International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2015): 78.96 | Impact Factor (2015): 6.391

Treating Wastewater of Pampa River during Pilgrimage Season with *Vetiver Zizanioids*

Maya M Nair

Post Graduate Department of Chemistry, NSS Hindu College Changanassery

Abstract: ***The project work aimed at the study of microbiological and physic-chemical water quality of River Pampa, Kerala and their phytoremediation using VetiverZizanioids(V.Z) after pilgrimage season. Sabarimala one of the major pilgrimage centers of South India is located on the banks of River Pampa. The pilgrimage season is from Dec to Feb every year. Pilgrims use river water for various sanitary purposes. The microbiological and physico- chemical chararacteristics like Total Coliform Count, Biological Oxygen Demand and Chemical Oxygen Demand were studied and analysed during Jan2015-May2015 using standard procedures. The water samples were collected from different sites-Triveni,Ranni and Chengannur. The result revealed that Triveni showed most pollution.V.Z is used for the remediation of Triveni by Hydroponic technique. V.Z is chosen as the preferred plant species due to its known efficiency, low cost, ease of propagation and availability. The observed results were tabulated, compared to conclude that V.Z has capable of reducing Coliform Count, COD and BOD on hydroponic technique.***

Keywords: Physico-chemical parameter and biological parameter

1. Introduction

Life began in water and no one live without water. Adequate supply of fresh and clean drinking water is a basic need for all human beings in the earth (Girija, 2013). Yet water pollution is one of the most serious ecological treats we face today. Therefore it is necessary to find a source of clean water.Pampa River, the third longest river in Kerala originates from Pulachimalai. The famous Sabarimala temple is located on bank of Pampa .The pollution of Pampa River is due to the Sabarimala pilgrimage, free flow of sewage, domestic waste and faecal matter into the river.(Firozia *et.al*, 2013).

Phytoremediation is a bioremediation process that uses various types of plants to remove, transfer, stabilize or destroy contaminants in the water and soil. It is clear, simple, cost effective, eco-friendly process(Truong and Smeal, 2013). The*Vetiver Zizanioids (V.Z)* is most useful for phytoremedial application due to its unique morphological and physiological characteristics.

Coliform bacteria are a commonly used bacteria indicator of sanitary quality of food and water. Commonly it is found in faeces of warm-blooded animals. Coliform themselves are not normally cause serious illness but their presence is used to indicate other pathogenic organism.(APHA,1995).The study focuses to remove microbiological pathogens such as e-coli, coliform by *V.Z* on water media technique or Hydroponic technique.

2. Objectives

The study aimed to the following objectives

1) To collect the water sample from the study area during pilgrimage season and study the water quality parameters.
2) To evaluate phytoremediation efficiency using *V.Z*in remediating Coliform bacteria.
3) To study and compare the powdered of *V.Z*roots and shoots grown in the contaminated water and the control of medium.

3. Materials and Methods

Water sample were collected from different 3 stations of River Pampa. These 3 stations were representing different pollution rate.

Station-I: Triveni, place near Sabarimala temple in the district of Pathnamthitta, Kerala. Pilgrims use the water in this region of the Pampa River for sanitary purposes during pilgrimage season.
Station-II: Ranni is one of the largest taluk in Kerala. The renowed Hindu temple of Sabarimala is in this taluk situated approximately 60km from the main town, Ittiapara
Station-III: Parumala, a town in the district of Pathnamthitta, Kerala.

About 2l of sample were collectedat monthly intervals between January 2015 to May2015 for the comparison of Biological parameters like total coliform count and chemical parameter like BOD and CODwith stations according to the standard procedure in APHA, 1992. Scanning Electron Microscopy-EDAX (SEM) is also analyzed according to the standard procedure. The work involved laboratory methods and field work to access the pollution status and phytoremediation of waste using *V.Z*. The sample is collected in sterilized bottle and primarily trial was carried out in laboratory using container of 10l capacity. Small plants of *V.Z* were grown in wastewater with Floating technique in container by the support of thermocoal and allowed plant to grow for 6 months. During the growth of *V.Z*, small amount of water sample was drawn after every 2 months and chemical parameters were measured. SEM of dried sample of roots and shoots of *V.Z* after 6 months were recorded.

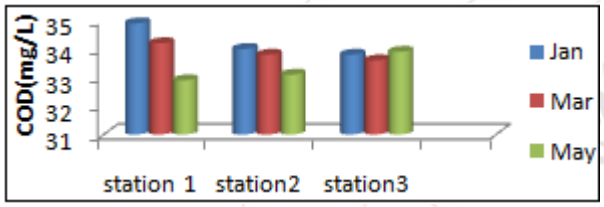
4. Result and Discussions

The important chemical and biological characteristics of water which influences the ecology of the study area, the phytoremedial efficiency of *V.Z* using hydroponic method, and chemical analysis of extract are discussed in this chapter.

Hydrochemistry
Monthly intervals variation between Jan-May 2015of chemical parameters of waterin study area.

Chemical Oxygen Demand (COD).
COD determines the amount of organic pollutants found in waste water. COD is the measure of oxygen required to carry out the oxidation process of organic matter chemically. The permissible limit of COD as per WHO is 10mg/L (Sharma and Kaur, 1994).

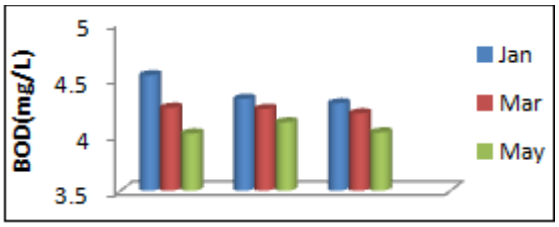
The monthly intervals distributions of COD of different stations of the study area is reported graphically in Fig (I).All the study area showed high COD value. The high COD value could be due to added load of organic matter in wastewater (Neena *et.al*, 2007).



Monthly intervals variation of COD is reported graphically in Fig (I)

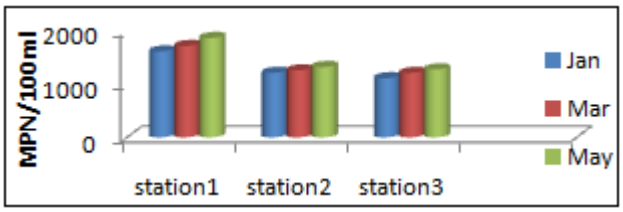
Biological Oxygen Demand (BOD)
It is amount of oxygen required for microbial oxidation of organic compounds in the water body. It is often expressed in mg of oxygen consumed per liter of sample during 5 days of incubation at 20℃. The permissible limit of BOD is 3.0mg/L (ISI, 1983).The monthly intervalsdistributions of BOD at different stations of the study area is reported graphically in Fig (II). The BOD value of water samples from all the stations exceeded the permissible limit.

The monthly intervals variation of BOD is reported graphically Fig(II)



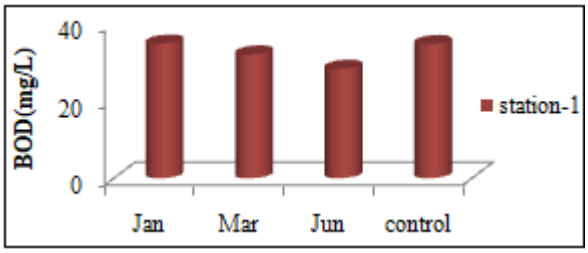
MPN of Coliform
The most basic test for bacterial contamination of a water supply is the test for total coliform bacteria (Girija,2013). Total coliform counts give a general indication of the sanitary condition of a water supply. The MPN method is based on the ability of coliform group of organisms to ferment lactose and produce CO_2. The organic matter is the food of coliform bacteria. The acceptable limit of MPN/100ml proposed by Indian standard limits>10 and 0 for faecal coliform. The monthly intervals distributions of coliform of different stations in the study area is recorded graphically in Fig.(IV).The highest MPN value was seen in station (I), this might be due to the highest amount of organic matter.

The monthly interval variation of coliform is recorded graphically in Fig(IV).



Phytoremediation using *V.Z*
Phytoremediation is a new area of biotechnology that take advantage of act that certain species of plants and fungi flourish by accumulating waste material in wastewater. Contaminants such as metals, pesticides, solvents, crude oil and its derivatives have been mitigated in phytoremediation. Plants absorb contaminants through root systems and transforms through shoot systems. The current study on the treatment performs of *V.Z* in water collected by floating platform technique. The chemical parameters of water samples from station (I) treated with *V.Z* were given in Table (VI) to Table (IX). Water collected from station (I) is used for phytoremediation using *V.Z* because this station is more contaminated from station (II) and (III).

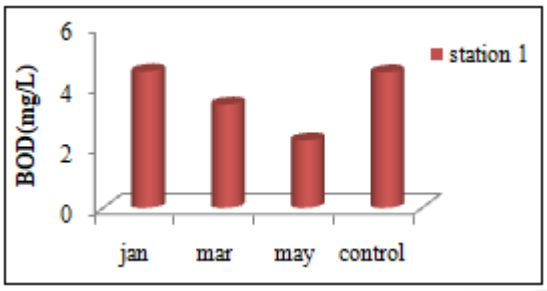
COD
COD in the water sample were decreased by an average of 95% in the treatment pots as compared with that in the control pot. So many works has been done showing the efficiency of *V.Z* in removing COD.Liao *et.al* (2003) showed that within 4 days of planting *V.Z* in pig farm wastewater the COD level reduced to 64% of the initial value. Nyakango and Van Bruggen (1999) also showed a satisfactory removal of COD by planting *V.Z* in waste water. Variation of COD value after planting *V.Z* for every 2 months and control of medium is recorded graphically in Fig (V).



BOD
BOD in the water samples were decreased by an average 95% in the treatment pots as compared with that in the control pots**.** The decrease in BOD as a result of remediation can be directly attributed in the concentration of organic matter in the wastewater as a result of plant growth (Girija, 2013). So many works has been done showing the efficiency of *V.Z* in removing BOD from wastewater.

Liao *et.al*(2003) found that when *V.Z* were grown in pig farm wastewater with BOD at 500 mg/L could reduce to 68% within four days. 90% removal efficiency of BOD by *V.Z* was reported by Lakshmanperumalsamy *et.al* (2008) on the 60th day of planting.

Variation of BOD value after planting *V.Z* for every 2 months and control of medium is recorded graphically in Fig(VI).



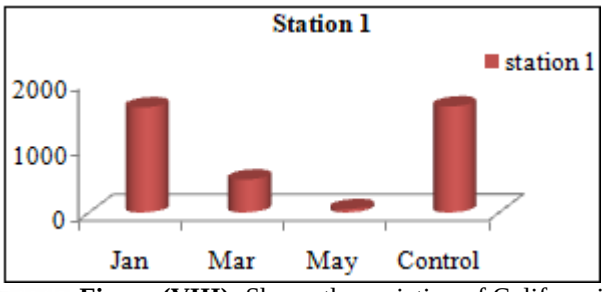


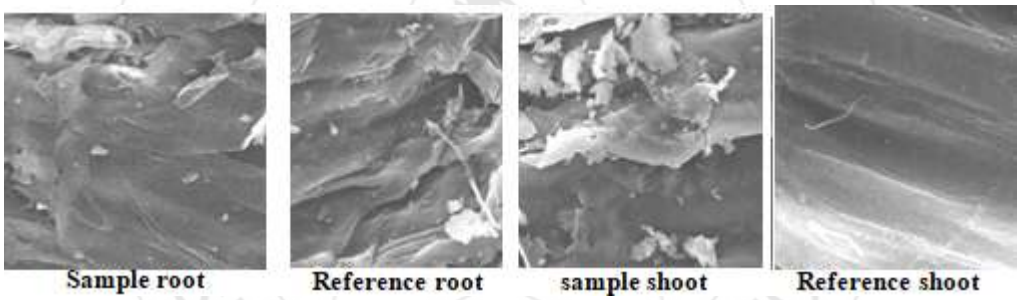
Figure (VIII): Shows the variation of Coliform in station (I) for every 2 months and control medium by planting *V.Z.*

MPN of Coliform

In the present study MPN of Coliform was found to decrease by planting *V.Z* by an average of 94% in the treatment pots as compared with that in the control pots. This may be due to the increase in Dissolved Oxygen (DO), which oxidize the organic matter resulting in the depletion of coliforms. The main factor influenced the rising of DO was due to Oxygen translocation through the root system of *V.Z.*The increase in DO in the solution may also be due to photosynthesis.(Girija,2013).In the control sample which was kept idle for 6 months there has been a steady increase of coliform bacteria. This may be due to the favorable condition for the growth of coliform in stagnant water. Similar work has been carried out by Truong and Hart (2001) and found that *V.Z* successfully removed the waste products from the septic tank effluent in Australia.

Chemical analysis after treatment water

Scanning Electron Microscopy (SEM)



SEM was taken using dried powdered of root and shoot of *V.Z.* On analyzing the SEM of root and shoot, surface modification was found greater in the shoot than in the root. It is supposed that the absorption is may be in root and then transform to shoot where biomass is stored. On comparison SEM result of sample with reference it shows the absorption of microbacterial by *V.Z.* This clearly suggests that *V.Z* is highly beneficial for waste treatment.

5. Summary and Conclusions

Phytoremediation using plants in promising because of its low cost compared to convential physical or chemical methods, suitability for removal of low concentration pollutants.*V.Z* was selected for this study because of its deep root system, fast growth rate and high biomass as well as its high tolerance to heavy metals and organic wastes.The first part of the study covered the monthly intervalscontamination of water by measuring chemical parameter like BOD, COD, and MPN of Coliform. All parametersare comparatively high. Second part of the study involves evaluation of phytoremedial efficiency of *V.Z.* This study was done for about 6 months which shows that *V.Z* improves the water quality by decreasing pollutant. BOD and COD was found to be decreases about 95% and MPN of Coliform decreases by an average of 94% in the treatment pots within 6 months of planting. A SEM result proves that surface absorption is in root which transforms to shoot.

The information presented above clearly demonstrates that the *V.Z* with its many advantages is a very effective and low cost method for treating effluent from both industrial and domestic sources.

References

[1] APHA, Standard methods for estimation of water and waste water, American Public Health Association, New York, 1992.
[2] Firozia Naseema Jalal, Sanal Kumar M.G, Water Quality Assessment of Pampa River of Kerala, India in relation to Pilgrimage season.*International Journal of Research in Chemistry and Environmental, Vol.3 (2013) 341-347.*
[3] Girija.N, Impact of Vetiver on the Hydrochemistry and biogeochemistry of lentic system at Karthikapally in Alleppey District in Kerala*; Ph.D. thesis submitted to University of Kerala, Thiruvananthapuram,2013.*

[4] Lakshmanaperumalsamy.P; Jayashree.S and Rathinamala.J ; Application of Vetiver for water and soil restoration, *A paper presented in Vetiver workshop, (2008) 72-83*
[5] Liao, Studies on plant ecology and system mechanism of constructed wetland for pig farm in South China, *Ph.D. thesis, South China Agricultural University, Guangzhou, China (2000).*
[6] Nyakango J.B and Van Bruggen J J A; Combination of a well-functioning constructed wetland with a pleasing Landscape Design in Nairobi, Kenya, *J.Water Sci.Technol 40(3)(1999) 247-249.*
[7] Sharma B.K and Kaur H; (*J.Environ.chem.GOEL Publishing House, Meerut (1994) 656.*
[8] Trivedi.R.K and Goel P.K, Chemical and biological methods of water pollution studies, *Environ, publications, Karad, India (1986) 248.*
[9] Truong P.N and Hart B; Vetiver system for wastewater treatment (*Tech.Bull NO.2001/2, Pacific Rim VetiverNetwork,Royal Development Project Board, Bangkok, Thailand,2001)*
[10] Truong P.N and Smeal.C, Research development and implication of Vetiver System for wastewater treatment,*GELITA Australia a Pacific Rim Vetiver network Tech.Bull;3 (2003).*
[11] World Health Organization, International standard for Drinking Water.3rd Ed WHO Geneva,(1971).