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Reduction of Domestic Wastewater Pollution Load with the Help of Phytoremediation Method by Using *Azolla Pinnata*

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ABSTRACT: Phytoremediation is one of the eco-friendly novels, efficient cost effective and an innovative method of biotechnology for ecological pollution management. A systematic study was carried out to know the physico-chemical characteristics of domestic waste water and the treatment based on the Phytoremediation method. Results of the initial values and results after the treatment were significantly changed proving that the Phytoremediation is the only technique may decrease the pollution load. The Physicochemical parameters estimated were the dissolved oxygen, BOD, COD, chloride, calcium, total alkalinity, total dissolved solids, turbidity and total hardness. The analysis of DO shows that there is significant change in its level after the Phytoremediation treatment i.e.4.1 to 10.4 mg/litre. The analysis of BOD shows that there is significant decrease in its level after the treatment i.e.35.4 to 12.6 mg/litre. The analysis of COD shows that there is decrease in its level after the treatment i.e.36.1 to 13.8 mg/litre. The analysis of Chlorides shows that there is decrease in its level after the treatment i.e.35.4 to 11.7 mg/litre. The analysis of Calcium shows that there is significant change in its level after the treatment i.e.78.9 to 16.8 mg/litre. The analysis of Total alkalinity shows that there is decrease in its level after the treatment i.e.178.1 to 32.4 mg/litre. The analysis of TDS shows that there is significant change in its level after the treatment i.e.234.1 to 26.8 mg/litre. The analysis of Turbidity shows that there is significant change in its level after the treatment i.e.16.5 to 5.5 mg/litre. The analysis of Total hardness shows that there is significant decrease in its level after the Phytoremediation treatment i.e.78.2 to 23.08 mg/litre. Phyto remediation technique is the need of present era to curb environmental issues.

KEYWORDS: *Azolla pinnata*, physicochemical, parameter, Phytoremediation, pollution.

I. INTRODUCTION

Land and water are very precious natural resources on which rely the overall sustainability of agriculture and the civilization of the mankind. Unfortunately, they have been subjected to optimum exploitation and severely degraded or polluted due to manmade activities. The pollution includes point sources such as discharge, effluents and solid discharge from various industries, vehicle exhaustion and metals from smelting and mining units, and nonpoint sources like soluble salts (natural and artificial), use of insecticides and pesticides, disposal of wastes from industrial and municipalities in agriculture and excessive use of the fertilizers [1, 2, 3]. Each source of pollution has its own damaging effects on the plants, animals and ultimately to health of human beings, but those that add heavy metals to soils and waters are of major concern due to their persistence in the surrounding and carcinogenicity to the human beings. They cannot be disposed biologically but are only transformed from single oxidation state or organic complex to another one [4, 5]. Therefore, any kind of pollution poses a great threat to the environment and human health. Phytoremediation requires more effort than simply planting vegetation and, with less maintenance, considering that the contaminant will disappear. Phytoremediation requires thorough understanding of the processes that need to occur, the plants selected and what needs to be done to ensure overall plant growth. Screening studies will be important in selecting the most efficient plants. Determination of the applicability and efficacy of phytoremediation is likely to be needed on a site-specific basis, at least until the method becomes firmly proven and established. Phytoremediation requires a commitment of the resources and time, but has the significant potential to provide a low expenditure and environmentally acceptable alternative to conventional remedial methods at appropriate sites. Phytoremediation takes advantage of the natural processes of any plant. These processes generally include water and chemical uptake, metabolism, exudates release into the soil which leads to contaminant reduction and the physical and biochemical

effects of plant roots. In last few years the water pollution has become one of the most burning environmental issues at global level. Generally water is never pure in chemical sense. It contains many impurities of various types dissolved as well as suspended matter. When toxic matter enter lakes, streams, rivers, oceans and various water bodies, they get dissolved or lie suspended in water and get sediment. This results in the deterioration of water quality, which affects over the aquatic ecosystems. Contaminants can also seep down and severely affect the groundwater. Polluted waters are turbid, unpleasant, having bad smell, and mostly unfit for drinking, bathing, washing and various purposes [6].

II. RELATED WORK

Phytoremediation describes the treatment of environment contamination by use of plants. Several workers have carried out studies to check potential of various plant species to treat diverse wastewaters and removal of toxicants [7, 8, 9, 10, 11, 12, 6]. Phytoremediation is limited to surface area and the depth which is generally occupied by the roots, slow growth and low biomass require sustainable commitment. With plant based systems of remediation, it is impossible completely to prevent the leaching of pollutants into groundwater. The survival of the plants is mostly affected by toxicity of contaminated land and general condition of the soil. Plant based bioremediation methods have received attention as strategies to clean up polluted soil and water. Diverse plant species show variation in their performance [6].

III. METHODOLOGY

Aurangabad is one of the fast growing, renowned industrial region and which is best known for its Industrial auto cluster and brewery industries. The average temperature observed in summer month max 43°C and min. 28°C and in winter temperature max 32°C to 5°C. The basic sources of irrigation are streams and wells. Ground water plays a crucial role for irrigation needs as well as domestic sector. The Study area covers the Aurangabad in between 74 to 76 degree east longitude and the longitude 19 to 20 degree north [13]. The systematic scientific analysis of domestic waste water was carried out to assess the physicochemical properties and the Phytoremediation treatment was given by using *Azolla Pinnata* plant. Domestic wastewater was taken from a Residential area in Aurangabad city. The work was carried out continuously for five months i.e. January to May month of 2021. Fresh weight of 300 Gms of *Azolla Pinnata* was grown by providing suitable conditions in cement tank of 175 cm breadth, 250 cm length and 75 cm depth, containing domestic waste. Physicochemical parameters were assessed before and after the treatment as per the standard methods [14].

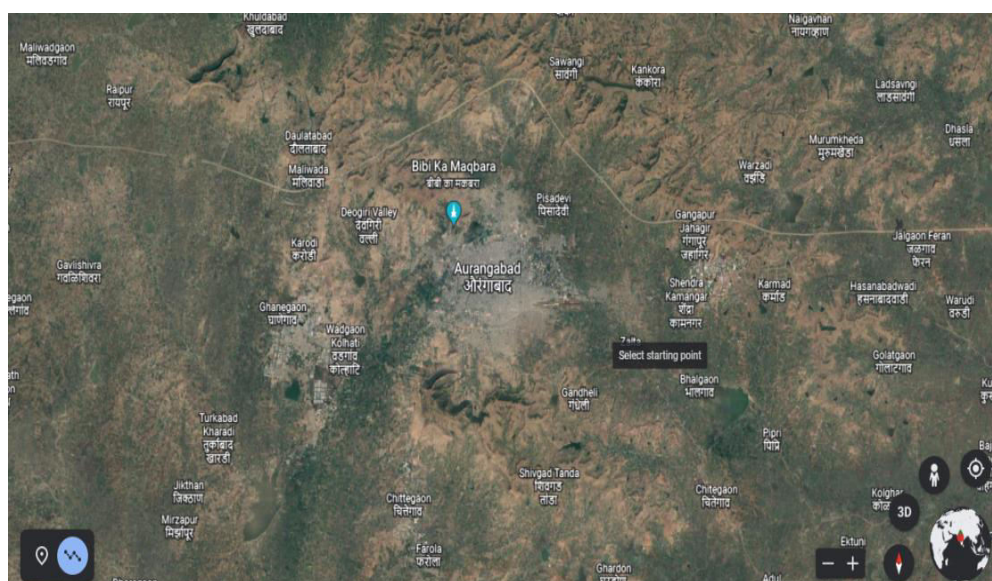


Fig.1. Study area map

IV. EXPERIMENTAL RESULTS

Among all the types of environmental contamination, water pollution is one of the most serious threat to public health especially in the developing and under developed regions, as drinking water quality in these countries is poorly managed [15, 16]. The rigorous study was carried out of domestic waste water was carried out to assess the physicochemical properties of water by using *Azolla Pinnata* plant. The Physicochemical parameters analysed before and after Phytoremediation treatment were dissolved oxygen, BOD, COD, chloride, calcium, total alkalinity, total dissolved solids, turbidity and total hardness.

Table: 1. Minimization in pollution load after Phytoremediation method by using *Azolla Pinnata* plant

Months	June		July		August		September		October	
Parameters	Initial readings	Final readings	Initial readings	Final readings	Initial readings	Final readings	Initial readings	Final readings	Initial readings	Final readings
Dissolved O ₂ (mg/L)	4.5	9.1	3.1	8.2	4.1	10.3	2.8	11.2	3.06	10.5
BOD(mg/L)	22.5	10.2	30.1	8.8	32.5	10.4	35.4	12.6	25.8	12.7
COD(mg/L)	19.5	14.8	22.6	15.6	31.4	16.5	30.5	12.4	36.1	13.8
Chloride(mg/L)	35.4	11.7	30.2	18.7	25.7	12.8	24.9	14.6	21.5	13.2
Calcium(mg/L)	65.8	16.5	70.2	21.5	78.9	16.8	71.4	19.9	48.9	20.7
Total Alkalinity(mg/L)	115	85.2	157.5	65.7	165.2	25.6	178.1	32.4	156.2	25.5
TDS(mg/L)	189.4	54.1	145.5	56.2	204	52.8	234.1	26.8	158.4	56.7
Turbidity(NTU)	9.8	3.5	10.2	4.2	11.6	4.9	16.5	5.5	15.5	3.9
Total Hardness(mg/L)	89.7	23.5	95.8	33.5	65.7	35.6	48.8	24.5	78.2	23.08

Estimated values have been tabulated in table no. 1 and graphically represented in Graph no. 2 to 10. The analysis of DO shows that there is significant change in its level after the Phytoremediation treatment i.e.4.1 to 10.4 mg/litre. The analysis of BOD shows that there is significant decrease in its level after the treatment i.e.35.4 to 12.6 mg/litre. The analysis of COD shows that there is decrease in its level after the treatment i.e.36.1 to 13.8 mg/litre. The analysis of Chlorides shows that there is decrease in its level after the treatment i.e.35.4 to 11.7 mg/litre. The analysis of Calcium shows that there is significant change in its level after the treatment i.e.78.9 to 16.8 mg/litre. The analysis of Total alkalinity shows that there is decrease in its level after the treatment i.e.178.1 to 32.4 mg/litre. The analysis of TDS shows that there is significant change in its level after the treatment i.e.234.1 to 26.8 mg/litre. The analysis of Turbidity shows that there is significant change in its level after the treatment i.e.16.5 to 5.5 mg/litre. The analysis of Total hardness shows that there is significant decrease in its level after the Phytoremediation treatment i.e.78.2 to 23.08 mg/litre.

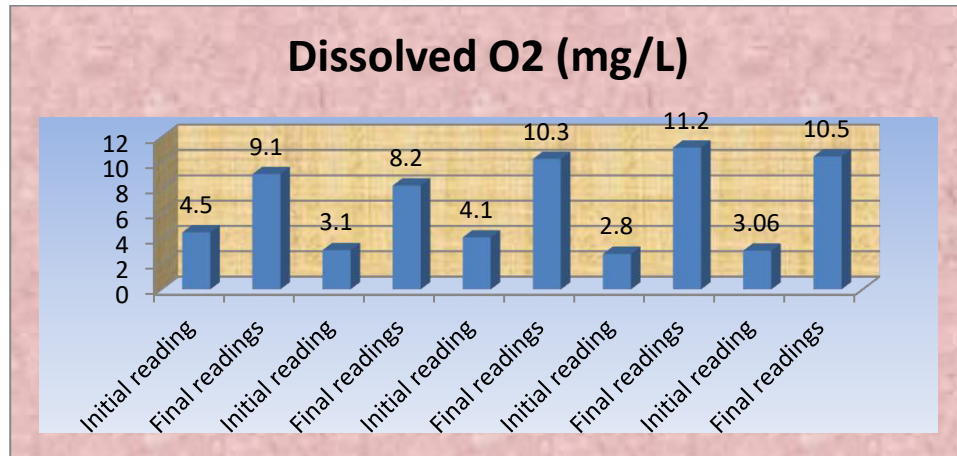


Fig. 2: Initial and final values of DO (June to October 2021)

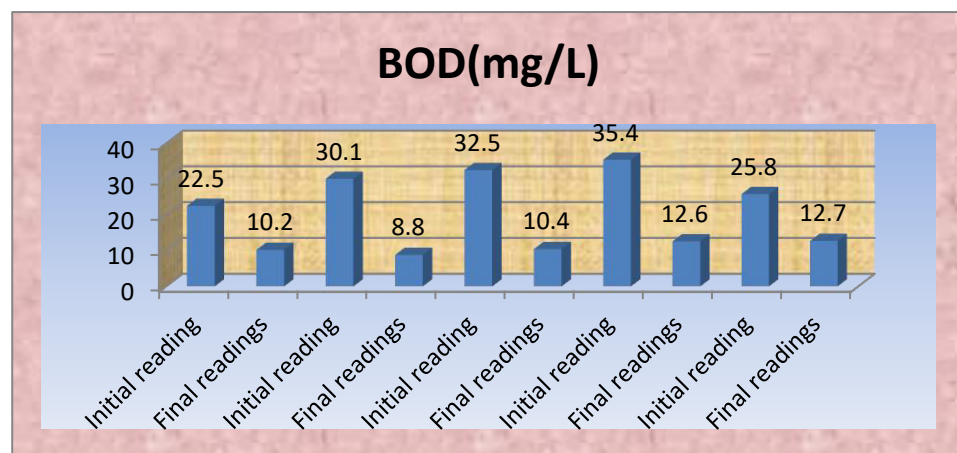


Fig. 3: Initial and final values of BOD (June to October 2021)

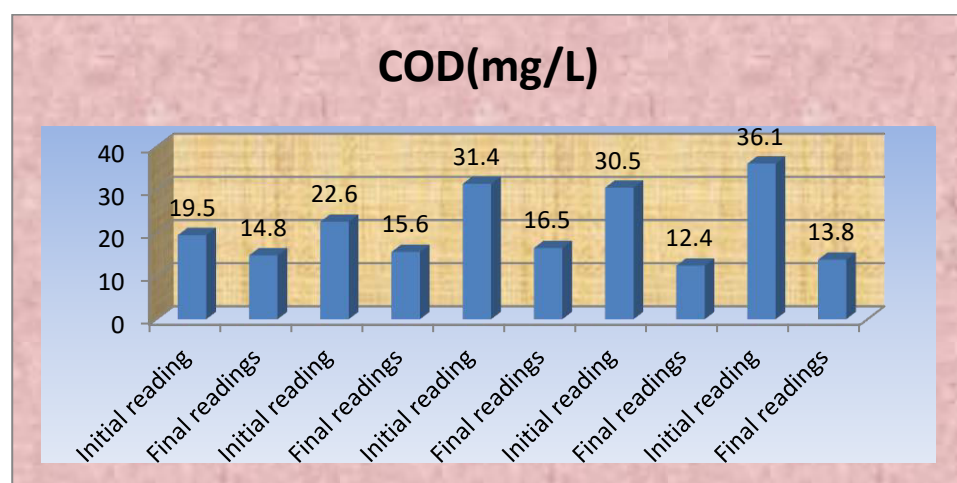


Fig. 4: Initial and final values of COD (June to October 2021)

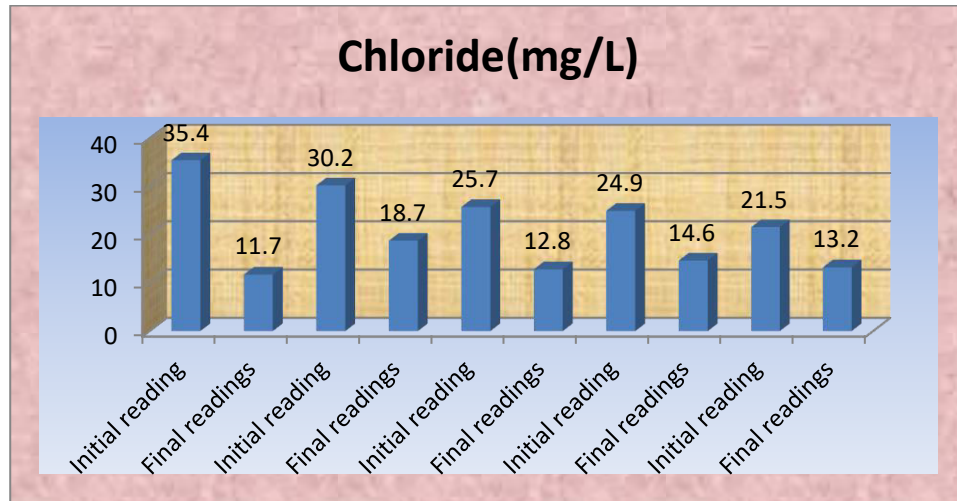


Fig. 5: Initial and final values of Chlorides (June to October 2021)

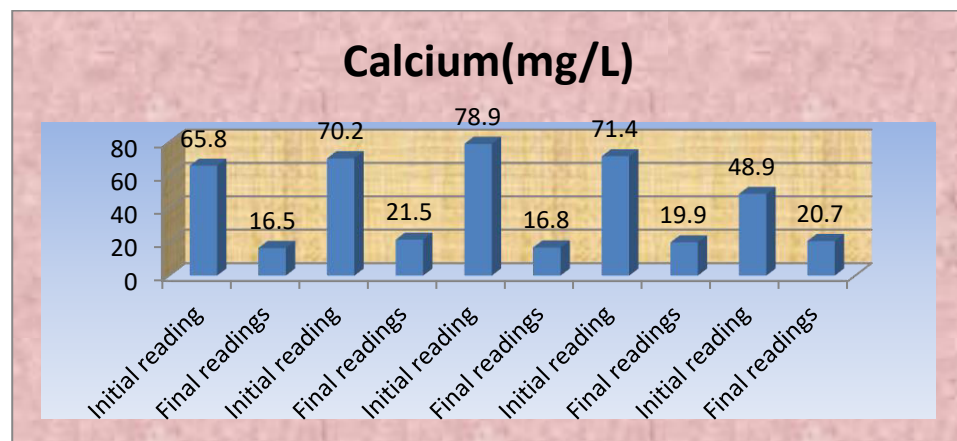


Fig.6: Initial and final values of Calcium (June to October 2021)

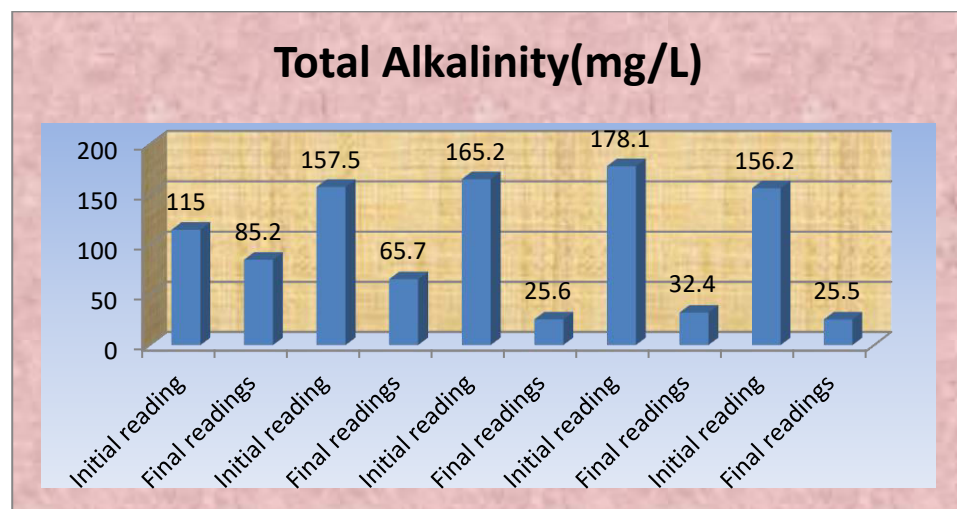


Fig.7: Initial and final values of Total Alkalinity (June to October 2021)

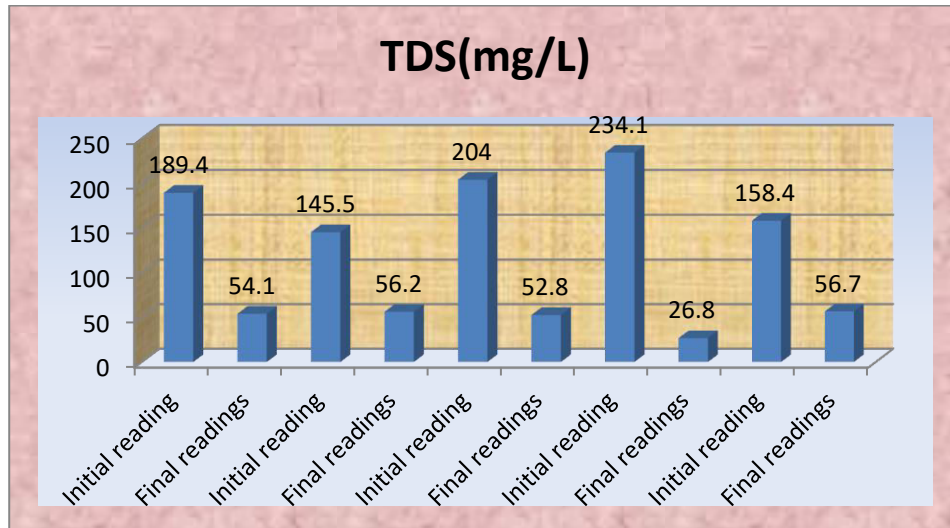


Fig.8: Initial and final values of TDS (June to October 2021)

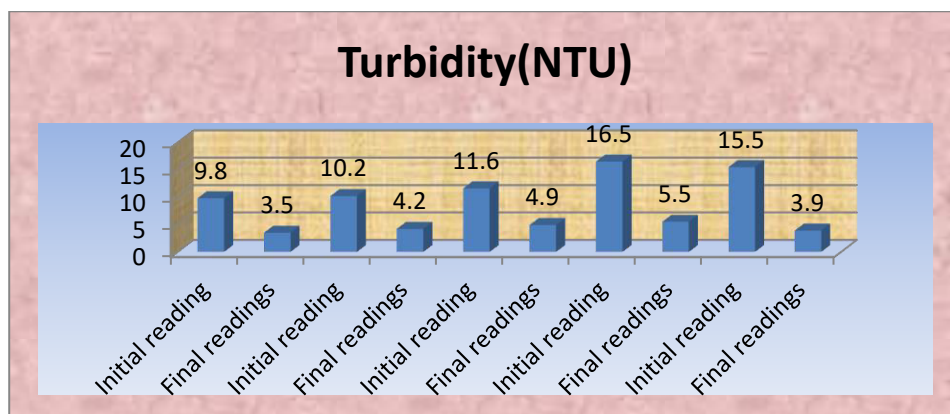


Fig.9: Initial and final values of Turbidity (June to October 2021)

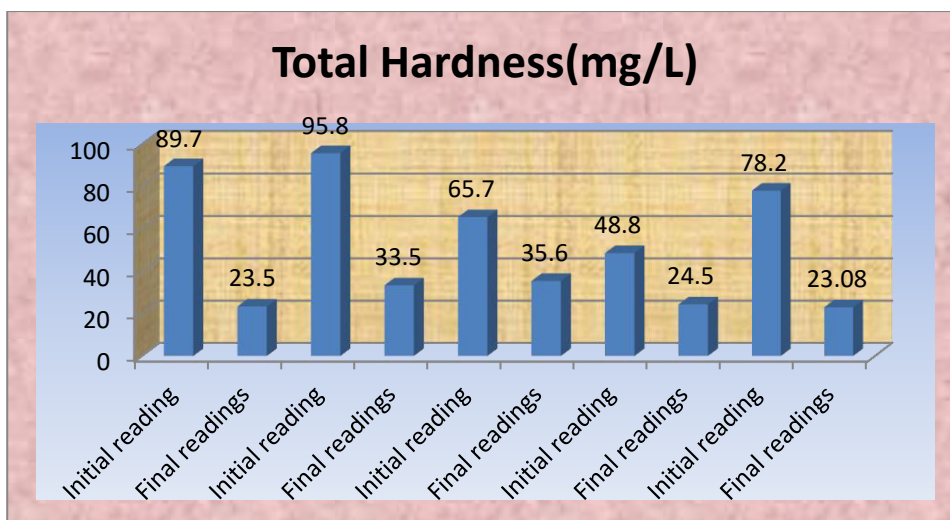


Fig.10: Initial and final values of Total hardness (June to October 2021)

V. CONCLUSION

The present study will be very beneficial to overcome the issues like pollution and contamination of domestic water. The present analysis shows that some crucial parameters were potentially improved after the treatment given by *Azolla Pinnata* plant species. The analysis of DO shows that there is significant change in its level after the Phytoremediation treatment i.e. 4.1 to 10.4 mg/litre. The analysis of BOD shows that there is significant decrease in its level after the treatment i.e. 35.4 to 12.6 mg/litre. The analysis of COD shows that there is decrease in its level after the treatment i.e. 36.1 to 13.8 mg/litre. The analysis of Chlorides shows that there is decrease in its level after the treatment i.e. 35.4 to 11.7 mg/litre. The analysis of Calcium shows that there is significant change in its level after the treatment i.e. 78.9 to 16.8 mg/litre. The analysis of Total alkalinity shows that there is decrease in its level after the treatment i.e. 178.1 to 32.4 mg/litre. The analysis of TDS shows that there is significant change in its level after the treatment i.e. 234.1 to 26.8 mg/litre. The analysis of Turbidity shows that there is significant change in its level after the treatment i.e. 16.5 to 5.5 mg/litre. The analysis of Total hardness shows that there is significant decrease in its level after the Phytoremediation treatment i.e. 78.2 to 23.08 mg/litre. The present study carried out by using standard biotechnological methods.

REFERENCES

- [1] McGrath, S.P., Zhao, F.J., Lombi, E., 2001. Plant and rhizosphere process involved in phytoremediation of metal-contaminated soils. *Plant Soil*, 232(1/2):207-214.
- [2] Nriagu, J.O., Pacyna, J.M., 1988. Quantitative assessment of worldwide contamination of air water and soils by trace metals. *Nature*, 333(6169):134-139.
- [3] Schalscha, E., Ahumada, I., 1998. Heavy metals in rivers and soils of central Chile. *Water Sci. Technol.*, 37(8):251-255.
- [4] Garbisu, C., Alkorta, I., 2001. Phytoextraction: A cost effective plant-based technology for the removal of metals from the environment. *Biores. Technol.*, 77(3):229-236.
- [5] Gisbert, C., Ros, R., de Haro, A., Walker, D.J., Pilar Bernal, M., Serrano, R., Avino, J.N., 2003. A plant genetically modified that accumulates Pb is especially promising for phytoremediation. *Biochem. Biophys. Res. Commun.*, 303(2):440-445.
- [6] Raju A. R., C. T. Anitha, P. D. Sidhimol and K. J. Rosna (2010): Phytoremediation of Domestic Wastewater by Using a Free Floating Aquatic Angiosperm, *Lemna minor* Nature Environment and Pollution Technology, An International Quarterly Scientific Journal Vol. 9 No. 1 pp. 83-88
- [7] Hamdani Al., S.H. and Blair 2004. Influence of copper on selected physiological responses in *Salvinia minima* and its potential use in copper remediation. *American Fern Journal*, 94: 47.
- [8] Asma, E.S. and Tahiro, A. 2005. Reduction in chromium content of tannery effluents by using some selected hydrophytes. *International Journal of Biology and Biotechnology*. 2: 741.
- [9] Bennicelli, R. and Stepniewska, Z. 2004. Ability of *Azolla caroliniana* to remove heavy metals from municipal wastewater. *Chemosphere*, 55: 141.
- [10] Ciria, M.P. and Solano, M.L. 2005. Role of macrophyte *Typha latifolia* in a constructed wetland for wastewater treatment and assessment of its potential as a biomass fuel. *Biosystems Engineering*, 92: 535.
- [11] Jain, S.K., Vasudevan, P. and Jha, N.K. 1989. Removal of some heavy metals from polluted water by aquatic plants, duck weed and water velvet. *Biological Wastes*, 28(2): 155.
- [12] Noraho, N. and Gaur, J.D. 1996. Cadmium adsorption and intracellular uptake by two macrophytes, *Azolla pinnata* and *Spirodela polyrrhiza*. *Archive fur Hydrobiologi*, 136: 135-144.
- [13] Jogdand Onkar. K., Potadar Vishnu, Sormare Vithhal, Naik Mukesh (2021): Ground Water Quality Assessment of Waluj Industrial Area, Aurangabad (MS), India. *International Journal of Scientific Research and Engineering Development*. Volume 4 Issue 4, Pp 1227-1232
- [14] APHA 1989. Standard Methods for Examination of Water and Wastewaters, American Public Health Association, Washington DC.
- [15] Mwegoha WJS (2008). The use of phytoremediation technology for abatement soil and groundwater pollution in Tanzania: opportunities and challenges. *J. Sustain. Dev. Afr.* 10(01):140-156
- [16] Azizullah A, Khattak MN, Richter P, Hader DP (2011). Water pollution in Pakistan and its impact on public health- A review. *Environ. Int.* 37(02):479-97



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