International Journal of Research and Development in Pharmacy and Life Sciences
Available online at http//www.ijrdpl.com
April - May, 2014, Vol. 3, No.3, pp 978-982
ISSN: 2278-0238

Research Article

VETIVERIA ZIZANIODES AND *TERMINALIA CHEBULA* AS ALTERNATIVE NATURAL ADSORBENT FOR DRINKING WATER TREATMENT

M. Razia*, V. Karthiga, C. Thamaraiselvi, S.H.Saira Banu, L. Paul Evangelin Shavisha, W. Bernala

Department of Biotechnology, Mother Teresa Women's University, Kodaikanal – 624 102, TamilNadu.

***Corresponding Author: Email** razia581@gmail.com

(Received: January 22, 2014; **Accepted:** March 06, 2014**)**

ABSTRACT

Drinking water samples was collected from lake and silver cascade water falls in Kodaikanal were analyzed for physico- chemical characteristics. Vetiveria zizaniodes and Terminalia chebula plant extract were examined as natural alternative materials for drinking water treatment. The results was compared with the WHO standards of drinking water quality parameters namely pH, electrical conductivity, COD, magnesium, alkalinity, and sulfate, total dissolved solids and total hardness, dissolved oxygen, iron, fluoride. The result showed that, V. zizaniodes enhanced the water quality than T. chebula in terms of (denoted values). Therefore, the use of plant materials with low cost natural absorbents is recommended for eco-friendly, nontoxic, simplified water treatment.

Keywords: V. zizaniodes, T. chebula, Natural absorbents, Drinking Water Treatment.

INTRODUCTION

Water is one of the most important elements for all forms of life in the earth. For agricultural, industrial, household activities groundwater is used. In India, most of the population is dependent on groundwater source for drinking water (Ramesh et al., 2012). Potable water is a vital requirement for the nourishment of healthy human life (Datta, 2005). Lakes and surface water reservoirs are the planet most important freshwater resources and provide innumerable benefits. They are used for domestic and irrigation purposes, and provide ecosystems for aquatic life especially fish, thereby functioning as a source of essential protein, and for significant elements of the world's biological diversity. The remarkable increase in population resulted in a significant consumption of the water reserves worldwide (Arain et al.,2008). The quality of surface water is largely affected by natural processes (weathering and soil erosion) as well as anthropogenic inputs (municipal and industrial wastewater discharge). The abundance of organic compounds, radionuclides, toxic chemicals, nitrites and nitrates in water may cause unfavorable effects on the human health especially cancer, other human body malfunctions and chronic illnesses (Usharani et al., 2010).Therefore; it is necessary to frequently monitor water quality, used for drinking purposes.

Phytoremediation is one of the biological water treatment methods which is simple, environmentally friendly and consumes less energy. Suitable plant species used for phytoremediation should have high uptake of organic and inorganic pollutants, grow well in polluted water and be easily controlled in quantitatively propagated dispersion (Roongtanakiat et al., 2007). Plant seeds, leaves, and root extracts have been found potential source of treatment of water, many infectious diseases, and improvement in animal welfare and hygiene (Nwaiwu et al., 2010). Therefore, the

aim of the study was to investigate the water quality analysis of Kodaikanal region of Dindigul using seeds of V. zizaniodes and T. chebula.

MATERIALS AND METHOD

Water sample Collection

Water samples were collected from lake and silver cascade of Kodaikanal, Dindigul district of TamilNadu. Samples were collected in sterilized screw-capped polyethylene bottles and it was properly labeled for their physico-chemical parameters.

Analysis of Water samples

The physicochemical characteristics was performed namely pH, turbidity, hardness, alkalinity, total dissolved solids, total solid suspension, electrical conductivity, dissolved oxygen, BOD, COD, nitrate, nitrite, sodium, calcium, magnesium, chloride, phosphate, sulphate, iron, fluoride were determined using standard methods (APHA, 2005) and the results were compared with World Health Organization (WHO) permissible for the drinking water.

Plant Materials

Seeds of V. zizaniodes, and T. chebula were collected, dried and grounded to a fine powder using electric blender. Fine powder was directly used as coagulant with the dosage of 50 mg/l. The seed powder was used as coagulant and mixed with drinking water sample and incubated for one hour at 120 rpm. After sedimentation, supernatant of treated water were filtered by using Whatmann filter paper. The water quality parameters were checked for physicochemical (Maithi, 2004) after the treatment. The water quality parameters were checked after treatment.

RESULT AND DISCUSSION

The sample collected from were collected from lake and silver cascade following drinking water quality parameters were analyzed before and after the treatment of V. zizaniodes and T. chebula seed powder. The physico-chemical parameters, which were analyzed, have been shown in Table 1. The desirable pH range necessary for drinking water is from 6.5 to 8.5. The pH value of water sample in the study area was a desirable limit as prescribed by WHO for drinking water was 6.96 and 7.59. Most of the waters in the environment are slightly acidic (Lawson et al., 2011). Hardness of water mainly depends upon the amount of calcium or magnesium salts or both. In the present study, the observed total hardness was more than the normal WHO permissible limit. The water treated with V. zizaniodes and T. chebula, which reduces the total hardness of the water to optimum level. The maximum level of total hardness is due to presence of carbonate and non-carbonate hardness (Suleyman et al., 1994). In the present study, the observed turbidity was more than the normal WHO permissible limit. Efficiency of turbidity removal for V. zizaniodes was 7 and 6 NTU.

Total dissolved solids indicate the salinity behavior of groundwater. Water containing more than 500 mg/L of TDS was not considered desirable for drinking water supplies. After the treatment of V. zizaniodes and T. chebula, TDS was reduced to 462 and 488 mg/l respectively. TDS pose a variety of health hazards such as causing stiffness in the joints, hardening of the arteries, kidney stones, gall stones (Sinha et al., 2011). The electrical conductivity of water samples under study was 321 µmho/cm. The maximum permissible limit of this parameter for drinking water is 300µ mho/cm. However, the average specific conductivity exceeds this limit because of its high values during rainy season. In rainy season due to floods and rains, water level in the well increases, which contains more electrolytes (Saravanakumar, 2011). After treatment, EC was reduced to 290 and 289 respectively.

Alkalinity of water is its capacity to neutralize a strong acid and it is normally due to the presence of bicarbonate, carbonate and hydroxide compound of calcium, sodium and potassium. The desirable limit of total alkalinity (Prescribed by WHO) is 200. The alkalinity of untreated water sample is higher than the permissible limit. After the treatment with V. zizaniodes the values were reduced to 174 and 152 which are within the limit. Dissolved oxygen is important parameter in water quality assessment and reflects the physical and biological processes prevailing in the water (Gupta et al., 2000). The DO values indicate the degree of pollution in water bodies. DO value was 7 .97 in untreated water sample. V. zizaniodes and T. chebula treated water samples shows reduced DO 4.8 and 4.2 which is in the WHO permissible limit. The WHO permissible limit of COD for drinking water is 4 mg/L. Hence the observed COD value was 7 and 5.3, which is reduced to 4.1 and 3.9. Sulphate occurs naturally in water as a result of leaching from gypsum

Table 1: Physicochemical parameters before and after treatment with extracts of *Vetiveria zizaniodes* and *Terminalia chebula*

S. No	PARAMETERS	Permissible Limit (WHO)	LAKE WATER	SILVER CASCADE	LAKE WATER		SILVER CASCADE	
					(*Vetiveria zizaniodes*)	(*Terminalia chebula*)	(*Vetiveria zizaniodes*)	(*Terminalia chebula*)
1	pH	6.5 – 8.5	6.92	7.59	6.7	7.4	7.1	7.2
2	TURBIDITY (NTU)	10	37	23	7	9	6	11
3	HARDNESS mg/l	300	353	306	285	296	174	314
4	ALKALINITY (mg/l)	200	240	216	174	193	152	196
5	TDS mg/l	500	534	586	462	541	488	523
6	EC (mho/cm)	300	355	321	290	312	289	306
7	DISSOLVED OXYGEN (mg/l)	5	7.97	6.3	4.8	5.2	4.2	5.1
8	COD (mg/l)	4	7	5.3	4.1	4.9	3.9	4.6
9	NITRITE	30.2	34	32	29	30	26	28.6
10	SODIUM (mg/l)	20	35	26	19	22	16	18
11	MAGNESIUM (mg/l)	50	59	54	42	45	43	46
12	PHOSPHATE (mg/l)	0.01	0.8	0.5	0.03	0.07	0.01	0.04
13	SULPHATE (mg/l)	400	596	537	408	411	388	394
14	IRON (mg/l)	0.3	1.0	0.6	0.3	0.5	0.1	0.4
15	FLUORIDE (mg/l)	1.5	1.9	1.8	1.2	1.4	1	1.3

and other common mineral. Discharge of industrial wastes and domestic sewage tends to increase its concentration. The sulphate concentration was 596 and 537 which exceeded the WHO prescribed limit 400, by treating the water sample with V. zizaniodes reduced the sulphate value to 408 and 388. Sodium plays an important role in human body. The maximum permissible limit of sodium in water was 20 mg/L. From table1 it is seen that the concentration of sodium for sample was 35 mg/L and 26 mg/L which was above the permissible limit. After the treatment with V. zizaniodes the values were reduced to 19 and 16 respectively.

Higher the concentration of magnesium in drinking water gives unpleasant taste to the water. The concentration of magnesium in potable water is 50mg/L. But the magnesium level in untreated water sample was 59 and 54, which is reduced to 42 mg/L and 43 mg/L by V. zizaniodes. The WHO permissible limit for nitrite was 30.2 mg/L. In study area nitrite concentration was 51 mg/l. High level of nitrite in water may cause unfavourable effects on the human health especially cancer, other human body malfunctions and chronic illnesses. Nitrite can form a variety of N-nitroso compounds by reacting with proteins in the stomach. Some of these compounds have been found to cause cancer in animals (Gupta et al., 2000).

Therefore, it was necessary to frequently monitor water quality, used for drinking purposes. After treatment with V.

zizaniodes and T. chebula the nitrite level was reduced to permissible limit. V. zizaniodes was found to be most effective as compared to T. chebula.

High concentration of iron causes slight toxicity. The result showed that the concentration of iron is almost zero for all the stations. Iron in concentrations greater than 0.3 mg/l may cause brown and black stains on laundry, plumbing fixtures and sinks. High concentrations of iron do not appear to present a health hazard (Hujare et al., 2008). Treatment includes a water softener or iron filter for iron. The iron concentration of water samples was1.0 and 0.6 above the WHO permissible limit, which was reduced to 0.3 and 0.1 by V. zizaniodes.

Fluoride is essential for human beings as a trace element and higher concentration of this element causes toxic effects. Maximum permissible limit was 1.5 mg/l. If fluoride concentration is more than 1.5 mg/L it may cause fluoride dental molting and bone diseases (Gulis et al., 2000). In the study area, the fluoride content in water sample was 1.9 and 1.8. After treatment with V. zizaniodes the fluoride value was reduced to 1.2 and 1. In natural water system, phosphorous is gradually released from rocks due to weathering. Phosphate may occur in groundwater as a result of domestic sewage, detergents, agricultural effluents with fertilizers and industrial waste water. The phosphate content in the study area was 0.8 mg/L and 0.5 mg/L. Samples had the phosphate concentration higher than 0.01 mg/l. Excessive phosphorous in natural water bodies often spurs rapid algae growth, resulting in eutrophication. However phosphate is not toxic to human beings or animals. The phosphate content in the water sample was reduced to 0.03 and 0.01 by V. zizaniodes. For water quality improvement, Vetiver is ideally suitable for treating contaminated and polluted wastewater from industries as well as domestic discharge. Naturally occurring coagulants are usually presumed safe for human health (Truong et al., 2001)

CONCLUSION

The analysis of the water quality parameters of drinking water from lake and silver cascade water falls in Kodaikanal were analyzed for pH, turbidity, total hardness, total dissolved oxygen, sulphate, phosphate, electrical conductivity, dissolved oxygen, fluoride, iron, nitrite, magnesium, COD values are well within the permissible limits after the treatment with plant extract. In the present study a seed of V. zizaniodes was found to be most effective as compared to T. chebula.

REFERENCES:

1. Arain MB, Kazi TG, Jamali, MK, Afridi HI, Baig JA, Jalbani N, and Shah AQ. 2008, Evaluation of Physico-chemical Parameters of Manchar Lake Water and Their Comparison with Other Global Published Values, Pak. J. Anal. Environ. Chem. 9(2) pp. 101 – 109.
2. Arku AY, Musa SM, and Mofoke ALE. 2012, Characterization And Standardization Of Crude Moringa Oleifera Seeds For Wastewater Treatment, Journal of Applied Phytotechnology in Environmental Sanitation, 1(2) pp. 67.
3. Datta P S. 2005, Groundwater ethics for its sustainability, Current science, 89(5).
4. Eaton AD, Clesceri LS, Rice EW, and Greenberg AE. (2005), Standard methods for examination of water and wastewater. 21st Edn, American Public Health Association, NW Washington, DC., 10.
5. Ebrahim A, Ali M, GauthamJawahar, and Hariram S. 2011, A Preliminary Attempt To Reduce Total Dissolved Solids In Ground Water Using Different Plant Parts, Journal of Pharma and Bio Sciences.
6. Gulis G, Czompolyova G, and Cerhan JR, 2000, An Ecologic Study Of Nitrate In Municipal Drinking Water And Cancer Incideonce In Trnava District Slovakia, Environmental Research,88 (3) pp. 182-187.
7. Gupta SK, Gupta RC, Gupta AB, Seth AK, Bassin JK, and Gupta A. 2000, Recurrent Acute Respitory Tract Infections In Areas With High Nitrate Concentrations In Drinking Water, Environmental Health perspectives, 108 (4) pp. 363- 366.
8. Hujare MS, 2008, Seasonal variation of physicochemical parameters in the perennial tank of Talsande, Maharashtra, .Ecotoxicol. Environ. Monit. 18(3) pp. 233-242.
9. Lawson EO, 2011 . Physico-Chemical Parameters and Heavy Metal Contents of Water
10. from the Mangrove Swamps of Lagos Lagoon, Lagos, Nigeria, Advances in Biological Research, 5 (1) pp. 08-21.
11. Mangale SM, Chonde SG, Jadhav AS, and Raut PD. 2012, Study of Moringa oleifera (Drumstick) seed as natural Absorbent and Antimicrobial agent for River water treatment, J. Nat. Prod. Plant Resour, 2(1) pp. 89.
12. Mathur P, Agarwal S, and Nag M, 2007, Assessment of Physico-Chemical Characteristics and Suggested Restoration Measures for Pushkar Lake, Ajmer Rajasthan (India). Proceedings of Taal: Work Lake Conference pp 1518-1529

13. Ndabigengesere A, and Narasiah KS, 1998, Use of Moringa Oleifera Seeds as a Primary Coagulant in Wastewater Treatment, Environmental Technology, 19(8) pp. 789.
14. Nwaiwu NE, and Moses J, 2010, The Performance Of Moringa oleifera seed powder sodium chloride extract on natural surface water, Continental J. Engineering Sciences, 5(2) pp. 55.
15. Ramesh M, Dharmaraj E, and Ravindraraj JB, 2012, Physico-chemical characteristics of ground water of Manachanallur Block, Trichy, Tamilnadu, India, Advances in Applied Science Research, 3(3) pp. 1709.
16. Roongtanakiat N, Tangruangkiat S, and Meesat R. 2007, Utilization of Vetiver Grass (Vetiveria zizanioides) for Removal of Heavy Metals from Industrial Wastewaters, ScienceAsia 33
17. Saravanakumar K, and Ranjithkumar R, 2011, Analysis of water quality parameters of groundwater near Ambattur industrial area, Tamil Nadu, India, Indian Journal of Science and Technology, 4 (5) pp. 660.
18. Sarpong G, and Richardson CP, 2010, Coagulation efficiency of Moringa oleifera for removal of turbidity and reduction of total coliform as compared to aluminum sulfate, African Journal of Agricultural Research, 5(21) pp. 2939.
19. Sinha SN, and Biswas M, 2011, Analysis of Physico-Chemical Characteristics to Study theWater Quality Of a Lake in Kalyani,West Bengal, Asian. J. Exp. Biol. Sci. 2 (1).
20. Standard Methods for the Examination of Water and Wastewater (1998). APHA-AWWA-WPCF, Washington D.C.
21. Suleyman A, Muyibi and Evison LM, 1994, Moringa oleifera seeds for softening hardwater, Wat. Res.29 (4) pp. 1099.
22. Usharani K, Umarani K, Ayyasamy PM, Shanthi K, Lakshmanaperumalsamy P. 2010, Physico-Chemical and Bacteriological Characteristics of Noyyal River and Ground Water Quality of Perur, India, J. Appl. Sci. Environ. Manage. 14 (2) pp. 29 – 35.
23. WHO. (2004), Guidelines for Drinking Water Quality, 2nd edition. World Health Organization,
24. Geneva, 231.
25. Yongabi KA, Lewis DM, and Harris PL. 2011, Application of phytodisinfectants in water purification in rural Cameroon, African Journal of Microbiology Research, 5(6) pp. 628.

How to cite your article:

Razia M., Karthiga V., Thamaraiselvi C., Saira Banu S. H., Paul Evangelin Shavisha L., Bernala W., "*Vetiveria zizaniodes* and *Terminalia chebula* as alternative natural adsorbent for drinking water treatment", Int. J. Res. Dev. Pharm. L. Sci., 2014, 3(3), pp. 978-982.

