Journal of Chemical Health Risks

www.jchr.org

JCHR (2023) 13(4), 1328-1334 | ISSN:2251-6727

Water Purification Potential of Selected Medicinal Plants

Bindhu .K .B[1], Keerthana T.P [2] , P S Rekha[3], Betty K.P [4] , Adya Shibu [5]

[1]Associate Professor, Post Graduate and Research Department of Botany, Carmel College (Autonomous), Mala, Thrissur, Kerala
[2]MSc Student, Department of Botany, Carmel College, Mala, Thrissur, Kerala
[3]Assistant Professor, Department of Botany, NSS College Ottappalam, Thrissur, Kerala
[4]Associate Professor, Department of Botany, Sacred Herat College, Chalakudy
[5]MSc student, Dept. of Horticulture ,Central University of Tamil Nadu, Thiruvarur

(Received: 02 September 2023 Revised: 14 October Accepted: 07 November)

KEYWORDS

Water purification, *Tulsi*, *Coriander*, *Moringa*, *Azadiracta*, BOD

ABSTRACT:

The present study entitles ‘ water purification potential of selected medicinal plants outlines the physical, chemical and bacteriological analysis of plants and their role in water purification and further future aspect. The study provides a comparative account of the physical, chemical and bacteriological properties of *Coriandrum sativum*, *Moringa oleifera*, *Azadirachta indica* and *Ocimum tenuiflorum.* From the physical analysis, study identified that when adding plants, turbidity always increases. The evaluation of chemical properties (pH, Chemical oxygen demand and Biological oxygen demand) and bacteriological analysis (*Coliform*) shows that *Neem*is a better choice for water purification. The second best choice for the purification of polluted water is *Tulsi*. *Coriander* and *Moringa* were also showing potential to make the polluted water todrinking water. All the plants, especially *Neem* can be use wisely for treating polluted water as a future prospect of the study which aimed as a solution in the regions where there is lack of potable water.

Introduction: Medicinal plants have wide range of uses for mankind. They can be used for purification of water. Their extracts have the wonderful capacity to purify water and our environment due to the presence of various useful biochemical contents. Here in this study an attempt is made to check the potential of selected medicinal plants to purify water.

Objectives: In the present work we aim to evaluate physical, chemical and bacteriological properties of water samples treated with *Coriander*, *Moringa*, *Azadirachta* and *Ocimum*, and compare it with properties of well water.

Methods: Plant extract were prepared using the leaves of selected plants and were traetd with pollutes water. Their physical and chemical properites presence of E.Coli bacteria etc were studied after treatment and compared with that of pure water which was taken as control.

Results: All four medicinal plants used in the current study demonstrated a notable transformation in turning contaminated water into drinkable water. More than any other plant, neem has proven to be effective at cleaning contaminated water. Along with a value closer to that of neem, tulsi also possesses the ability to filter contaminated water. This study examines the potential of plants for water filtration, building on the numerous studies that have been conducted on the subject. It is possible to cleanse water using any of the selected plants. In the future, this research may be used to help people in rural regions purify their drinking water with neem, which will help them stay healthier and find a good solution to the pollution of water sources.

Conclusions: The study examined the effectiveness of four different medicinal plants and found that the water treated with neem leaves showed values that were closer to the control group's results. In

Journal of Chemical Health Risks

www.jchr.org

JCHR (2023) 13(4), 1328-1334 | ISSN:2251-6727

every study parameter, neem's miracle properties were apparent. The values showed a significant drop after the contaminated water was treated with neem leaves. The greatest option for thoroughly purifying water is neem leaves. Tulsi leaves, which are next to it, are likewise doing better at turning the contaminated water into drinkable water. The third and fourth plants that are good for cleaning up contaminated water and making it safe to drink are moringa and coriander. The future lies in using neem leaves to achieve even better outcomes.

1. Introduction

More than 70% of the earth's surface is covered by this valuable natural resource. Only 4% of the water that is completely available is usable. Industrialization and inadequate management of water resources are major threats worldwide because of diverse human activities. Approximately 20% of the world's population lacks access to safe drinking water for sanitization.

About 20% of world's population lacks access to safe drinking water and 50% of the world's population lacks access to safe sanitation .All over the world drinkable water for day to day life become less . People in the under developed and rural areas have no access to the water purification methods and are forced to use the contaminated water. The alarming factor is that the water table is decreasing every day and the available water even after treatment is containing various pollutants like arsenic, cadmium etc which may lead to serious diseases on consumption. In addition to this the microbes like bacteria , fungus etc present in water may also cause many contaminated diseases.

Water purification or water treatment is necessary step to increase the quality of water. There are many methods of water treatment like municipal waste water treatment, domestic waste water treatment etc. But they have their own shortcomings like high cost, usage of electricity etc. Use of biological water treatment become more suitable in this scenario. It is more sustainable and eco-friendly way.

Water purification by plants is one of such powerful method. Some plants like *Tulsi, Moringa* , *Opuntia* etc are being used by various tribal communities to treat water. Of these the gummy nature of exudate from the *Opuntia* can kill the microbes in water , like this the seeds of *Moringa oleifera* can remove the turbidity of water due microbial contamination by killing the microbes. Many aquatic plants also absorb excess nutrients from the polluted water and release oxygen to purify the water.

All these plant resources are renewable and easily and cheaply available in nature and can be used for water purification so that we van consider this method of purification of water by plant resources as cost effective alternative and energy saving method.

In the present work we aim to evaluate physical, chemical and bacteriological properties of water samples treated with *Coriander, Moringa, Azadirachta* and *Ocimum,* and compare it with properties of well water.

Objectives

Our goal in this investigation is to compare the physical, chemical, and bacteriological characteristics of water samples treated with coriander, moringa, azadirachta, and occimum to those of well water.

Methods

Collection of plant leaves:

Fresh leaves of *Coriandrum sativum, Moringa oleifera, Azadirachta indica* and *Ocimum tenuiflorum* were the materials selected for this study. They were collected from Aloor, Thrissur District of Kerala.

Collection of water sample

1000 mL of well water and 5 Litre of water from a polluted pond was collected from Aloor, Thrissur district on 20/01/2021. Well water was used as the control solution.

Preparation of plant extract

Clean leaves of *Coriander, Moringa, Neem* and *Tulsi* were washed with tap water and with distilled water. They were dried under sunlight. The dried leaves were crushed using mortar and pestle. 5gm of each leaf extract was added to 1000 mL of polluted water. Left the samples undisturbed for few hours and filtered the water.

Journal of Chemical Health Risks

www.jchr.org

JCHR (2023) 13(4), 1328-1334 | ISSN:2251-6727

SAMPLE 1- Control solution
SAMPLE 2- Polluted water
SAMPLE 3-Water with *Coriander* leaves
SAMPLE 4- Water with *Moringa* leaves
SAMPLE 5-Water with *Tulsi* leaves
SAMPLE 6-water with Neem leaves

CHEMICAL ANALYSIS

Determination of pH

pH was determined using pH meter. It was connected to an electrical circuit. Washed the electrodewith distilled water. Switched the instrument and allowed them to warm up the standard buffer ofpH 4 and 7 brought to the room temperature. Immersed the electrode in each standard buffers. Used the calibration knob and adjusted the reading on the instrument to the standard pH value. After calibration the electrode lifted out from the standard buffer and rinsed with distilled water. Dipped the electrode in the sample solution. Noted the pH value. After each pH measurement, rinsed the electrode with distilled water and dried.

Determination of chemical oxygen demand (COD)

Placed 0.4g sulphuric acid in a reflux tube. 20mL of sample was added and mixed well. 10 mL of std. potassium dichromate was added and slowly added 30 mL sulphuric acid which already containing silver sulphate. Mixed well. Connected tubes to condenser and refluxed for 2 hours at 150° C. Cooled and washed condenser with 60 mL distilled water. Titrated this against std. ferrousammonium sulphate using ferroin as indicator. Near end of titration color changed from sharply green blue to wine red. Using the titration value COD was calculated.

$$\text{Chemical oxygen demand(COD)} = \frac{(V1 - V2)\ N * 8000}{V0}$$

Where,

V1= volume of ferrous ammonium sulphate for titration against blank

V2= volume of ferrous ammonium sulphate for titration against sample

V0= volume of sample taken for testing

N= normality of ferrous ammonium sulphate

Determination of biological oxygen demand (BOD)

A glass topped BOD bottle at known volume (125 mL) filled out with sample water. No air trappedin the bottle after the stopper was placed. Opened the bottle and poured 1 mL manganese sulphateand 1 mL potassium iodide using pipette. A precipitate appeared. Placed the stopper and shaken the bottle thoroughly. 2 mL of concentrated sulphuric acid was added and shaken to dissolve the precipitate. Transferred gently 20 mL of it into conical flask. Put 2 drops of starch as indicator. A blue color formed. Titrated it against sodium thiosulphate and noted the end point when initial blue color turns to colorless. Analysis repeated twice and mean value was used to calculate.

Biological oxygen demand(BOD) =

$$V1 \times N \times 8 \times 1000/V4[V2-V3/V4]$$

Where,N= Normality of titrant
V1= Volume of titrant
V2= Volume of sample in the bottle after placing the stopper
V3= Volume of manganese sulphate and potassium iodide solution
V4= Volume of sample pipetted out for titration

Determination of presence of *Coliform*

Presence of *Coliform* bacteria was determined by membrane filter technique. Sterilized the blendended forceps and carefully removed a sterile membrane filter from its package, holding it only byits edge. Placed the membrane filter in the filter apparatus and clamped it in place. Mixed the sample by inverting its container several times. Pipetted out 10 mL of sample into filter funnel. Applied a vacuum to the suction flask and drew the sample through the filter; disconnected the vacuum. Dismantled filtration apparatus and removed the membrane filter using sterile forceps. This was placed on the sterile *m. Endo* agar plate with a rolling motion to avoid the entrapment ofair. Incubated the plate for 24 hours at 35° C , all lid side down. After 24 hours, removed the agar plate from incubator and counted colonies that are dark red using a low power

Journal of Chemical Health Risks

www.jchr.org

JCHR (2023) 13(4), 1328-1334 | ISSN:2251-6727

stereo microscope. From this, *Coliform* density was calculated.

Coliform density=coliform colonies counted x100

Volume of sample used

Results

PHYSICAL ANALYSIS

Determination of turbidity

Turbidity observed for the control is zero. It is very suitable for drinking. Polluted water has turbidity of 39.7 NTU. Turbidity observed in samples treated with *Neem, Moringa*, *Tulsi* and *Coriander* as 6.8 NTU, 11.2 NTU, 16.7 NTU and 28 NTU respectively. Results were represented in Table.1. and compared by a graphical representation in Figure 1.

CHEMICAL ANALYSIS

Determination of pH

Control has the pH nearer to pure water. In the treated samples, *Tulsi* has more preferable pH and *Coriander* has relatively low pH than others. pH of *Tulsi, Neem, Moringa* and *Coriander* are 6.1, 5.9, 5.2 and 5 respectively. Results were represented in the Table.1. and compared in Figure2.

Determination of chemical oxygen demand (COD)

Lower COD was observed for control (15 mg/L) and higher value for polluted water (83 mg/L).Water treated with *Neem, Tulsi, Moringa* and *Coriander* showed COD values 21 mg/L, 28 mg/L,54 mg/L and 67 mg/L respectively. Results were depicted in Table. 1. and compared in Fig. 3.

Determination of biological oxygen demand (BOD)

Control has lowest BOD (4 mg/L), for polluted water it was 48 mg/L. Water treated with *Neem* 11 mg/L followed by those treated with *Tulsi, Moringa* and *Coriander* 24 mg/L, 32 mg/L and 36 mg/ L. Results and comparison were done in the Table.1 and Figure 4 respectively.

BACTERIOLOGICAL ANALYSIS

Determination of presence of *Coliform*

Coliform found in polluted water was 24 no:/ mL and relatively higher for the sample with *Coriander* (15 no:/mL). Lower values observed in sample with *Neem* (4 no:/100 mL), *Tulsi* (9 no:/mL) and *Moringa* (14 no:/mL). Control has no *Coliform*. The results represented in Table.1.and comparison were done in Fig. 5

Plate 1. Water samples: **a.** Control; **b.** Water sample treated with *Coriandrum sativum* leaves; **c.** Water sample treated with *Moringa oleifera* leaves; **d.** Water sample treated with *Azadirachta indica* leaves; **e.** Water sample treated with *Ocimum tenuiflorum* leaves; **f.** Polluted water

Parameter	Control	Polluted water	Sample with *Coriander*	Sample with *Moringa*	Sample with *Neem*	Sample with *Tulsi*
Turbidity (in NTU)	0	39.7	28	11.2	6.8	16.7
pH	6.6	4.7	5	5.2	5.9	6.1
COD(in mg/L)	15	83	67	54	21	28
BOD(in mg/L)	4	48	36	32	11	24
***Coliform* (in no:/100 mL)**	0	24	15	14	4	9

Table. 1. Physical, chemical and bacteriological analysis of water samples

Fig. 1 Comparison of Turbidity of water samples

Journal of Chemical Health Risks

www.jchr.org

JCHR (2023) 13(4), 1328-1334 | ISSN:2251-6727

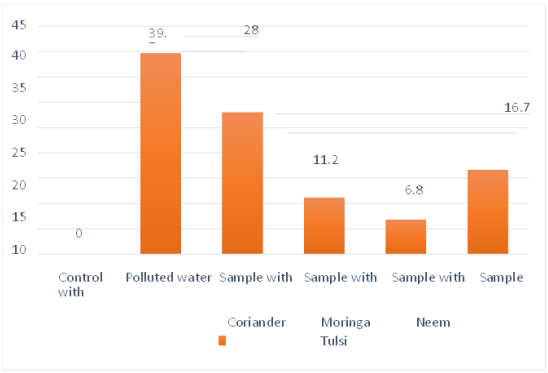


Fig. 2 Comparison of pH of water samples

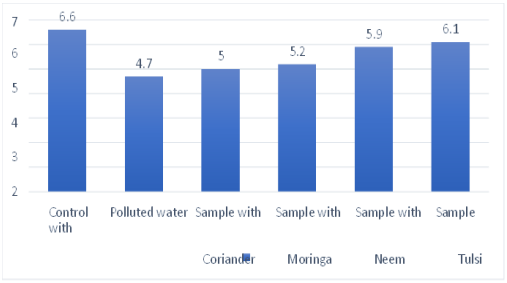


Fig. 3. Comparison of Chemical Oxygen Demand (COD) of water samples

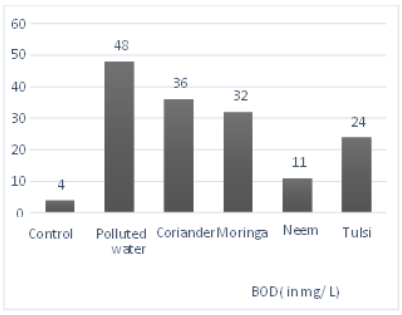
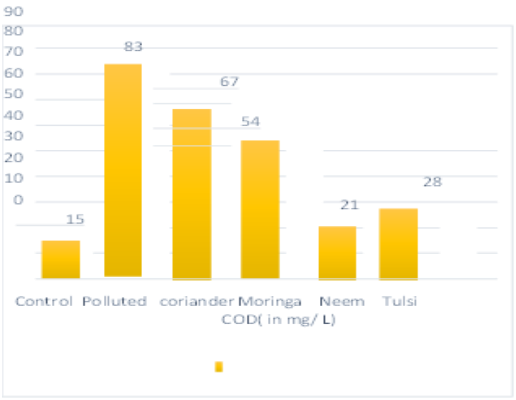


Fig. 4 Comparison of Biological Oxygen Demand (BOD) of water samples



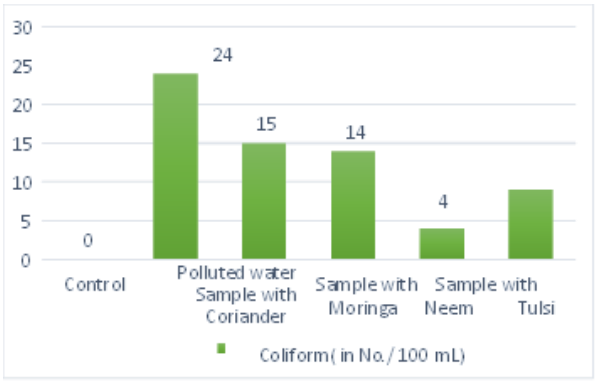


Fig. 5. Comparison of number of *Coliform* in water samples

Discussion

As per the report of United Nations World Water Development there will be huge scarcity for clean water for about 6 billion people. Due to dramatic increase in population and economic growth, there is increased rate of water pollution, water scarcity and increased water demand[2]. Many projects were implemented by Government to provide pure water to the people inhabiting in slums and rural areas . but many of them are not reaching into the proper hands. So alternate and cheap sources for water purification is needed. In India from ancient days water purification by using herbs were common practice. While treated with polluted water many plants like *Moringa* kernal, *Neem Nirmali* etc. showed positive results[7] .Some plants can also absorb heavy metals[6]. In the present study we used the plants like *Coriander, Moringa, Neem* and *Tulsi which* are easily available. Moringa seeds are powerful antibacterial agents [3].

The cloudiness of water is turbidity which indicates pollution. Appropriate doze of plant extract can reduce the turbidity[1]. Well water has no turbidity and turbidity is higher for the pollutedwater with a value of 39.7 mpn. *Neem* leaves (6.8NTU) are showing lowest turbidity when comparing with other plants. Higher turbidity observed for water treated with *Coriander* leaves (28 NTU). *Moringa* has 11.2 NTU and *Tulsi* has 16.7 NTU. Hence there was reduction in treatmentwith all plants.

Chemical oxygen demand (COD) is the amount of oxygen consumed to chemically oxidize organic water contaminants to inorganic end products. It is higher for the polluted water (83 mg/L). The lowest value is

Journal of Chemical Health Risks

www.jchr.org

JCHR (2023) 13(4), 1328-1334 | ISSN:2251-6727

observed for *Neem* (21 mg/L) and it is nearest to the value of control which hasa COD of 15 mg/L. *Tulsi* has next small value for COD (28 mg/L). *Coriander* has 67 mg/L and *Moringa* has 54 mg/L.

Lowest BOD shown by control (4 mg/L) and higher BOD value is for the polluted water (48 mg/L). Low BOD observed for *Neem* (11 mg/L). *Neem* has more capacity to reduce the BOD than others. *Tulsi* has the potential to lower BOD (24 mg/L) andit is next to neem. *Coriander* and *Moringa* lowered the BOD to 15 mg/L and 14 mg/L respectively. Some plants have the tendency to lower BOD specifically. *Salvina molesta* reduced upto 86.5% BOD from domestic waste water[5].

Presence of *Coliform* is an indicator organism of pollution. If it's presence is high, there ishigh risk of water borne diseases. Well water has no Coliform. Polluted water has *Coliform* at a rate of 24 mpn. Water treated with neem have 4 mpn *Coliform* and *Coliform* is higher in *Coriander*(15 mpn). *Moringa* and *Tulsi* have 14 mpn and 9 mpn respectively. Water sample which is stored showed more coliform than water collected from a tube well in Rajasthan [4].Sample water taken from the well gave lower rate of pollution than water treated with plants. That's why the preference for well water is increasing among local people.

The evaluation of physical, chemical and bacteriological analysis showed that the well water is the best choice for consuming. The water sample treated with neem leaves also provide good results like that of well water. pH was more preferable for water with *Moringa*. Chemical oxygen demand, biological oxygen demand and *Coliform* was comparatively low for *Neem. Tulsi*is the next one showing better results than *Coriander* and *Moringa*. Considering the overall performance, *Neem* is more suitable for treating polluted water for making it into pure potable water. A slight modification in the treatment procedure can make it more effective in phytoremediation. *Tulsi* is the second next plant which has an evident activity to purify polluted water.

Neem not only purify water, but also contribute to our health. That is why it is also called as ' the village pharmacy'. More than 140 compounds have been isolated from different parts of plant. These active compounds give *Neem* it's antioxidant, antimicrobial, antiparasitic, anti- inflammatory and wound healing properties. *Neem* leaf is used for leprosy, eye disorders, intestinal worms, skin ulcers, diseases of heart and blood vessels, diabetes and liver problems [8]

Drinking water scarcity is a major problem in India. The polluted water obtained can be rectified to pure water using various methods. The methods will not be acceptable for all sectionsof people. Medicinal plants have the potential to purify polluted water. From the present study conducted using four medicinal plants, all the plants showed a remarkable change in making polluted water to potable water. *Neem* has showed better results in purifying polluted water than others. *Tulsi* also has the potential to purify the polluted water and its values are nearer to the values of *Neem*. Many studies were done on the purification of water using plants and this study also deals with the ability of plants in water purification. All the plants chosen can be use for purifying water. People in the rural areas can use *Neem* for purifying drinking water as a future prospect of the study which will be a good solution for pollution of water resources and help to improve their health.

CONCLUSION

The study compared efficiency of four medicinal plants and identified that the water treated with *Neem* leaves are showing values nearer to the values of control. The miraculous activity of *Neem* were evident in all the parameters used for the study. A notable decrease in the values wereobserved when the polluted water treated with *Neem* leaves. *Neem* leaves are the best choice for purification of water in all aspects. Next to it is the *Tulsi* leaves which are also showing better results for making the polluted water into drinking water. *Moringa* is the third and *Coriander* is the fourth plant which is suitable for purifying polluted water and making it safe for consuming. Utilizing *Neem* leaves for further more better result is the future prospect of this study; mainly inthe regions where there is scarcity of potable water

Refrences

1. Asrafuzzaman, M., Fakhruddin, A. N. M., & Hossain, M. (2011). Reduction of turbidity of water using locally available natural coagulants. International Scholarly Research Notices, 2011.

2. Boretti, A., & Rosa, L. (2019). Reassessing the projections of the world water development report. *NPJ Clean Water*, *2*(1), 1-6.

3. Delelegn, A., Sahile, S., & Husen, A. (2018). Water purification and antibacterial efficacy of Moringa oleifera Lam. *Agriculture & Food Security*, *7*(1), 1-10.

4. Mahmud, Z. H., Islam, M. S., Imran, K. M., Hakim, S. A. I., Worth, M., Ahmed, A., ... & Ahmed, N. (2019). Occurrence of Escherichia coli and faecal coliforms in drinking water at source and household point-of-use in Rohingya camps, Bangladesh. *Gut pathogens*, *11*(1), 1-11.

5. Mustafa, H. M., & Hayder, G. (2021). Performance of Salvinia molesta plants in tertiary treatmentof domestic wastewater. *Heliyon*, *7*(1), e06040.

6. Raskin, I., Smith, R. D., & Salt, D. E. (1997). Phytoremediation of metals: using plants to removepollutants from the environment. Current opinion in biotechnology, 8(2), 221-226.

7. Sowmeyan, R., Santhosh, J., & Latha, R. (2011). Effectiveness of herbs in community water treatment. *International Research Journal of Biochemistry and Bioinformatics*, *1*(11), 297-303.

8. Subapriya, R., & Nagini, S. (2005). Medicinal properties of neem leaves: a review. Current Medicinal Chemistry-Anti-Cancer Agents, 5(2), 149-156.