E.

d. Height of this cut bottles should be 20 cm and the diameter is 7.5cm.

For Bottle A:-

a. Fills the bottle from net side of the bottle toward the opened side of the bottle by material like cotton, coconut husk, fine sand, sugar husk , gravel , and stone pebble one by one.

b. Take different thickness for a different material such as:-

S. No.	Material	Thickness
1	Cotton	1.7cm
2	Coarse charcoal	2.3cm
3	Coconut husk	1.5cm
4	Fine sand	4.2cm
5	Sugar husk	3cm
6	Gravel	1cm
7	Stone pebble	3.2cm

For Bottle B:-

a. Fill the bottle from net side of the bottle toward the opened side of the bottle by material like cotton, fine coal, fine sand, seashell ,gravel and stone pebble one by one.

b. Takes different thickness for a different material such as: -

S. No.	Material	Thickness
1	Cotton	0.9cm
2	Fine coal	2.4cm
3	Fine sand	2.3cm
4	Seashell	1.2cm
5	Gravel	3.2cm
6	Stone pebble	3cm

For Bottle C:-

a. Fills the bottle from net side of the bottle toward the opened side of the bottle by material like cotton, fine sand, medium size charcoal, coconut husk, stone pebble and coarse aggregate one by one.

b. Takes different thickness for a different material such as:

S. No.	Material	Thickness
1	Cotton	3cm
2	Fine sand	5.6cm
3	Medium size charcoal	1cm
4	Coconut husk	1.5cm
5	Stone pebble	2.1cm
6	Coarse aggregate	1.1cm

For bottle D:-

a. Fills the bottle from net side of the bottle toward the opened side of the bottle by material like coconut husk, sugar husk, fine sand, fine sea shell, sea shell, coarse coal, Gravel and stone bolder one by one.

b. Takes different thickness for a different material such as:

S. No.	Material	Thickness
1	Coconut husk	1.4cm
2	Sugar husk	1.5cm
3	Fine sand	2cm
4	Fine sea shell	2.5cm
5	Sea shell	2.5cm
6	Coarse coal	2.7cm
7	Gravel	2.9cm
8	Stone bolder	2.2cm

For Bottle E:-

a. Fills the bottle from net side of the bottle toward the opened side of the bottle by material like cotton, fine sand, fine coal, coco peat, medium coarse stone, cotton seed, sugar husk, coconut husk, sea shell and gravel one by one.

b. Takes different thickness for a different material such as:

S. No.	Material	Thickness
1	Cotton	2.1cm
2	Fine sand	1.5cm
3	Fine coal	3.1cm
4	Coco peat	1.3cm
5	Medium coarse stone	1.3cm
6	Cotton seed	2cm
7	Sugar husk	1.5cm
8	Coconut husk	1.5cm
9	Sea shell	0.7cm
10	Gravel	0.9cm

Main Purification System Construction for Daily Use:

a. Takes 3 cylindrical container of similar capacity up to 5 to 6 lit.

b. Place this cylindrical tank one on one to make like a column.

c. Make the holes in the bottom of the upper tank and middle tank, for passing water through the holes.

d. Similar to bottle A, take similar material with similar sequence and place inside a middle tank of the column to obtain this tank to work as a purifier system.

e. Hence by considering the above points we obtain a large capacity water purifier, gives result similar to bottle A (purifier) in terms of water quality.

Test of different properties of water:-

Three major steps involved in experiment

i. Preparation of Regent

ii. Calibrating the Instrument

iii. Testing of sample

- Using standard pH solutions perform calibration of the pH meter the procedure of calibration would depend on the range of interest.
- In a clean dry 100ml beaker take water sample and place in magnetic stirrer also insert Teflon coated stirring bar and stir well.
- Now place electrode in the beaker containing water sample and check reading in the pH meter wait until you get stable reading.
- Take electrode from sample water wash it with distilled water and wipe gently with soft tissue.

Determination of color of water:-

- Prepare standard samples having color within a specific range by mixing different concentration of standard potassium chloro-platinate solution with distilled water using these for the spectrophotometer prepare sample color calibration curve.
- Take 50 ml of filtered test sample in beaker; take 50ml of distilled water in another beaker.
- Set spectrophotometer to determine color concentration of the sample.
- Put the blank sample inside the spectrophotometer cell and set reading as zero.
- Bring out the blank sample and place test sample inside the spectrophotometer.
- After display will shows the color concentration of the samples.

Determination of turbidity of water:-

- The reagents are to be prepared for testing the given water sample then the turbidity meter is required to be calibrated.
- To the example cells, add test water up to the level imprint, wipe delicately with delicate tissue and spot it in the turbidity meter to such an extent that the vertical imprint in the example cell ought to correspond with the imprint in the turbidity meter and spread the example cell. Check reading in the turbidity meter and wait to get stable reading for some time.
- Turbidity's exceeding 40 units: Dilute the sample with one or more volumes of turbidity free water up to turbidity fall below 40 units.
- The turbidity of original sample is computed from the turbidity of diluted sample and the dilution factor.

4. Determination of total dissolved solid (TDS):-

- ake clear dry glass beaker (103^0c in oven for 1 Hour) of 150 ml capacity and put appropriate identification mark on it weight the beaker and note weight.
- Take a 100 ml of sample and filter it through a double layered filter paper and collect the filtrate in a beaker.
- Place the beaker in an oven maintained at 103^0c for 24 hour after 24 hour, cool the beaker and weight find out the weight of solids in the beaker by subtracting the weight of the clean beaker determined in step (1).
- Repeat same procedure as in step 3 for total solids determination.

RESULT & DISCUSSION

pH Test Result of different samples:-

S. No.	Water Samples	pH Result
1	Kitchen waste water	7.6
2	Bore Water	8.0
3	Bath and Washing water	7.8

4	Well Water	8.2
5	River Water	8.1

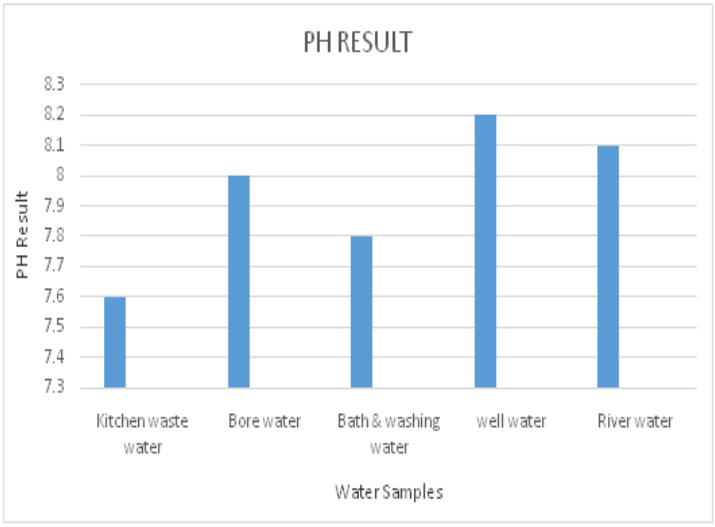

Fig.1 pH Test Result of different samples

Color Test Result of different samples:-

S. No.	Water Samples	Colour Result
1	Kitchen waste water	1.9
2	Bore water	0.9
3	Bath & washing water	2.95
4	Well water	1
5	River water	1.1

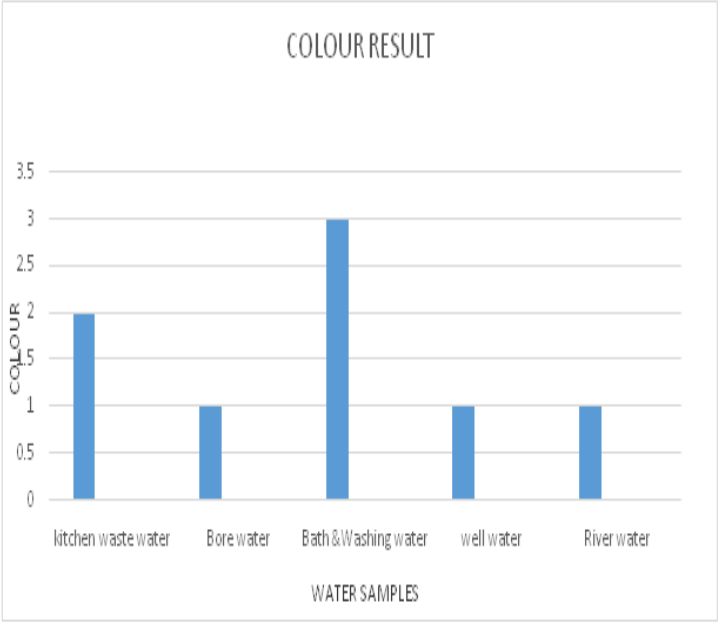

Fig.2 Color Test Result of different sample

Turbidity Test Result of different samples:-

S. No.	Water Samples	Turbidity Result
1	Kitchen Waste Water	32.9

2	Bore water	0.7
3	Bath and Washing Water	29
4	Well water	1.5
5	River water	2.5

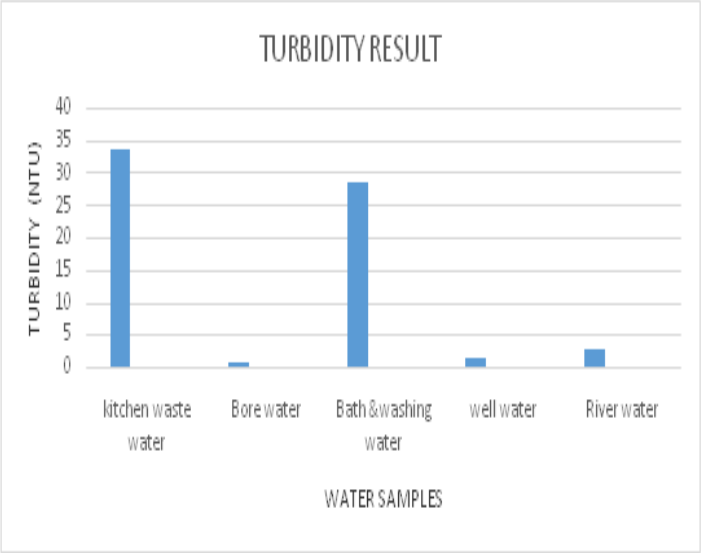

Fig.3 Turbidity Test Result of different sample

Total dissolved solids Test Result of different samples:-

S. No.	Water Samples	Total Dissolved Solids (mg/l)
1	Kitchen waste water	630
2	Bore water	578
3	Bath and Washing water	14199
4	Well water	670
5	River water	401

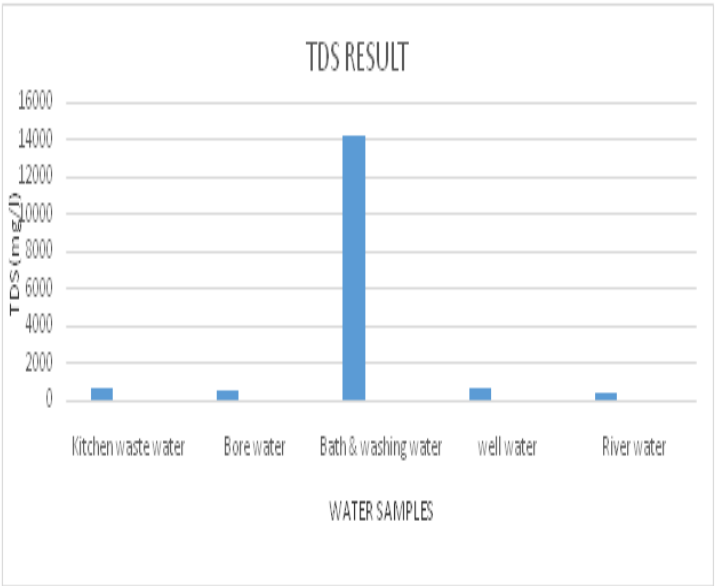

Fig.4 Total Dissolved Solids Test Result of different samples

CONCLUSION & FUTURE SCOPE

The water quality for samples which is taken from five different places which is improve after passing through the filters which having various waste and natural materials This water is taken from five places i.e. Bore, well, River, Kitchen water, household water.

By many research, it is found that the different places and also rain water consists a number of chemical compounds like zinc sulphate and nitrate etc.

The different places water contains impurities presence in water which harvesting method itself all the water harvested through land, roof, river, dam and reservoir.

There are many impurities should be present in reservoir because it is dispose open to environment and various dispose in reservoir leaves vegetation, Industry waste, washing water by soups etc. is present.

Industrial water coming in it and ground water also some amount contain chemical compounds in it and is directly responsible to the micro biological growth of the organism also it lead to high BOD reading of reservoir water.

In term by producing a filters that successfully produced can be improve the quality of reservoir bad rainwater and other impure water. At some point the samples taken from five different places before and after filter is show some error and microbe after also present for that improvement of water some filter material should be use. Therefore it is good idea to made filter from natural and waste materials to improve the quality of impure water which is use in daily life for various purposes.

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