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Municipal Wastewater Treatment with the help of Phytoremediation method by using common water hyacinth *Pontederia Crassipes*

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ABSTRACT: Phytoremediation works on the basis of use of the plants. These processes like water and chemical uptake, metabolism within the plant, exudates discharge into the water that leads to loss of the contaminant and the physicochemical impacts. A systematic study was carried out to know the physico-chemical characteristics of municipal 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 pH, dissolved oxygen, BOD, COD, chloride, calcium, total alkalinity, total dissolved solids, turbidity and total hardness. The present analysis shows that pH in the month of May was significantly improved i.e. 5.78 to 7.1, analysis of Turbidity shows that there is decrease. 9.2 to 2.4 mg/L, TDS in the month of January was significantly decreased i.e. 215.6 to 68.5 mg/L. Total Alkalinity in the month of January was significantly decreased i.e. 145 to 65 mg/L. Chlorides in the month of February was significantly decreased i.e. 68 to 21.1 mg/L. Dissolved O₂ in the month of January was significantly increased i.e. 2.5 to 7.2 mg/L. COD in the month of April was significantly decreased i.e. 25.7 to 10.8 mg/L. Total Hardness in the month of January was significantly decreased i.e. 125 to 65 mg/L. Calcium in the month of March was significantly decreased i.e. 165 to 91.2 mg/L. BOD in the month of March was significantly decreased i.e. 64.1 to 32.8 mg/L. The present study will be very beneficial to overcome the issues like pollution and contamination of domestic water.

KEYWORDS: physicochemical, parameter, phytoremediation, decrease, pollution.

I. INTRODUCTION

Water is crucial element for life and is regarded as most important and beneficial naturally originated resource. Water is the largest common liquid of the Earth, very important to all life forms [1]. Water is very necessary to biotic components and is most important and abundantly available compounds at the global level [2]. Approximately 1% or less than 1% of the earth's water is fresh water on the surface of land, as groundwater, in the atmosphere and of this total amount, most of the water readily available and renewable in lakes and streams for use by the population on the earth. Some research studies demonstrated that only a small percentage (0.01%) of the fresh water is only available as potable water [3]. The water crises at global level and availability of quality water becomes a greatest challenge for development agencies at the global level because all the ground water gets polluted due to rapid urbanization and industrialization processes in the developed and developing world [4]. The extent of artificial environmental pollution in the developing world is well documented by the experts [5]. It is universally accepted that the flora as a suitable vegetation cover develop the quality of life as they absorb harmful pollutants from the environment [6, 7, 8, 9].

II. RELATED WORK

Available literature shows that a healthy, well managed anthropogenic forest can provide many ecological benefits [10]. If water flows quickly over the land surface, many of the pollutants present on the surface, the run-off transports will reach the main body of water. If the water flows more and more slowly due to the presence of vegetation on land more of the pollutants will get filtered out, either by adhering to plants and soil, or by being absorbed through plant roots. They utilize waste water and uptake heavy metals and pollutants due to their extensive root system [11]. Plantation and

vegetation may filter and immobilize sediment and other water pollutants, such as fertilizer and pesticide run-off, reducing water contamination [12]. It has long been identified that natural lands such as forests, parks and wetlands aid to slow and filter the water before it gets to reservoirs, rivers or aquifers, keeping those drinking water sources pure and making treatment cost effective [13].

III. METHODOLOGY

Aurangabad is one of the renown industrial and fastest growing region and which is best known for its Industrial auto cluster. The average temperature observed in summer max 43°C and min. 28°C and in winter temperature max 32°C to 5°C. The main sources of irrigation are streams, percolation tanks and wells. Ground water plays a crucial role for irrigation as well as domestic utilization. The Study area covers the Aurangabad in between 74 to 76 degree east longitude and longitude 19 to 20 degree north [14]. The systematic analysis of municipal waste water was carried out to assess the physicochemical properties and the treatment was given by using *Pontederia crassipes* plant. Domestic wastewater was taken from a Salim Ali lake in Aurangabad city. The work was carried out continuously for five months i.e. January to May month of 2021. Fresh weight of 250 gms of *Pontederia crassipes* which was grown by providing suitable ecological conditions in cement tank of 150 cm breadth, 225 cm length and 100 cm depth, containing municipal waste. Physicochemical parameters were assessed before and after the treatment [15].

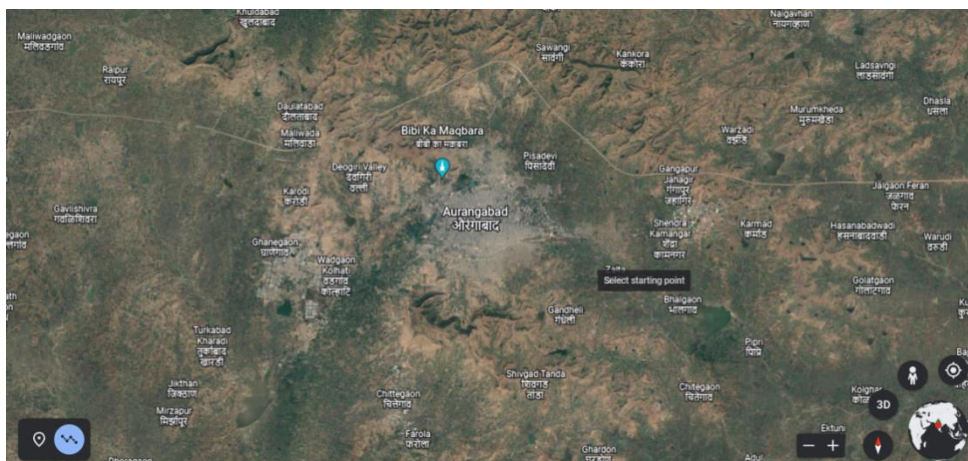


Fig.1. Study area map

IV. EXPERIMENTAL RESULTS

Among all the types of environmental pollution, water pollution is one of the serious threat to public health especially in developing and under developed nations as drinking water quality in these countries is poorly managed [16, 17]. The rigorous analysis of municipal waste water was carried out to assess the physico-chemical properties of water by using *Pontederia crassipes* plant. The Physico-chemical parameters analysed before and after phytoremediation treatment were pH, dissolved oxygen, BOD, COD, chloride, calcium, total alkalinity, total dissolved solids, turbidity, total hardness.

Table: 1. Reduction in pollution load after phytoremediation method by using *Pontederia crassipes* plant

Months	January		February		March		April		May	
Parameters	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
pH	5.98	7.11	6.15	7.8	6.31	7.4	5.91	7.5	5.78	7.1
Dissolved O ₂ (mg/L)	2.5	7.2	4.7	8.09	3.6	8.56	5.9	10.2	7.1	12.5
BOD(mg/L)	22.5	6.8	26.7	12.02	64.1	32.8	44.2	25.7	36.5	14.6
COD(mg/L)	12	5	11.5	9.2	22.4	10.2	25.7	10.8	26	11
Chloride(mg/L)	45	17.5	68	21.1	55.8	25.1	65.2	48.7	38	26.9
Calcium(mg/L)	35	15.8	45.9	25.1	165	91.2	98.2	23.9	69	35.1
Total Alkalinity(mg/L)	145	65	142	57.1	140	49.6	110	28.2	98	21.7
TDS(mg/L)	215.6	68.5	156.5	65	165.2	88.8	198.1	55	181.04	36.7
Turbidity(NTU)	9.2	2.4	5.1	1.6	7.6	2.04	3.3	2.4	8.9	2.8
Total Hardness(mg/L)	125	65	110	65	102	67	98	55	123	78

Observed values have been tabulated in table no. 1 and graphically represented in Graph no. 2 to 11. The analysis of pH shows that there is significant improvement in pH status. pH in the month of May was significantly improved i.e. 5.78 to 7.1. The analysis of Turbidity shows that there is significant decrease in its level. Turbidity in the month of January was significantly decreased i.e. 9.2 to 2.4 mg/L. The analysis of TDS shows that there is significant decrease in its level. TDS in the month of January was significantly decreased i.e. 215.6 to 68.5 mg/L. The analysis of Total Alkalinity shows that there is significant decrease in its level. Total Alkalinity in the month of January was significantly decreased i.e. 145 to 65 mg/L. The analysis of Chloride shows that there is significant decrease in its level. Chloride in the month of February was significantly decreased i.e. 68 to 21.1 mg/L. The analysis of Dissolved O₂ shows that there is significant increase in its level. Dissolved O₂ in the month of January was significantly increased i.e. 2.5 to 7.2 mg/L. The analysis of COD shows that there is significant decrease in its level. COD in the month of April was significantly decreased i.e. 25.7 to 10.8 mg/L. The analysis of Total Hardness shows that there is significant decrease in its level. Total Hardness in the month of January was significantly decreased i.e. 125 to 65 mg/L. The analysis of Calcium shows that there is significant decrease in its level. Calcium in the month of March was significantly decreased i.e. 165 to 91.2 mg/L. The analysis of BOD shows that there is significant decrease in its level. BOD in the month of March was significantly decreased i.e. 64.1 to 32.8 mg/L.

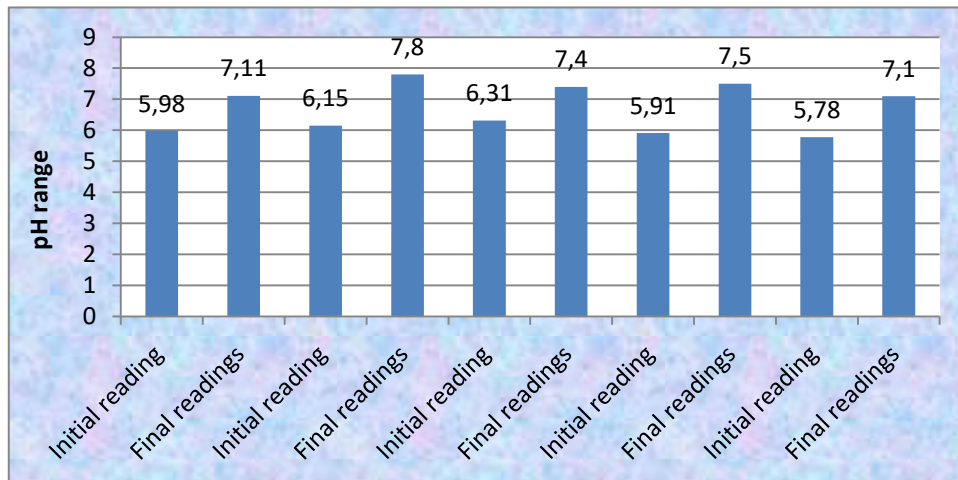


Figure: 2.Change in pH values before and after treatment

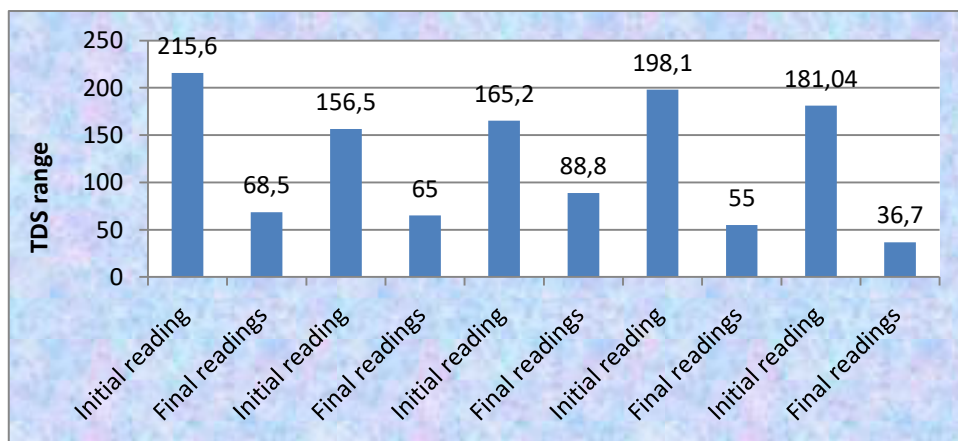


Figure: 3.Change in TDS values before and after treatment

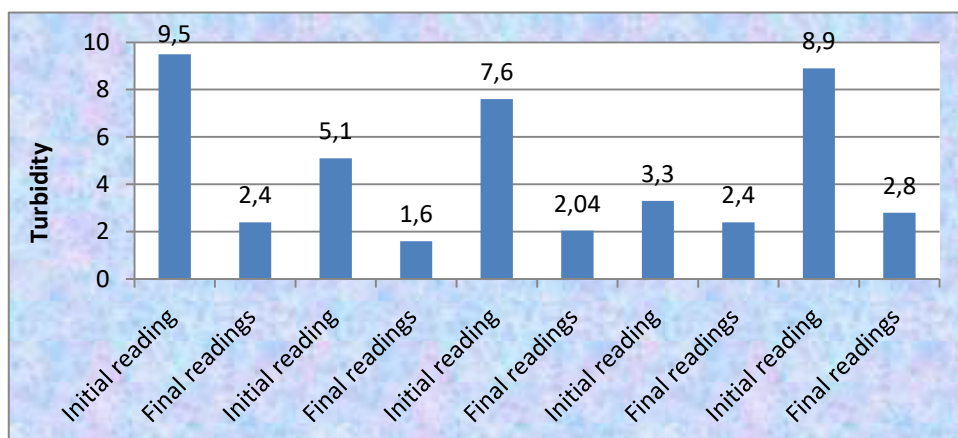


Figure:4 .Change in Turbidity values before and after treatment

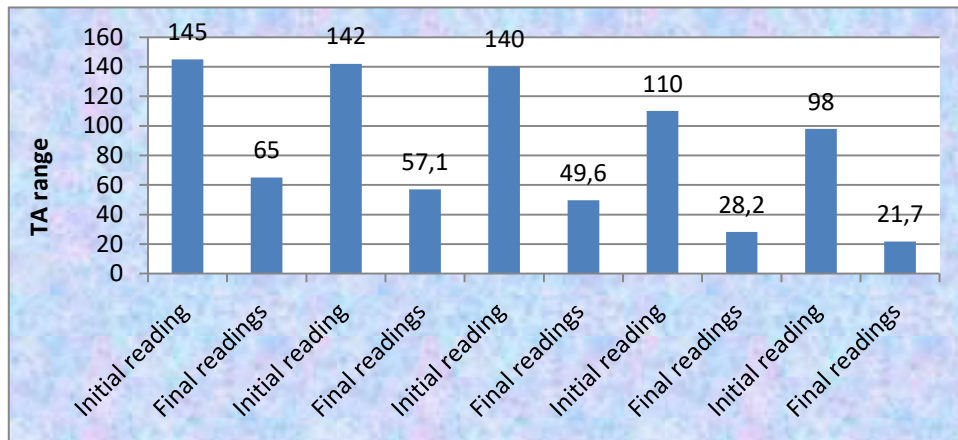


Figure: 5.Change in TA values before and after treatment

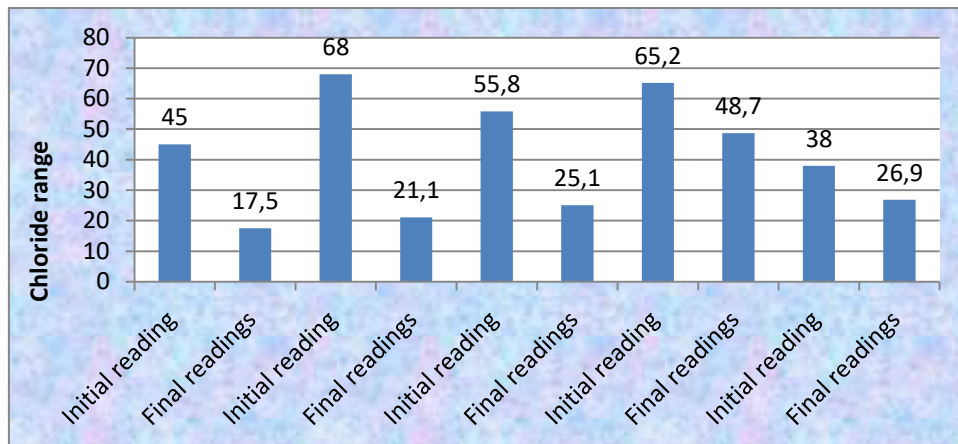


Figure: 6.Change in Chloride values before and after treatment

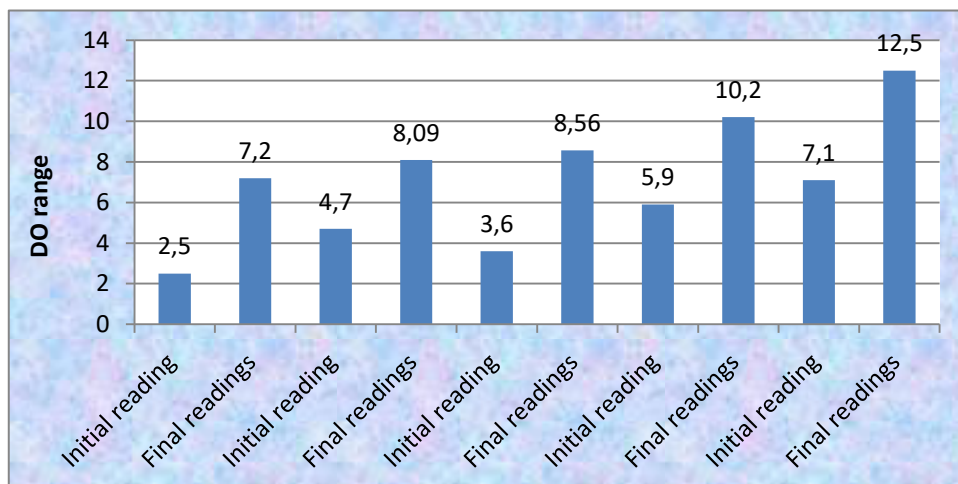


Figure: 7.Change in DO values before and after treatment

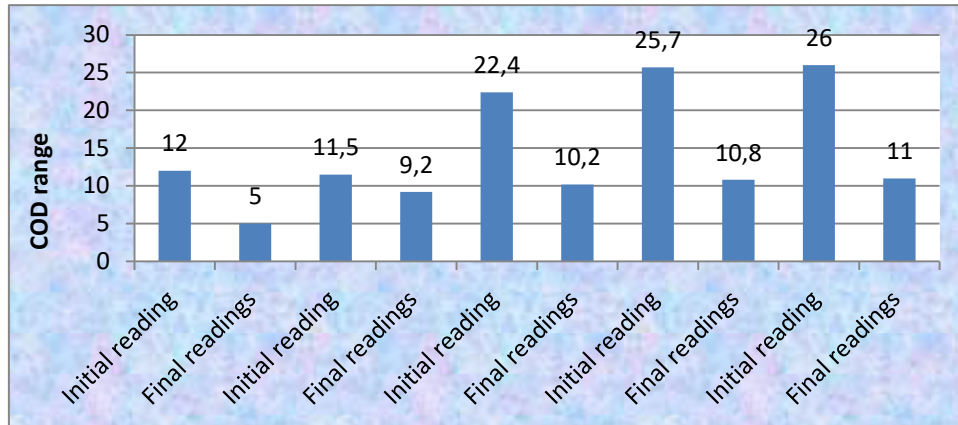


Figure:8.Change in COD values before and after treatment

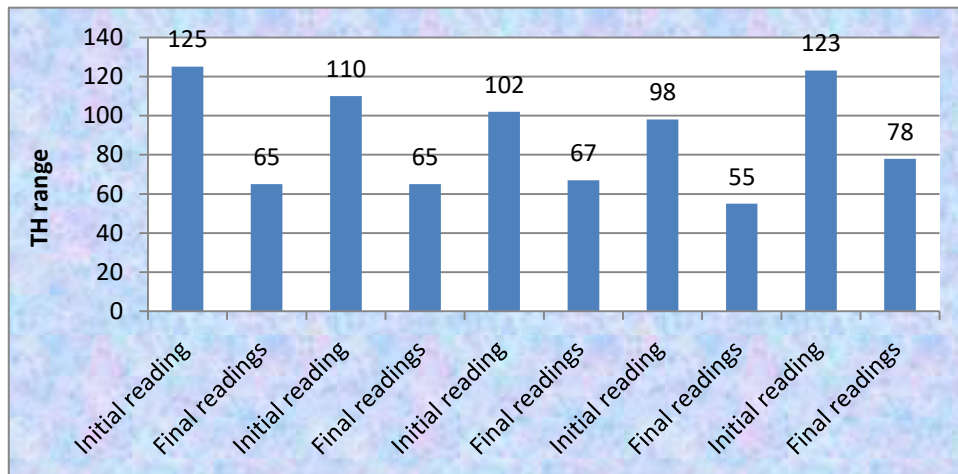


Figure: 9.Change in Total Hardness values before and after treatment

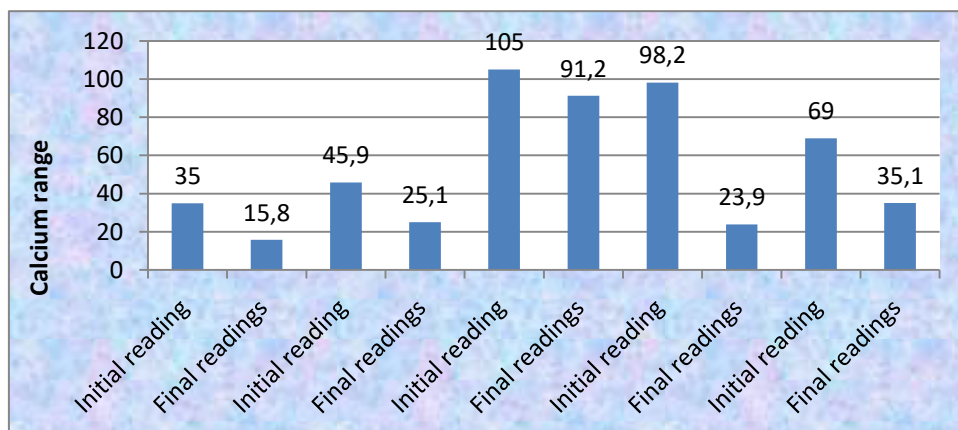


Figure: 10 .Change in Calcium values before and after treatment

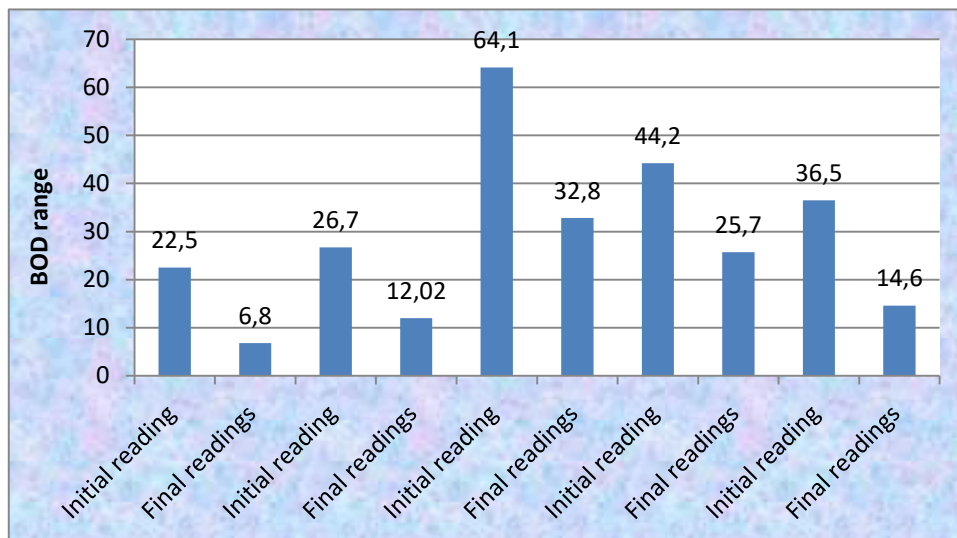


Figure: 11. Change in BOD values before and after treatment

V. CONCLUSION

Phytoremediation needs an understanding of the various processes that required to occur, the plants selected and what needs to be done to ensure overall plant growth. The present analysis shows that some crucial parameters were potentially improved like pH in the month of May was significantly improved i.e. 5.78 to 7.1, analysis of Turbidity shows that there is decrease. 9.2 to 2.4 mg/L., Total Alkalinity in the month of January was significantly decreased i.e. 145 to 65 mg/L. Chlorides in the month of February was significantly decreased i.e. 68 to 21.1 mg/L. Dissolved O₂ in the month of January was significantly increased i.e. 2.5 to 7.2 mg/L. COD in the month of April was significantly decreased i.e. 25.7 to 10.8 mg/L. Total Hardness in the month of January was significantly decreased i.e. 125 to 65 mg/L. BOD in the month of March was significantly decreased i.e. 64.1 to 32.8 mg/L. The present research work carried out by using standard phytoremediation methods. Apart from providing the basic sources in the form of NPK in the soil by the plants, they also provide substantial benefits to water and even soil to decrease pollution load by removing contaminants load. In the 21st century green approaches like phytoremediation techniques proved to be very crucial.

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