

REMOVAL OF IMPURITIES IN SURFACE WATER USING LOW COST FILTER TECHNIQUE

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Engineering degree in
Civil Engineering
By

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**DEPARTMENT OF CIVIL ENGINEERING
SCHOOL OF BUILDING AND ENVIRONMENT**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

**Accredited with Grade "A" by NAAC
JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119**

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DEPARTMENT OF CIVIL ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **GADDE CHAMUNDESWARI DEVI (37200021)** who carried out the project entitled **"REMOVAL OF IMPURITIES FROM SURFACE WATER USING LOW COST FILTER TECHNIQUE"** under our supervision from October 2020 to March 2021.

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DECLARATION

I **GADDE CHAMUNDESWARI DEVI (Reg.No.37200021)** hereby declare that the Project Report entitled “**REMOVAL OF IMPURITIES FROM SURFACE WATER USING LOW COST FILTER TECHNIQUE**” done by me under the guidance of **Mrs.S.VANITHA** is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Civil Engineering.

1.

SIGNATURE OF THE CANDIDATE

DATE:

PLACE:

ACKNOWLEDGEMENT

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ABSTRACT

Sustainability of good health depends upon the purity of water. Indian rural population obtains the water supply mostly from the unprotected sources such as small ponds , streams and rivers which are often polluted. Disinfection of water can be done in various methods but not all methods are economically feasible for poor people. The present study involves the most common *Ocimum sanctum* (Tulsi) and *Azadirachta indica* (Neem), the herbal plants which have antimicrobial activity against many of the organisms. This study shows an evaluation of plant based coagulant and disinfectant sand filter medium for the surface water treatment.

Keywords: Adsorbents, Surface water, Antimicrobial Activity, *Azadirachta Indica*, *Ocimum sanctum*.

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CHAPTER 1

1. INTRODUCTION

About 65% of the people of India live in rural areas. Rural population in India obtains their water supply from unprotected sources such as open dug wells, small streams, ponds and rivers which are often polluted. Due to economical and political constraints, the provision of piped water is not currently feasible. This circumstances leaves millions without access to safe drinking water. There are various methods available for disinfecting drinking water but not economically feasible for poor people. Supplying safe drinking water to such a large population is a huge task. Around 37.7 million Indians are affected by water borne diseases annually.

The plant and plant based products usage as medicine traces back to the beginning of human civilization. Countries like Nepal and India have been using plants as medicine since Vedic period. The earliest mention of plants as a medicine in Hindu culture can be found in 'Rigveda', which is said to be written between 4500-1600 B.C. It is Ayurveda, the foundation of medicinal science of Hindu culture. Azadirachta Indica and Ocimum sanctum are commonly found in India. They have been used in Ayurvedic medicine for more than 4000 years. In both the oral and written traditions, knowledge of alternative methods of water treatment is still available. According to traditional belief Tulsi leaves (Ocimum sanctum) & Neem leaves (Azadirachta indica) have the capacity to purify water. This is virtually cost less way to render contaminated water fit for human consumption

CHAPTER 2

LITERATURE SURVEY

2.1 GENERAL

In this the review is done about the journals based on the purification processes by using natural adsorbents are discussed.

2.2 LITERATURE REVIEW

Anannya Mohapatra et al. (2014) studied the Antimicrobial Activity of Neem (*Azadirachta Indica*) Leaf Extracts. Neem ethanol and water extracts were prepared by using soxhlet apparatus and Hydro distillation respectively. Then these extracts were screened for the presence of different phytochemicals. Tannins, Flavonoids, Terpenoids, Saponins and Steroids have shown positive results in neem ethanol extracts. Extracts were then tested for the antimicrobial activity against *M.roseus*, *E.coli*, *B.licheniformis*, *M.luteus*, and *S.aureus* by MIC test. After the MIC test Ethanol extract of *Azadirachta Indica* found highly effective against *Micrococcus roseus* and *Escherichia coli* compared to other organisms. The zone of inhibition found to be 9.5mm for *E.coli* and 8.5mm for *M.roseus*.

Ankit a. jinturkar et al (2017) In this study, the Neem leaves are made into fine powder and it is used as natural adsorbent. The removal of iron from water was studied by varying the contact time and the concentration of the adsorbent.

Garima Pandey et al. (2014) studied the evaluation of phytochemical, antibacterial and free radical scavenging properties of *Azadirachta Indica* (Neem) leaves. A 50% ethanolic extract of neem leaves was subjected to qualitative and quantitative estimation of phytoconstituents followed by HPTLC analysis. The DPPH free radical scavenging activity was conducted to understand the antioxidant potentials of neem leaves. The antibacterial effect of extract was studied against Gram negative *Escherichia coli* and Gram positive *Staphylococcus aureus* using well-diffusion assay.

Ghanshyam Pandhare et al. (2013) studied effective and economical adsorption technique to an application level. In this study Neem leaves powder activated carbon has developed as an adsorbent. The aim of this work is to study the color removal by Neem leaves powder from methyl red and $K_2Cr_2O_7$ solution and to offer this biosorption as local replacement for existing commercial adsorbent materials.

Gideon Sarpong and Clinton P. Richardson (2010) "Coagulation Efficiency of Moringa Oleifera for Removal of Turbidity and Reduction of Total Coliform as compared to Aluminum Sulfate". In this study the Moringa oleifera seed extract is used as the primary coagulant for the local river water source with respect to turbidity removal and total coliform reduction. In this the aqueous solutions of powdered Moringa oleifera and conventional aluminium sulfate (alum) were evaluated using jar test.

Grace K Mikhayel and Ankita K(2018) this review says how to develop a "Low cost water purification technique" using plastic bottles and locally available herbal materials like Neem leaf powder and Tulsi leaf powder. It focuses on the removal of iron and chromium from pharmaceutical wastewater. Filtration is the simplest and cheapest technique for the removal of metal components from wastewater. The initial concentration of iron and chromium is 0.536 mg/L and 0.289 mg/L respectively. Neem with aluminium hydroxide is more efficient in removing iron content from waste water with efficiency of removal is 60.075%. Tulsi with aluminium hydroxide is more efficient in removing chromium from waste water with efficiency of removal is 93.77%. Thus it is below than the permissible limit and can be used for drinking and irrigation purposes.

Islamuddin et al. (2016) studied Neem (*Azadirachta indica*) leaf powder as a natural adsorbent for the removal of Chromium (VI) from the aqueous solutions. The equilibrium studies are carried out in batch process, covering various process parameters that include adsorbent size and dosage, agitation time, volume of aqueous solution, initial chromium concentration and p^H of aqueous solution. Adsorption behavior is found to follow Freundlich and Langmuir isotherms.

Kenneth Yongabi et al. (2010) studied about the plant based coagulants/disinfectants and the sand filter media for surface water treatment in Bamenda, Cameroon. An Evaluation of plant- based coagulants and disinfectant-sand filter medium for surface water treatment in Bamenda, Cameroon using bacterial analyses and turbidity were carried out. 100L of very turbid surface water (Turbidity approx. 500NTU) was pretreated with 100 seeds of *Moringa oleifera*, and further filtered through a sand filter drum (120 L carrying capacity) made of fine, coarse sand, charcoal and gravel. The mean total heterotrophic bacterial counts, *Escherichia coli*, coliform, *pseudomonas* and yeast counts, as well as turbidity of untreated surface water significantly reduced by 85 to 95%. The results suggested that the mean values of the same parameters for sand filtered pond water alone was significantly lower than the corresponding mean values obtained for plant coagulant treated surface water. The findings from this study demonstrates strongly that a biocoagulant sand filter media (plant based coagulant-sand filter drum) could be applied to treat contaminated surface water, rendering it free from solids and pathogens.

G.k.khadase et al (2005) This paper has the goal of improving water treatment efficiency and reducing water treatment cost based on comparative studies and can improve water treatment efficiency, reduce water treatment cost, lower water treatment expense, and implement effective communication.

Krishna G. Bhattacharyya and Arunima Sharma (2004) studied the adsorption of Pb(II) from aqueous solution by using Neem (*Azadirachta indica*) leaf powder. An adsorbent was developed from the mature leaves of the Neem (*Azadirachta indica*) tree for removing Pb(II) from water. Adsorption was carried out in a batch process with several different concentrations of Pb(II) by varying amount of adsorbent, pH, agitation time and temperature. The uptake of the metal was very fast initially, but gradually slowed down indicating penetration into the interior of the adsorbent particles. Both first-order and second-order kinetics were tested and it was found that the latter gave a better explanation. The experimental data closely followed both Langmuir and Freundlich isotherms. The adsorption continuously increased in the pH range of 2.0-7.0, beyond which the adsorption could not be carried out due to the precipitation of the metal. The adsorption was exothermic at ambient temperature.

Maragathavalli et al.(2012) This journal studied the Antimicrobial activity in leaf extract *Azadirachta indica* Linn. Antimicrobial activity in leaf extract of neem (*Azadirachta indica*) against human pathogenic bacteria. *E.coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Salmonella typhimurium*, *Bacillus pumilus*. Antimicrobial activities of alcoholic extracts of neem leaves were used. Varying concentration of each extracts 200mg/ml, 150 mg/ml, 100mg/ml, 50mg/ml, 25mg/ml prepared by using a disc diffusion method. When compared with gentamicin 200mg and gentamicin 10mg, the methanol and ethanol extract shows maximum inhibition on *Bacillus pumilus*, *Pseudomonas aeruginosa* and *Staphylococcus aureus* in an ascending order.

Megha N S (2019) has studied that the Adsorption method for removal of iron from drinking water is more economical and effective in rural villages. Amla Tree Bark (ATB), Sugarcane bagsse (SCB) and Banana Peel (BP) have been using as a natural low coast adsorbent for the removal of Iron from drinking water. A batch adsorption study was conducted to check the efficiency of ATB, SCB and BP and the studies

were conducted to investigate the effect of various operational parameters such as Adsorbent dose, pH, Contact time and Initial iron concentration on the treatment efficiency. The maximum removal efficiency of iron from synthetic water was observed in the pH range 4-6 by the adsorbents. The study of Freundlich and Langmuir adsorption isotherms were carried out. Amla tree bark and Sugarcane Bagasse show higher iron removal efficiency than the Banana peel.

Pandhare and Dawande (2010) This journal reviews about Neem leaves powder as low cost adsorbent and its characteristics. Adsorption has been used successfully in the removal of impurities from effluents. He developed the Neem leaves powder activated using chemical treatment as low-cost adsorbent.

Reena Malik et al. (2012) studied Neem leaves utilization for copper and zinc ions removal from aqueous solution. An adsorbent was developed from the mature leaves of Neem (*Azadirachta indica*) tree for removal of copper and zinc ions from water. Adsorption was carried out by varying the p^H for different concentrations of copper and zinc. The rate of removal of ions with time and the optimum p^H for efficient biosorption is studied.

Sunil B. Somani et al (2011) studied the performance evaluation of natural herbs for antibacterial activity in water purification. The aim of the study was to evaluate the effectiveness of natural herbs for antibacterial activity in water purification. The antimicrobial activity of Tulsi (*Ocimum Sanctum*), Neem (*Azadirachta indica*), Wheatgrass (*Triticum Aestivum*), Amla (*Phyllanthus Emblica*) and Katakphala (*Strychnos Potatorum*) were tested by Disc Diffusion Method (Kirby –Bauer Method) after extracting the dried material powder of natural herbs in 50% alcohol (ethanol). An antibacterial activity was observed in all herbs used. Most effective antibacterial activity was observed in Tulsi, Neem and Wheat. In all herbs maximum removal of

E.coli was found at 30 minutes contact time onwards. The percentage removal of E.coli were found 82.05% , 71.79% , 64.1% , 41.03% & 28.20% by using Tulsi, Neem , Wheatgrass , Amla and Katakphala herbs extract respectively, at 30 minute optimum contact time. The optimum removal of E.coli was observed at 1% concentration of extract of different herbs used.

Sunil P Lekhak et al. (2010) studied the antibacterial property of different medicinal plants, *Ocimum sanctum*, *cinnamomum zeylanicum*, *Xanthoxylum armatum* and *Origanum majorana*. Based on local use of common diseases and Ethnobotanical knowledge, an attempt has been made to assess the antibacterial properties of selected medicinal plants. VIZ. *Ocimum sanctum* (Tulsi), *Origanum majorana* (Ram Tulsi), *Cinnamomum zeylanicum* (Dalchini), and *Xanthoxylum armatum* (Timur), for potential antibacterial activity against 10 medically important bacterial strains, namely *Bacillus subtilis*, *Bacillus cereus*, *Bacillus thuringiensis*, *Staphylococcus aureus*, *Pseudomonas* spp, *Proteus* spp, *Salmonella Typhi*, *Escherichia coli*, *Shigella dysenteriae*, *Klebsiella pneumoniae*. The antibacterial activity of ethanol extracts was determined by agar well diffusion method. The plant extracts were more active against Gram-positive bacteria than against Gram-negative bacteria. The most susceptible bacteria were *B. subtilis*, followed by *S. aureus*, while the most resistant bacteria were *E.coli*

Tanushree Bhattacharjee et al (2013), this study reviews the disinfection of Drinking Water in Rural Areas Using Natural Herbs. Here tulsi leaf and neem leaf are used for purification of water and check coliform reduction in water samples by Aqueous leaf extract, Alcoholic leaf extract and Fresh leaf juice. *Ocimum sanctum* and *Azadirachta indica* showed increase in antimicrobial activity with increase in concentration at specified contact time (18hrs). The antimicrobial effect of Aqueous extract showed better MPN reduction. The alcoholic extract showed the best result.

S.P. Tawde and S.A. Bhalerao (2010) In this study *Azadirachta indica* leaf powder and activated charcoal are compared for their absorptive capacity to remove Chromium (VI) from aqueous solution. The process parameters that are included in this study are agitation time, adsorbent dosage, initial concentration of Chromium, volume of aqueous solution and p^H of aqueous solution.

Thomas et al. (2009) studied about the bio sorption of heavy metal ions from aqueous solutions using a biomaterial. The aim of this work is to study the removal of toxic heavy metal ions by Neem leaves from synthetic wastewater and to offer this bio sorbent as local replacement for existing commercial adsorbent materials.

S. Vanitha et al. (2019) studied the removal of *E.coli* from groundwater and surface water by using nylon membrane filtration techniques. In this study, a low-cost filter material such as Nylon was used for the disinfection of groundwater poses an excellent bacterial filtration activity against *Escherichia coli* (gram-negative) cultures. Textile fabrics have gained wide acceptance as a filtration membrane, and various substrates having a pore size in microns such as Nylon, polyester, and cotton have been shown to develop microbial filtration properties. In this study, a simple method to filter bacteria using nylon is presented and the solutions are prepared using Autoclave and Laminar Air Flow Chamber. For checking the bacterial concentration in the underground water, a very small volume of sample was tested by keeping it in shaking Incubator. The results revealed that nylon filters were able to decrease the concentration of *E. coli* from a groundwater sample, with a higher removal efficiency achieved by using two membranes and a lower efficiency by using a single membrane. This study, therefore, suggests that the Nylon membrane demonstrated antibacterial activity against *E.Coli*. For the disinfection of groundwater, Nylon

membrane can be used as a potential alternative cost-effective filter for production of safe drinking water.

Ugwu Celestina Chibuzo (2019) studied the Antimicrobial Activity of *Azadirachta indica* (Neem) Leaf Extract on Some Bacteria. The antimicrobial activity of *Azadirachta indica* leaf extract (Neem leaf) was carried out on *Staphylococcus aureus*, *Pseudomonas aeruginosa* (ATCC 27853) and *Escherichia coli* using the agar well diffusion method. Ethanolic, aqueous and methanolic extracts of the plant were used at varying concentrations of 200 mg/ml, 100 mg/ml, 50 mg/ml, 25 mg/ml, 12.5 mg/ml, 6.25 mg/ml, 3.125 mg/ml and 1.56 mg/ml respectively. The three extracts were found to show a very high antimicrobial activity though the ethanolic extract possessed more activity than the methanolic and aqueous extracts. The minimum inhibitory concentration (MIC) was found to range from 1.56 mg/ml to 6.125 for the three extracts respectively. When compared with standard antibiotics, the ethanolic and methanolic extracts showed maximum inhibition on these organisms. The phytochemical analyses revealed the presence of alkaloids, saponins, tannins, glycosides, steroids, terpenoids, and reducing sugars. Leaf extract of *Azadirachta indica* is therefore recommended for the treatment of human infections associated with these organisms.

CHAPTER 3

AIM AND SCOPE OF THE WORK

3.1 AIM

To remove the impurities from surface water using natural adsorbents like Tulsi powder and Neem powder to the maximum extent.

3.2 OBJECTIVE AND SCOPE OF WORK

- To study the existing water filtration methods and to design a **Low cost water filtration** using **natural adsorbents**.
- Critical analysis of various natural adsorbents used for identification of water purification.
- Making a suitable method for reduction of bacterial count.

CHAPTER 4

EXPERIMENTAL WORK

4.1 METHODOLOGY

The steps involved in the process of the removal of impurities from the surface water which has been collected from the Sangamam ghat was analyzed using Natural adsorbents like Tulsi powder and Neem powder is discussed in the methodology framework as shown in fig 3.1. the process involved in testing the water for both physical and chemical parameters and the preparation of the low cost filtration model using the Natural adsorbents is discussed. The below flow chart is the diagrammatic representation of the project process in removal of impurities from surface water.

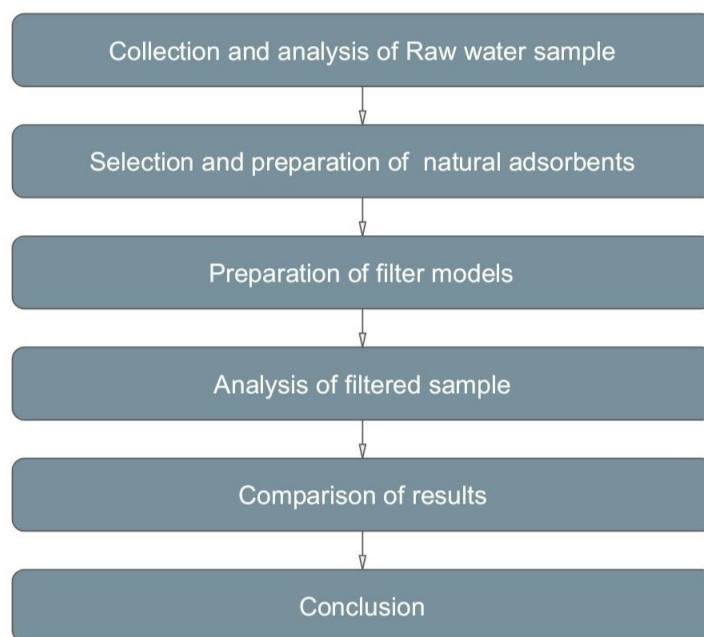


Fig.4.1: Methodological framework

4.2 COLLECTION OF WATER SAMPLES

- Water samples have been collected from the Pavithra Sangamam ghat.
- The areas where water samples collected and are given for testing to know the parameters of water samples.

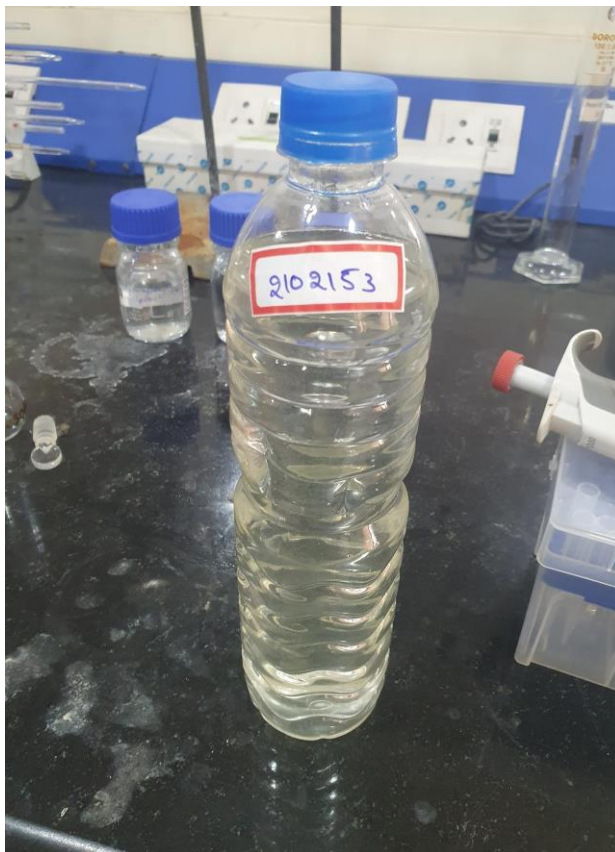


Fig.4.2: water samples collected

4.3 LOCATION OF SAMPLE COLLECTION

- Pavithra Sangamam ghat

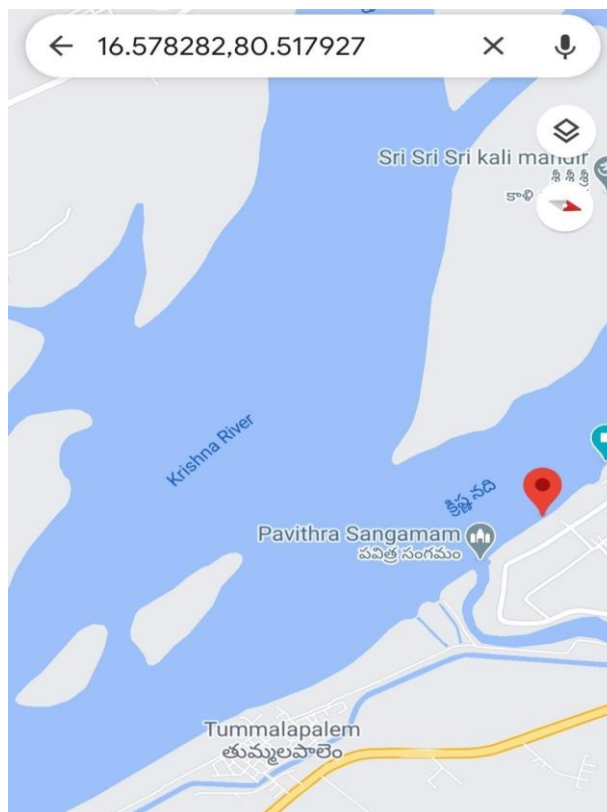


Fig.4.3: location of place where raw water samples collected

4.4 TESTING OF RAW WATER SAMPLES

Raw water samples have been tested for the following parameters to know the physio-chemical properties of the raw water samples collected from Sangamam ghat are

- Iron
- Turbidity
- Hardness of water
- Total dissolved solids
- pH
- Nitrite

Table 4.1: WHO Drinking standards for the following parameters

PARAMETERS	MAXIMUM LIMIT	MINIMUM LIMIT	DESIRED RANGE
TOTAL HARDNESS(mg/l)	1000	100	500
TURBIDITY(NTU)	25	0.3	5
IRON(mg/l)	1	0.2	0.3
TDS(mg/l)	2500	200	1000
NITRITE(mg/l)	3.3	0.003	0.5
pH	5	9.7	6.5

4.4.1 Testing of Total hardness of water

- Total hardness is due to the presence of bicarbonates, chlorides and sulphates of calcium and magnesium ions.
- The total hardness of water is estimated by titrating the water sample against EDTA using the Eriochrome Black-T (EBT) indicator.

- Initially EBT forms a weak $\text{EBT}\text{Ca}^{2+}/\text{Mg}^{2+}$ wine red colored complex with $\text{Ca}^{2+}/\text{Mg}^{2+}$ ions present in the hard water.
- On addition of EDTA solution, $\text{Ca}^{2+}/\text{Mg}^{2+}$ ions preferably forms a stable $\text{EDTACa}^{2+}/\text{Mg}^{2+}$ complex with EDTA leaving the free EBT indicator in solution which is steel blue in color in the presence of ammonia buffer (mixture of ammonium chloride and ammonium hydroxide, pH 10).

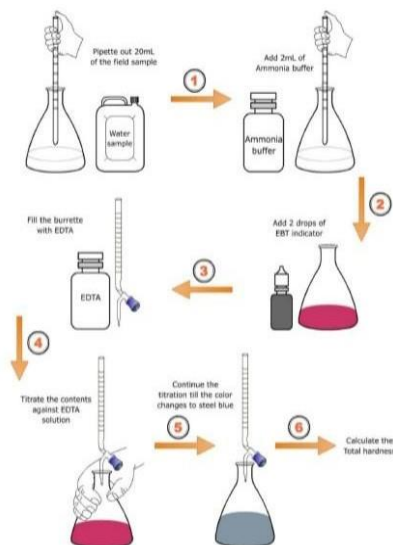


Fig.4.4: Testing of hardness of water

4.4.2 Turbidity test

- Turbidity is the measure of the relative clarity of water. Turbidity water is cost by suspended and colloidal matter such as clay, silt, organic and inorganic matter and microscopic organisms
- The water testing kit container is used to perform the turbidity test. Remove the backing from the secchi disk icon sticker.
- Adhere sticker on the inside bottom of the large white jar(kit container) positioned the sticker slightly off centre.
- Fill the jar to the turbidity to the line located on the outside kit label. Hold the turbidity chart on the top edge of the jar.
- Looking down into the jar, compare the appearance of the secchi disk icon in the jar to the chart. Record the result as turbidity in NTU.



Fig.4.5: Sample in the Digital Turbidity meter

4.4.3 P^H test

- The P^H electrode is first calibrated with standard buffer solutions with known P^H values.
- The electrode is rinsed after usage and stored in a storage solution.
- To measure the P^H of the sample, the electrode is immersed into the sample solution until a steady reading is reached



Fig.4.6: Sample in the Digital P^H meter

4.4.4 TDS test

- The water sample is filtered through a standard filter media (Whatman filter paper).
- The filtrate is poured into a ceramic dish and weighed.
- It's then placed in a drying oven at a temperature of 103°C.
- The dish is then allowed to cool and weigh.

4.4.5 Nitrite

Nitrite is tested using end point change in the sample after mixing it with the respective indicator to indicate the presence of the parameter in the raw water samples and the end point is compared with the range of Nitrite content.

On testing the following parameters in the environmental lab the following report is made on the parameter analysis in the table.

Table 4.2: Analysis report of raw water sample

PARAMETERS	SAMPLE-1
IRON	0.03mg/l
TURBIDITY	2.9 NTU
TDS	492 ppm
pH	8.23
Nitrite	0.01 mg/l
Hardness	178.36 mg/l

4.5 LISTS OF ADSORBENTS

Following are the lists of adsorbents used for the study

- Azadirachta Indica (Neem)
- Ocimum sanctum (Tulsi)

4.6 MATERIALS USED AND PREPARATION OF ADSORBENT MEDIA

Large number of scientists and environmentalists have investigated the possibility and efficiency of utilization of the natural adsorbents *Azadirachta Indica* and *Ocimum sanctum*. Following materials were used for the study.

4.6.1 Preparation of Neem powder adsorbent

The scientific name of Neem is *Azadirachta indica*. The leaves were first washed thoroughly with distilled water to remove the dust particles, and then well dried. Neem leaves are dried under the Sunlight naturally till the leaves turn to pale yellow and are kept in open air for some time, with the passage of time chlorophyll material gets degraded and the leaves are crushed and roughly powdered.



Fig.4.7 Dry Neem leaves



Fig.4.8: Neem leaves powder

4.6.3 Preparation of Tulsi powder adsorbent

The scientific name of Tulsi is *Ocimum sanctum*. The similar pattern of washing and sundry is done for Tulsi leaves too. The leaves were first washed thoroughly with distilled water to remove the dust particles, and then well dried. The leaves are dried under the Sunlight naturally till the leaves turn to pale yellow and are kept in open air for some time, with the passage of time chlorophyll material gets degraded and the leaves are crushed and roughly powdered.



Fig.4.9 Dry tulsi leaves



Fig.4.10 : Tulsi leaves powder

4.6.4 Plain sand

Fine sand is 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 iron removal from drinking water. Here for the experimentation plain sand passing through 600 Micron IS sieve were used after washing it thoroughly with tap water followed by distilled water. 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 layers due to rigorous use. Again back washing is needed from time to time.



Fig.4.11 Sand

4.7 FILTRATION MODEL DEVELOPMENT

Here we have manufactured a simple cylindrical filtration bottle as shown in Figure with the following dimensions

4.7.1 Adsorbents cylinder

The cylinder of the mentioned dimensions is used which is plastic in material and consisted of plain sand of 3cm thickness on the both ends and the adsorbent of particular thickness is kept in the middle of cylindrical jar respectively where every layer is covered with a nylon cloth as a filter membrane, when the raw water sample passes through the adsorbent cylinder it purifies the impure water or the raw water and is collected in the water collecting cylinder of the below mentioned dimensions.

- Length = 15cm
- Diameter = 6.25 cm



Fig.4.12: Adsorbent cylinder

4.7.2 Water collecting cylinder

Water which has filtered through the adsorbent media that has shown in the above fig.4.10 and is collected in the water collecting cylinder which has the following dimensions

- Length = 10 cm
- Diameter = 6.25 cm

In this adsorbent cylinder a layer of sand, filter paper and the adsorbents wrapped in a filter cover was placed respectively. A filter paper was kept at the bottom of the adsorbent media which was connected with the bottom sand layer to filter the dissolved solids and filter the water. Inside the bottle cylinder, different adsorption media of specified thickness were placed with proper gravel support. Then after filtration, the filtered water was collected through the collecting cylinder.

The samples were tested for each adsorbent and concentration was considered for analyzing filter effectiveness.

4.8 FILTRATION PROCESS

The natural materials that has been used in the experiments i.e. Tulsi powder and Neem powder. The following adsorption media had been experimented here for removal of iron from collected raw water samples.



Fig.4.13: Filtration model set

CHAPTER 5

RESULTS AND DISCUSSION

5.1. TULSI POWDER with cotton as a filtration membrane:

The results are obtained by using Tulsi powder as mentioned. The effectiveness in reducing the bacterial count are tabled here. The initial TPC Value is and the results are shown in the following Table.

Table 5.1 Results of filtration of Tulsi powder

Sample no	Thickness of Tulsi powder layer in cm	Initial TPC Value Cfu/ml	Final TPC Value Cfu/ml
1.	3	4,45,60,000	2,15,00,000

5.2 NEEM POWDER with cotton as a filtration membrane :

The results are obtained by using Neem powder as mentioned. The effectiveness in reducing the bacterial count are tabled here. The initial TPC Value is and the results are shown in the following Table

Table 5.2: Results of filtration of Neem powder

Sample no	Thickness of Tulsi powder layer in cm	Initial TPC Value Cfu/ml	Final TPC Value Cfu/ml
1.	3	4,45,60,000	95,00,000

5.3. TULSI POWDER with nylon as a filtration membrane:

The results are obtained by using Tulsi powder as mentioned. The effectiveness in reducing the bacterial count are tabled here. The initial TPC Value is and the results are shown in the following Table.

Table 5.3 Results of filtration of Tulsi powder

Sample no	Thickness of Tulsi powder layer in cm	Initial TPC Value Cfu/ml	Final TPC Value Cfu/ml
1.	3	4,00,00,000	1,65,00,000

5.4 NEEM POWDER with nylon as a filtration membrane :

The results are obtained by using Neem powder as mentioned. The effectiveness in reducing the bacterial count are tabled here. The initial TPC Value is and the results are shown in the following Table

Table 5.4: Results of filtration of Neem powder

Sample no	Thickness of Tulsi powder layer in cm	Initial TPC Value Cfu/ml	Final TPC Value Cfu/ml
1.	3	4,00,00,000	5,00,000

5.3 COMPARISON OF RESULT

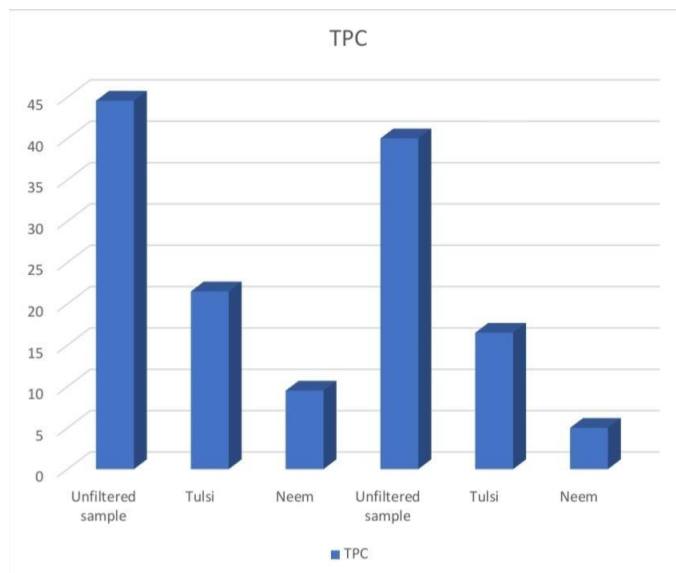


Fig.5.1: Variation of bacterial count using Tulsi and Neem powder

- The X axis indicates the Adsorbent used.
- The Y axis indicates the TPC count.

From the graph we can see that the variation is high while using the nylon membrane and Neem powder has greater effect on reduction than that of the Tulsi powder.

- The Neem leaves powder with the Nylon as a filtration membrane has a reduction rate of 87.5%.
- The Tulsi leaves powder with Nylon as a filtration membrane has a reduction rate of 58.75%.

5.4 COST OF THE FILTER

A chart has been provided for the cost of all the adsorbent media used for experimentation, the material cost of each adsorption media per kg used for experimentation is given in the table and the total cost as per the amount of material used is also mentioned in the table.

Table 5.3: Material cost of different adsorbent media used in experimentation

Material	Amount of material used for experimentation in Kg	Rate of material per Kg in rupees	Total cost in rupees
Tulsi powder	0.3	-	-
Neem powder	0.3	-	-
Sand	1	25	25
Cylindrical bottles	-	-	20

CHAPTER 6

SUMMARY AND CONCLUSION

6.1 GENERAL

In this chapter, the summary and conclusion of this project about removing the impurities from surface water using Neem powder and Tulsi powder as an adsorbents has been discussed.

6.2 SUMMARY

- In this project the treatment of the raw water sample for the removal of bacterial impurities using Natural adsorbents such as Tulsi powder and Neem powder.
- These materials have been used for reducing the bacterial count from the surface water sample by creating a filtration model.
- The filtration model has been set up in order to minimize the filtering cost as well as removal of impurities from the water sample.
- The results obtained after filtering through the adsorbent media of particular material is analyzed and its efficiency in reduction of bacterial count has been compared.

6.3 CONCLUSION

- Adsorption being the simplest and cheapest technique for iron removal, it has several advantages, like longer filtration runs, shorter ripening time, better filtrate quality.
- But the only limitation is backwash water requirement is essential for the filter media to run effectively.
- 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 layers due to rigorous use. Again back washing is needed from time to time.

- Smaller the size of the adsorbent larger will be the specific surface and better will be the removal.
- The adsorbents used here are of the same particle size as the same sieve used for both Neem and Tulsi powder for sieving.
- The Neem leaves powder has a greater effect on reduction of bacterial count than Tulsi leaf powder.
- Neem leaves powder with nylon membrane as a filtration membrane has the highest reduction rate of 87.5%.

REFERENCES

1. Anannya Mohapatra, ParijathamKanchana, Dr. Mala Ranjan, Sr.Sandra Horta Monica, Kavita, Priyanka, Antimicrobial Activity of Neem (*Azadirachta Indica*) Leaf Extracts, International Journal of Research in Agricultural Sciences, Volume 1, Issue 2, ISSN:2348–3997.
2. Ankit a. Jinturkar, Dr. Parag S. Sadjir, Removal of iron from aqueous solution using neem leaf powder as an adsorbent, International journal of innovative research in science, engineering and technology, Volume 6, Issue 5, 2017, pp.8948-8952.
3. Garima Pandey, KK Verma, Munna Singh,Evaluation of phytochemical, antibacterial and free radical scavenging properties of *Azadirachta indica* (neem) leaves, International Journal of Pharmacy and Pharmaceutical Sciences, Vol 6 Issue 2, 2014, ISSN: 0975-1491.
4. Ghanshyam Pandhare, Nikhilesh Trivedi, Nitin Kanse, S.D.Dawande, Synthesis of low cost adsorbent from *azadirachta indica* (Neem) leaf powder, International Journal of Advanced Engineering Research and Studies, Vol 2 Issue 2, Jan.-March 2013, ISSN: 2249–8974.
5. Gideon Sarpong and Clinton P. Richardson, Coagulation efficiency of *Moringa oleifera* for removal of turbidity and reduction of total coliform as compared to aluminum sulfate, African Journal of Agricultural Research, Vol. 5(21), pp. 2939-2944,ISSN: 1991-637X.

6. Grace K Mikhayel and Ankita K, Removal of iron and Chromium from wastewater using neem and tulsi leaf powder as filter bed,international Journal of Advanced information in engineering Technology, Volume 5, Issue 5, 2018, pp.33-40.
7. Islamuddin1, Rajneesh K. Gautam, Noor Fatima siddique, Nandkishor More, Azadirachta Indica (Neem) Leaf Powder Used As A Natural Adsorbent For The Removal Of Chromium Cr (VI) From An Aqueous Solutions, International Research Journal of Engineering and Technology (IRJET), Volume: 03, Issue: 08, Aug-2016, ISSN: 2395 -0056.
8. Kenneth A. Yongabi, D. M. Lewis and P. L. Harris,Indigenous plant based coagulants/disinfectants and sand filter media for surface water treatment in Bamenda, Cameroon, African Journal of Biotechnology, Vol. 10(43), pp. 8625-8629, 10 August, 2011.
9. G. K khadase, P M Patni and P.K.Labhasetwar, Need for water quality assessment, International Journal of environmental engineering, Volume 47, Issue 3, 2005, pp.242-249.
10. Krishna G. Bhattacharyya and Arunima Sharma, Adsorption of Pb(II) from aqueous solution by Azadirachta indica (Neem) leaf powder, Journal of hazardous materials, Volume 113, Issues 1-3, pp.97-109.
11. Maragathavalli, S.,Brindha, S.,Kaviyarasi, N.S., B. Annadurai, B. &Gangwar, S.K., Antimicrobial Activity in Leaf Extract of Neem (Azadirachta Indica Linn.), International journal of science and nature, VOL.3(1) 2012: 110-113, ISSN: 2229 – 6441.
12. Megha N S, Parvathy K Unni, Reshma PR, Shamily Monika KJ, Sreya C Job, Removal of iron from drinking water by using low cost natural adsorbents, International journal of scientific and engineering research, Volume 10, issue 5, 2019, pp.443-445.
13. Pandhare and Dawande, Synthesis of low cost adsorbent from azadirachta indica (neem) leaf powder, Archives of applied science research, Volume 2, Issue 5, pp. 456-461.

14. Reena Malik, Suman Iata, Sushila Singhal, Neem Leaf Utilization for Copper and Zinc Ions Removal from Aqueous Solution, International Journal of Science and Research (IJSR), Volume 3 Issue 5, May 2014, ISSN: 2319-7064.
15. Sunil B. Somani, Nitin W. Ingole, Shrikant S. Patil, Performance Evaluation of Natural Herbs for Antibacterial Activity in Water Purification, International Journal of Engineering Science and Technology (IJEST), Vol. 3 No. 9 September 2011, ISSN : 0975-5462.
16. Sunil Lekhak, Joshi Bishu, Sharma Anuja, Antibacterial property of Different Medicinal plants *Ocimum Sanctum*, *Cinnamomum Zeylanicum*, *Xanthoxylum Armatum* and *Origanum Majorana*, Kathmandu University Journal of Science Engineering and Technology, Volume 5, No.1, pp.143-150.
17. Tanushree Bhattacharjee, Prof. Milind R. Gidde, Bipinraj Nirichan Kunchiraman, Disinfection of Drinking Water in Rural Area Using Natural Herbs, International journal research, engineering and development, Volume 5, Issue 10, 2013, pp.7-10.
18. S.P. Tawde and S.A. Bhalerao, Biosorption of Chromium (VI) from an aqueous solution using *Azadirachta indica*. A. Juss. (Neem) and activated charcoal, A comparative study, Biological Forum — An International Journal, 2(2): 4-10(2010), ISSN : 0975-1130.
19. Thomas Audu, Innocent Oboh, Emmanuel A Luyor, Biosorption of Heavy Metal Ions from Aqueous Solutions Using a Biomaterial, Leonardo journal of sciences, Volume 23, Issue 1, 2009, pp.58-65.
20. S. Vanitha, P. Vijayalakshmi, P.K. Raji and M. Praba, Removal of E.Coli from Groundwater and Surface Water by Using Nylon Membrane Filtration Techniques, Rasayan J. Chem., Vol. 12, No. 1, 32 - 39, January - March, 2019.

21. Ugwu Celestina Chibuzo, Antimicrobial Activity of *Azadirachta indica* (Neem) Leaf Extract on Some Bacteria, International Journal of Current Microbiology and Applied Sciences, Volume 8 Number 07 (2019), ISSN:2319-7706 .