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Pollution Load Reduction of Municipal Waste Water by Phytoremediation Technique with the Help of *Polygonum Hydropiper* (Water Pepper) Plant Species in Aurangabad, Maharashtra (India)

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ABSTRACT: The most economically affordable, crucial and ecologically significant pollution removal technique is the Phytoremediation. The Physicochemical parameters estimated were the dissolved oxygen, BOD, COD, chloride, calcium, total alkalinity, total dissolved solids, turbidity and total hardness. The systematic study was carried out in Aurangabad city of Maharashtra state (India). It was aimed to reduce pollution load of municipal waste water. For which physico-chemical parameters of waste water were determined before and after Phytoremediation. The sample estimation of DO shows that there significant reduction observed in the October month i.e. initial 5.1 and final is 10.3 mg/litre. The estimation of BOD shows that there significant reduction observed in the December month i.e. initial 39.4 and final is 10.4 mg/litre. The estimation of COD shows that there significant reduction observed in the December month i.e. initial 35.8 and final is 16.1 mg/litre. The estimation of Chlorides shows that there significant reduction observed in the November month i.e. initial 36.2 and final is 17.4 mg/litre. The estimation of Calcium shows that there is significant reduction observed in the January month i.e. initial 79.5 and final is 26.9 mg/litre. The estimation of Total alkalinity shows that there significant reduction observed in the December month i.e. initial 185.2 and final is 69.1 mg/litre. The estimation of TDS shows that there significant reduction observed in the February month i.e. initial 204 and final is 52.8 mg/litre. The estimation of Turbidity shows that there significant reduction observed in the October month i.e. initial 16.5 and final is 5.5 mg/litre. The estimation of Total Hardness shows that there significant reduction observed in the October month i.e. initial 95.8 and final is 33.5 mg/litre. Phytoremediation is one of the technique has great potential to minimise the pollution load. In the present era it is found that some of the plants have the ability to minimise the contamination level by maintaining the ecological balance of the nature.

KEYWORDS: phytoremediation, reduction, parameter, pollution, final

I. INTRODUCTION

The combination of important two words Phyton plant in Greek language and Remediar-remedy in Latin language results into the term phytoremediation. Phytoremediation is a potent, cheaper and feasible sustainable method for reduction of pollutants. At the same time, it is an eco-friendly and further, it does not negatively affect people living and working in the ambient surrounding as it uses plants for cleaning nature. The plant origin microbes or involved microbiota are generally used to take up the pollution from soil or water. The remediation is achieved either by retaining, elimination or degradation, by the natural activities as it happens in an ecosystem by the association of organic or inorganic constituent major cycles, thus lead to the improvement of a low-cost remediation technology. Many plant species possess the endogenous quality to manage the soil, water, and air pollution. The fundamental principle behind phytoextraction is the plants potential to accumulate various metals. Sources of water pollutants are of two important types. First is point sources and second nonpoint sources. Point sources of pollution occur when harmful substances are released directly into a body of water. A nonpoint source delivers pollutants indirectly by environmental changes. The control of water pollution is one of the best aspects of environmental protection. Most of the growing cities in India hardly treatment facility and are simply diverting the untreated domestic wastewater into the aquatic bodies like rivers, ponds and lakes posing issue of Eutrophication. In this context phytoremediation may prove to be a

great solution. The pollution includes point sources such as discharge, effluents and solid discharge from various industries, vehicle exhaust 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].

II. RELATED WORK

Nowadays pollution of crucial water resources is a major concern and it is a main global cause of diseases and numerous deaths [4]. Water is an ecological and essential resource for the existence of life on the earth. But approximately 98% of the water present on earth is sea water, which cannot be used due to high salt concentration and other 2% is available as the freshwater. Most of the freshwater is locked up in the ice and in ground, only 1.2% of it is accessible to human beings for fulfil their demands [5]. The many organic compounds like dyes, bleaching salts, starch, synthetic polymers, surface active polymers, finishing chemicals etc. are consumed in various processes [6]. Heavy metals pollution is also a matter of prime concern due to bio accumulative nature of the heavy metals in biotic life forms. Heavy metals are vulnerable to be noxious and proved to be most carcinogenic in small concentration up to ppm [7]. 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 waste waters and removal of toxicants. They cannot be disposed by biological method but are only transformed from single oxidation state or organic complex to different complexes [8, 9]. It results in the deterioration quality of water, which affects over the aquatic ecosystems. Contaminants can also seep down and largely affect the groundwater. Polluted waters are mostly turbid, unpleasant, having bad smell, and unfit for uses like drinking, bathing, washing etc. [10].

III. METHODOLOGY

Aurangabad is one of the fastest growing, renowned industrial regions in Maharashtra (India), which is popularly known for its superior Industrial auto cluster and brewery industries. The average temperature observed in the summer month maximum i.e. 43.5°C and minimum 28.2°C and in winter temperature maximum 32°C. The fundamental sources of irrigation are wells and stream. Ground water plays a crucial role for irrigation demands as well as domestic region. The Study location covers the Aurangabad in between 74 to 76 degree east longitude and the longitude 19 to 20 degree north [11]. The systematic scientific analysis of municipal waste water has been carried out to analyse the selected physicochemical characteristics and the Phytoremediation treatment given by using *Polygonum hydropiper* plant. Domestic wastewater was taken from a municipal corporation station in Aurangabad city. The work was carried out continuously for five months i.e. October 2021 to February month of 2022. Fresh weight of 250 Gms of *Polygonum hydropiper* was grown by supplying suitable ecological conditions in cement tank of 185 cm breadth, 375 cm length and 100 cm depth, containing municipal waste. Selected Physicochemical parameters were analysed before and after the treatment as per the standard methods [12].

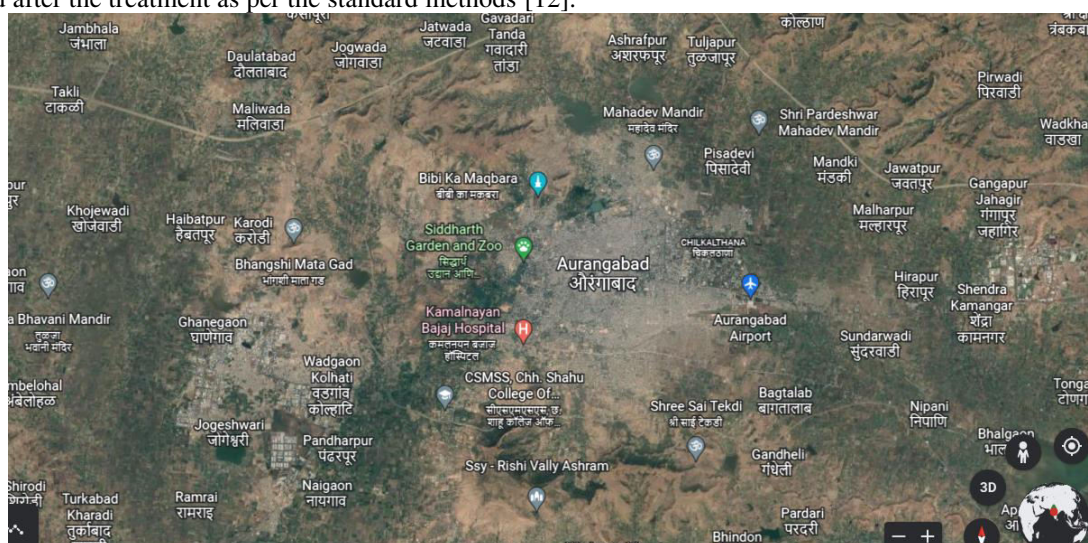


Fig.1. Study area map

IV. EXPERIMENTAL RESULTS

Among all the types of ecological pollution types, water pollution is one of the most disastrous and complicated threat to public health especially in the developing regions, as potable water quality in these countries is significantly managed [13, 14]. The scientific study was carried out of domestic waste water was carried out to assess the physicochemical properties of water by using *Polygonum hydropiper* plant. The Physical and chemical 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 *Polygonum hydropiper* plant

Months	October		November		December		January		February	
Parameters	Initial reading	Final reading	Initial reading	Final reading	Initial reading	Final reading	Initial reading	Final reading	Initial reading	Final reading
Dissolved O ₂ (mg/L)	5.1	10.3	3.8	4.5	2.8	9.2	3.06	8.3	2.8	7.2
BOD(mg/L)	38.4	13.6	25.8	12.7	39.4	10.4	16.6	9.2	27.1	11.6
COD(mg/L)	15.6	7.5	30.5	16.5	35.8	16.1	19.5	11.5	22.6	16.7
Chloride(mg/L)	21.5	14.6	36.2	17.4	32.7	11.2	18.7	11.7	30.2	18.7
Calcium(mg/L)	48.9	19.9	66.7	21.8	65.5	22.1	79.5	26.9	73.8	30.4
Total Alkalinity(mg/L)	125.6	65.2	178.1	32.4	185.2	69.1	115	85.2	157.5	65.7
TDS(mg/L)	158.4	26.8	165.7	88.7	169.1	98.5	145.5	56.2	204	52.8
Turbidity(NTU)	16.5	5.5	15.5	3.9	10.2	4.2	11.6	10.2	14.2	7.9
Total Hardness(mg/L)	95.8	33.5	78.2	23.08	48.8	24.5	65.7	35.6	89.7	23.5

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 significant reduction found in the October month i.e. initial 5.1 and final is 10.3 mg/litre. The analysis of BOD shows that there significant reduction found in the December month i.e. initial 39.4 and final is 10.4 mg/litre. The analysis of COD shows that there significant reduction found in the December month i.e. initial 35.8 and final is 16.1 mg/litre. The analysis of Chlorides shows that there significant reduction found in the November month i.e. initial 36.2 and final is 17.4 mg/litre. The analysis of Calcium shows that there significant reduction found in the January month i.e. initial 79.5 and final is 26.9 mg/litre. The analysis of Total alkalinity shows that there significant reduction found in the December month i.e. initial 185.2 and final is 69.1 mg/litre. The analysis of TDS shows that there significant reduction found in the February month i.e. initial 204 and final is 52.8 mg/litre. The analysis of Turbidity shows that there significant reduction found in the October month i.e. initial 16.5 and final is 5.5 mg/litre. The analysis of Total Hardness shows that there significant reduction found in the October month i.e. initial 95.8 and final is 33.5 mg/litre.

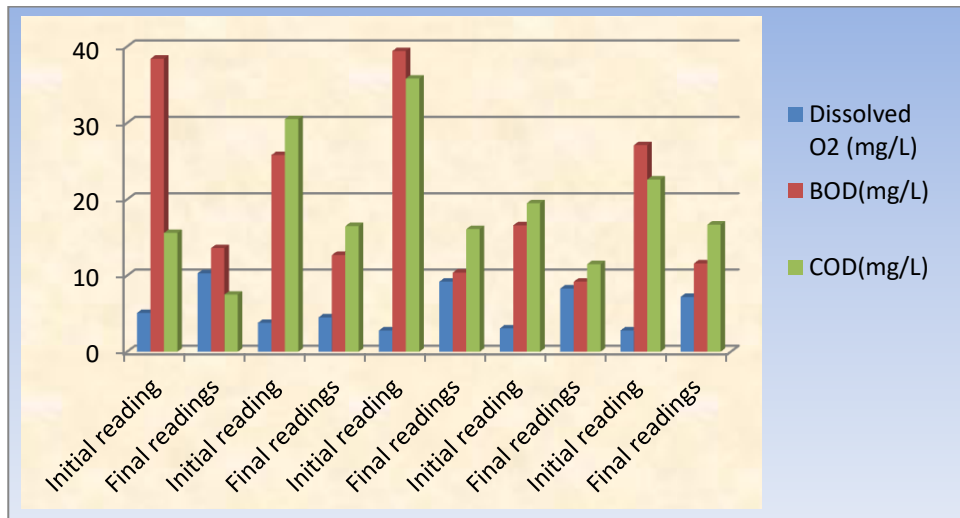


Fig.2: Initial and final values of DO, BOD & COD (October 2021 to February 2022)

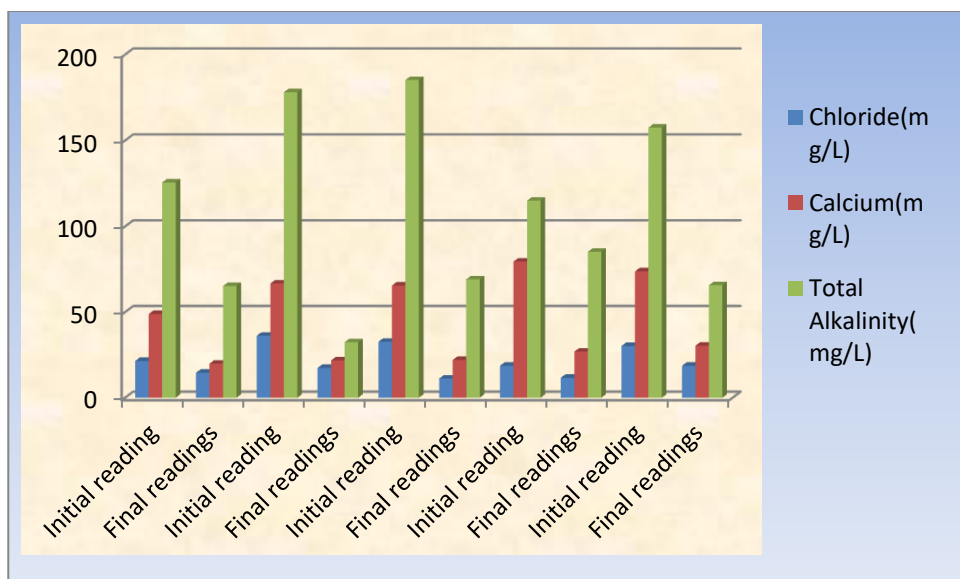


Fig.3: Initial and final values of Chlorides, Calcium & Total alkalinity (October 2021 to February 2022)

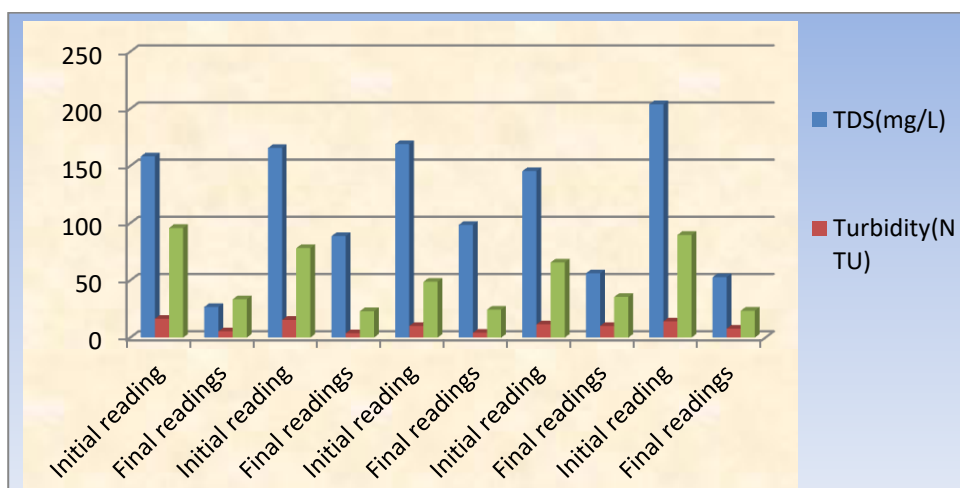


Fig.4: Initial and final values of TDS, Turbidity & Total Hardness (October 2021 to February 2022)

V. CONCLUSION

The present innovative study by using phytoremediation method with the help of *Polygonum hydropiper* plant species found very crucial as far as the pollution of municipal waste water is concerned. A scientifically planned research study was carried in Aurangabad a city to know the contamination level of waste water of the municipal waste water. It is found that in almost all the areas water contamination level was significantly controlled. The analysis of DO shows that there significant reduction found in the October month i.e. initial 5.1 and final is 10.3 mg/litre. The analysis of BOD shows that there significant reduction found in the December month i.e. initial 39.4 and final is 10.4 mg/litre. The analysis of COD shows that there significant reduction found in the December month i.e. initial 35.8 and final is 16.1 mg/litre. It was continued for all the selected parameters. The analysis of Chlorides shows that there significant reduction found in the November month i.e. initial 36.2 and final is 17.4 mg/litre. The analysis of Calcium shows that there significant reduction found in the January month i.e. initial 79.5 and final is 26.9 mg/litre. The analysis of Total alkalinity shows that there is significant reduction found in the December month i.e. initial 185.2 and final is 69.1 mg/litre. The analysis of TDS shows that there significant reduction found in the February month i.e. initial 204 and final is 52.8 mg/litre. The analysis of Turbidity shows that there significant reduction found in the October month i.e. initial 16.5 and final is 5.5 mg/litre. The analysis of Total Hardness shows that there significant reduction found in the October month i.e. initial 95.8 and final is 33.5 mg/litre. The potential role of *Polygonum hydropiper* plant species results in to the reduction in the pollution levels. Phytoremediation method is the need of the time to form a ecological balance.

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