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Potential Use of *Canna indica* for Phytoremediation of Municipal Waste Water to Minimize Pollution Load

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ABSTRACT: Phytoremediation is a crucial scientific technology that exploits the natural ability of green plant's to remove pollutants from the environment or make toxic compounds harmless. Phytoremediation has been gaining attention as a rapidly developing, inexpensive remediation technology based on plants use. A systematic analysis was carried out in Aurangabad city of Maharashtra, India to minimise the pollution load by phytoremediation method. 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. *Canna indica* plant species used to minimise pollution load of the water. The Physicochemical parameters estimated before and after Phytoremediation treatment were total alkalinity, total dissolved solids, turbidity and total hardness. BOD, COD, Chloride and Calcium. The analysis of parameters after the phytoremediation shows significant variation in almost all the parameters. Highest recovery in the Total Alkalinity values found in the September month i.e. 84.7 mg/litre. Highest recovery in the TDS values found in the July month i.e. 130.3 mg/litre. Highest recovery in the Turbidity values found in the October month i.e. 5.74 NTU. Highest recovery in the Total Hardness values found in the November month i.e. 118.9 mg/litre. Highest recovery in the BOD values found in the September month i.e. 29.7 mg/litre. Highest recovery in the COD values found in the November month i.e. 26.3 mg/litre. Highest recovery in the Chloride values found in the October month i.e. 39.8 mg/litre. Highest recovery in the Calcium values found in the July month i.e. 53.7 mg/litre. On the basis of present research outcomes it is recommended that phytoremediation technique has great potential to minimize water pollution load.

KEYWORDS: parameters, *Canna indica*, minimize, pollution

I. INTRODUCTION

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. In last few years, there has been a growing awareness to provide efficient, inexpensive, and eco- friendly options for the remediation of pollutants in municipal waste water. Currently, most facilities adopt methods like chemical precipitation that can be costly and produce hazardous waste issues of their own [1]. Phytoremediation is one of the superior biological wastewater treatment way of treatment [2], and is the concept of utilization of plant-based systems and microbiological processes to remove contaminants in nature. It is referred as the engineered use of green plants including aquatic microbes, grasses and woody species to remove, contain, or render harmless such environmental contaminants as heavy metals, trace elements, organic compounds and radioactive compounds in soil or water. Phytoremediation is a promising scientific cleanup technology for contaminated soils, groundwater and wastewater.

II. RELATED WORK

The remediation techniques utilize particular planting arrangements, floating-plant systems and numerous other ways [3]. Besides it, water quality improvement and energy savings, constructed wetland have other ecological protection features such as promoting biodiversity, providing proper habitat for organisms and the wildlife like

birds and reptiles in large systems), serving climatic CO₂ production [4]; major hydrological functions and biomethylation [5]. These systems are generally cost effective, simple, ecologically sustainable no disruptive [6], ecologically sound with very low maintenance cost [7]; and lowest land demand. Studies conducted by some experts show that many plants has the huge potential for removal of the wide range of pollutants from wastewater [8] and has the potential to grow in severe polluted waters [9]. It is also used to develop the quality of water by reducing the levels of organic with inorganic nutrients[10]. Plant roots potentially stabilize soil and prevent movement of the pollutants via runoff and windblown dust. The technique utilize plants and natural resources and is therefore generally less expensive compared to other methods. The remediation is done in place, saving transportation with its expenditure. Many metals like Mercury, lead, and arsenic are metals cause contamination and hazard to the environment. Contaminants hardly affect humans through air pollutants, consumption of contaminated potable water, and exposure to polluted soils. Pollution of water sources, increased toxicity in the plants and animal life, air pollution.

III. METHODOLOGY

The Study area 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 was carried out to assess the physicochemical properties and the Phytoremediation treatment was adopted by using *Canna indica* plant. Municipal wastewater was taken from Aurangabad city. The work was carried out continuously for five months i.e. July, August, September October and November in 2021. Fresh weight of 350 Gms of *Canna indica* plant was systematically grown by providing best ecological conditions in properly designed cement tank having the size 175 cm breadth, 275 cm length and 80 cm depth, containing municipal waste. Physicochemical parameters of the water samples were assessed before and after the treatment as per the standard method [12].

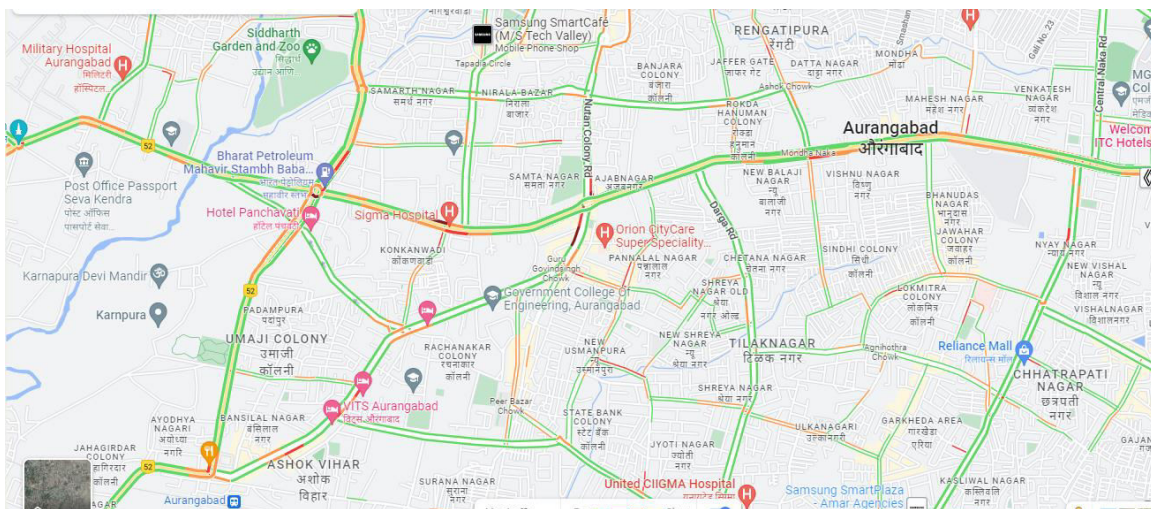


Fig.1. Study area map

IV. EXPERIMENTAL RESULTS

Compared to remaining all types of pollution, water pollution is one of the most hazardous to ecosystem and human health especially in the fast growing cities, as drinking water quality in these regions is poorly managed and less attention is given. The rigorous study was carried out of municipal waste water samples from Aurangabad city to estimate the physicochemical properties of water by using *Canna indica* plant. The Physicochemical parameters estimated before and after Phytoremediation treatment were total alkalinity, total dissolved solids, turbidity and total hardness. Chloride, calcium, BOD and COD.

Table: 1. Minimization in pollution load after Phytoremediation method by using

Months	July		August		September		October		November	
Parameters	Initial reading	Final readings	Initial reading	Final readings	Initial reading	Final readings	Initial reading	Final readings	Initial reading	Final readings
Total Alkalinity(mg/L)	106.1	35.2	115.6	32.8	121.4	36.7	98.5	26.8	101.9	32.8
TDS(mg/L)	156	25.7	125.7	35.6	153.5	25.8	145.3	63.7	157.2	41.8
Turbidity(NTU)	7.8	2.5	9.5	3.6	7.1	4.7	9.8	4.06	7.7	3.92
Total Hardness(mg/L)	152.4	95.8	115.7	69.7	148.3	55.8	108.1	69.8	165.7	46.8
BOD(mg/L)	26.7	6.1	31.2	7.1	35.2	5.5	27.8	6.8	21.8	7.1
COD(mg/L)	21.4	2.3	23.5	3.5	19.8	2.7	25.7	4.2	30.1	3.8
Chloride(mg/L)	36.7	12.5	33.6	13.8	41.5	12.8	56.2	16.4	48.7	12.7
Calcium(mg/L)	65.8	12.1	52.8	16.8	53.7	11.3	49.2	14.7	53.8	16.7

Estimated values have been tabulated in table no. 1 and graphically represented in Graph no. 2 to 10. The analysis of Total alkalinity shows that there is significant variation found in the initial and final values i.e. before treatment and after the treatment. Total alkalinity of July month was 106.1 and the final value was 35.2, August month 115.6 changed to 32.8, October month's variation was from 98.5 to 26.8 and November month's variation was 101.9 to 32.8. All the remaining parameters show approximately similar kind of change in the initial and final values of the parameters.

Table 2: Difference in the observed values of estimated parameters after the treatment

Parameter and Months	Difference in readings				
	July	August	September	October	November
Total Alkalinity(mg/L)	70.9	82.8	84.7	71.7	69.1
TDS(mg/L)	130.3	90.1	127.7	81.6	115.4
Turbidity(NTU)	5.3	5.9	2.4	5.74	3.78
Total Hardness(mg/L)	56.6	46	92.5	38.3	118.9
BOD(mg/L)	20.6	24.1	29.7	21	14.7
COD(mg/L)	19.1	20	17.1	21.5	26.3
Chloride(mg/L)	24.2	19.8	28.7	39.8	36
Calcium(mg/L)	53.7	36	42.4	34.5	37.1

Observed difference values in the parameters after the treatment have been tabulated in table no. 2. The analysis of parameters after the phytoremediation shows significant variation in almost all the parameters. Highest recovery in the Total Alkalinity values found in the September month i.e. 84.1 mg/litre. Highest recovery in the TDS values found in the July month i.e. 130.3 mg/litre.

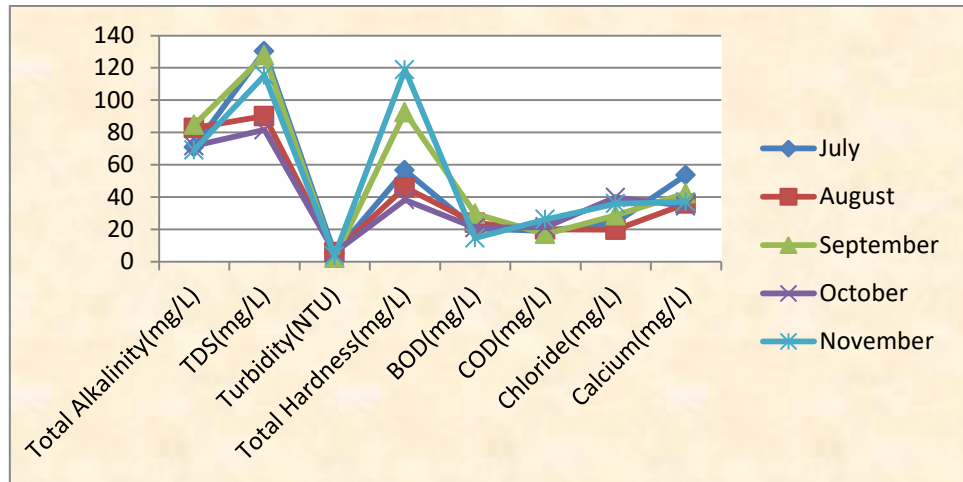


Fig. 2: Initial and final values of DO (June to November 2021)

Highest recovery in the Turbidity values found in the October month i.e. 5.74 NTU. Highest recovery in the Total Hardness values found in the November month i.e. 118.9 mg/litre. Highest recovery in the BOD values found in the September month i.e. 29.7mg/litre. Highest recovery in the COD values found in the November month i.e. 26.3 mg/litre. Highest recovery in the Chloride values found in the October month i.e. 39.8 mg/litre. Highest recovery in the Calcium values found in the July month i.e. 53.7 mg/litre.

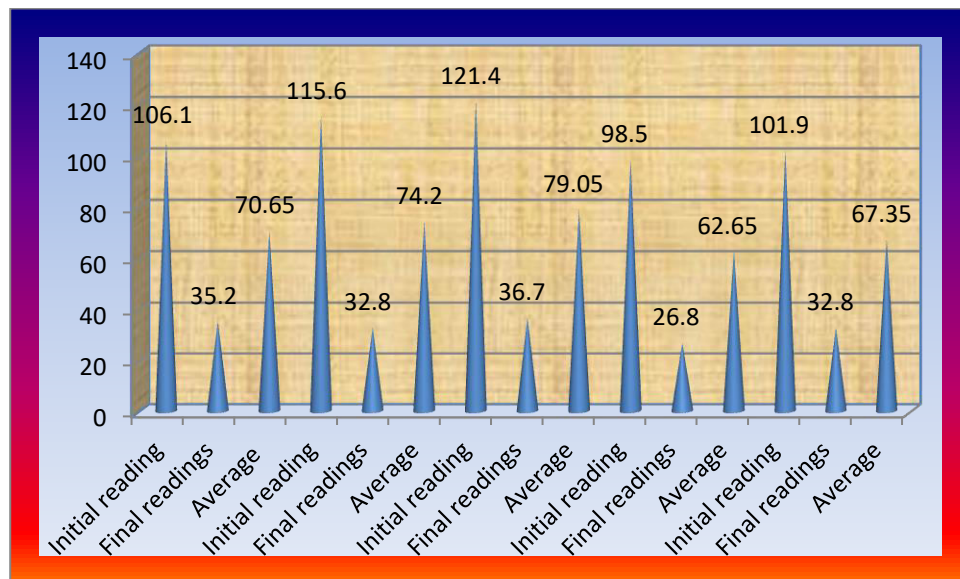


Fig. 3: Initial and final values of Total Alkalinity (June to November, 2021)

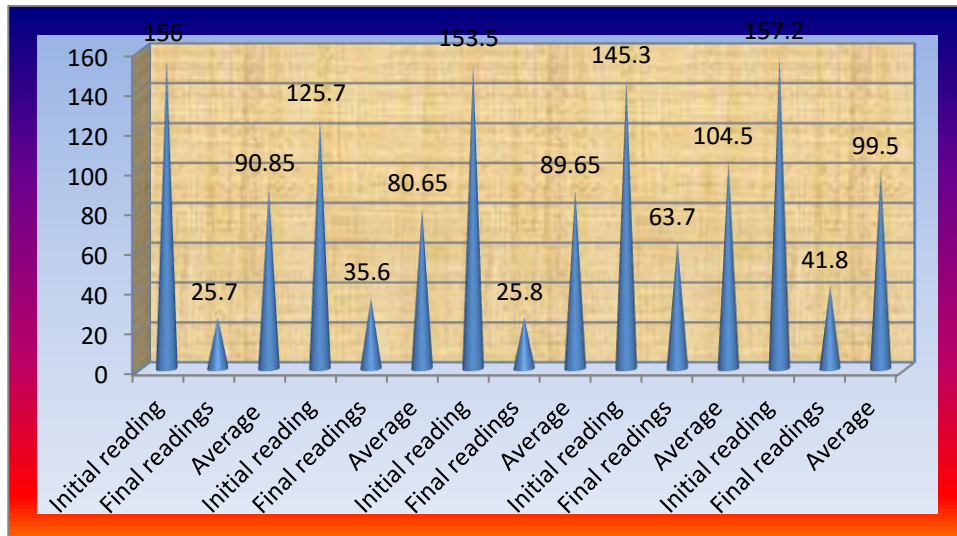


Fig.4: Initial and final values of Total Dissolved Solids (June to November, 2021)

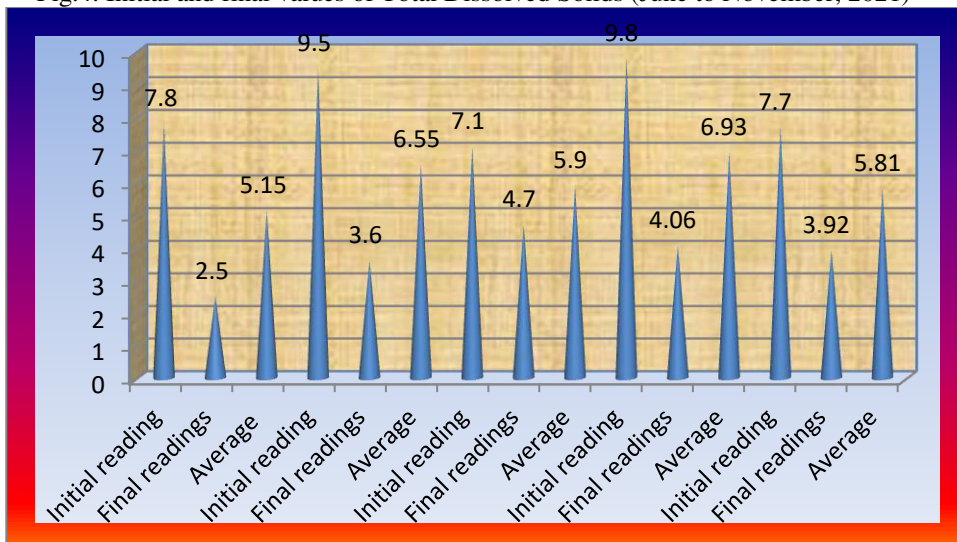


Fig. 5: Initial and final values of Turbidity (June to November, 2021)

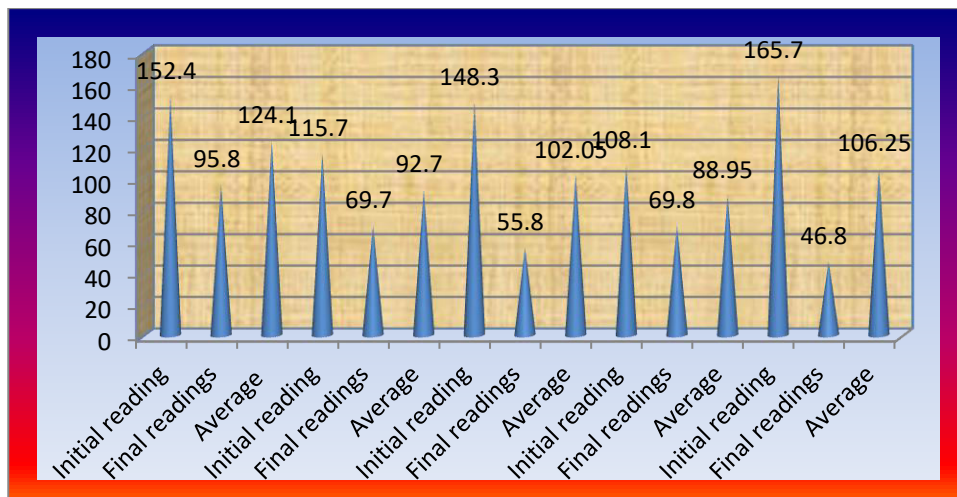


Fig.6: Initial and final values of Total Hardness (June to November, 2021)

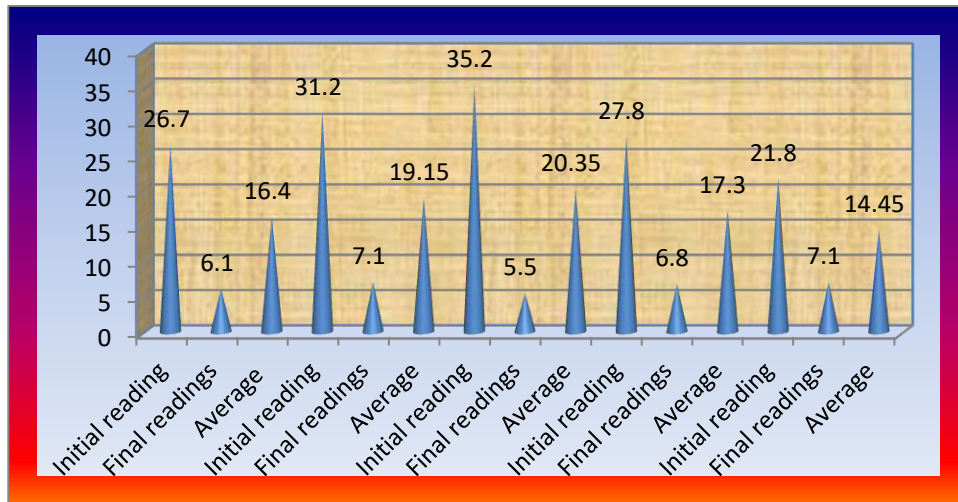


Fig.7: Initial and final values of BOD (June to November, 2021)

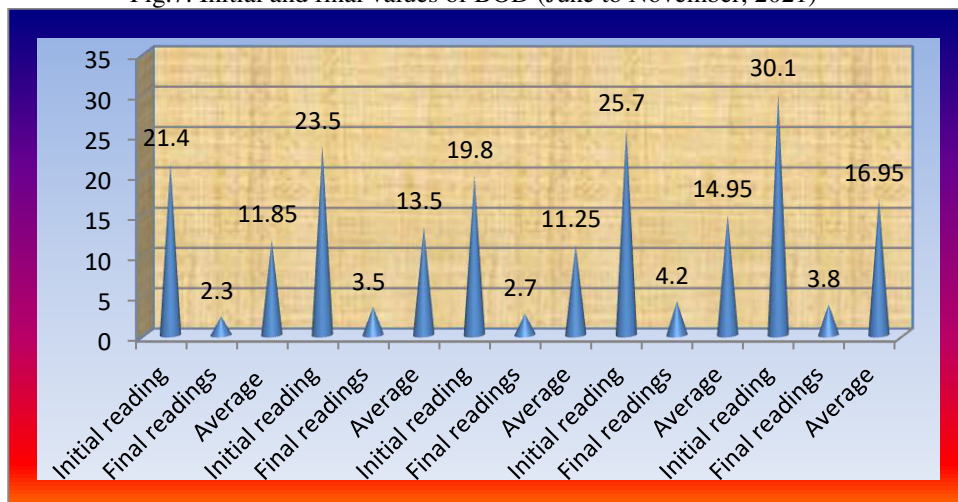


Fig.8: Initial and final values of COD (June to November, 2021)

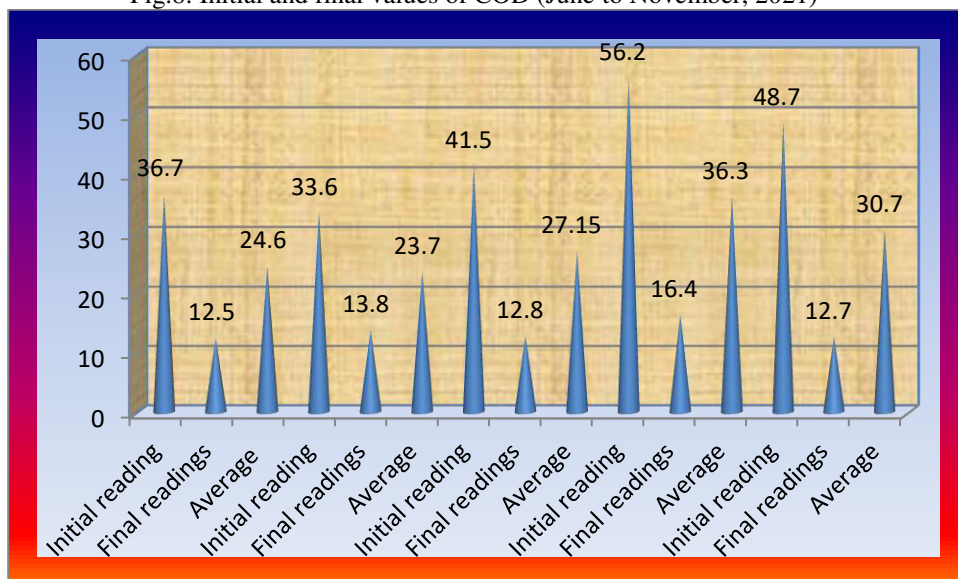


Fig.9: Initial and final values of Chlorides (June to November, 2021)

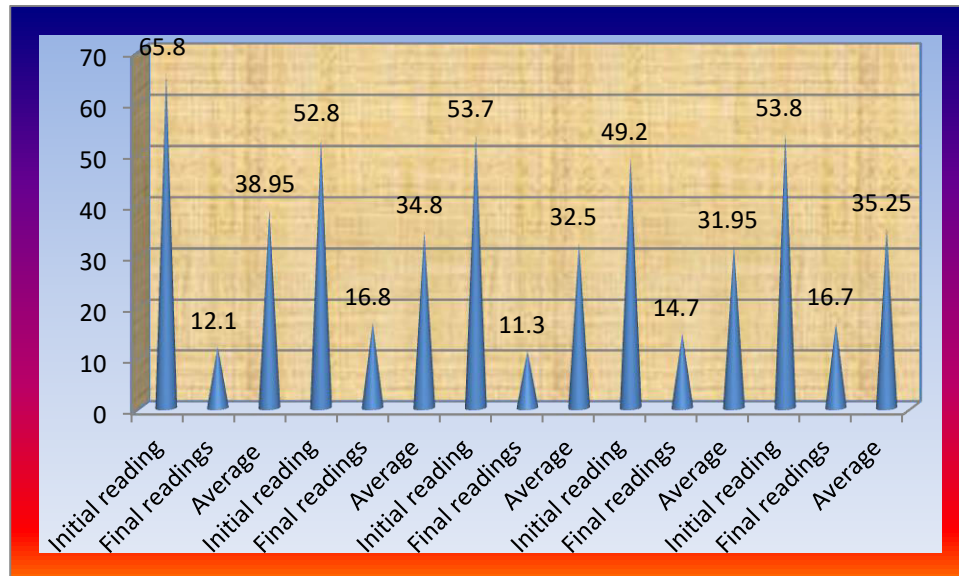


Fig.10: Initial and final values of Calcium (June to November, 2021)

The reduction rate of *Canna Indica* is significant. It is one of the superior species which has the highest rate of absorption rate of contaminants. The plant species has the high potential to remove pollutants from any liquids. Apart from the pollution removal function ecologically it has best rate of ecological balance.

V. CONCLUSION

Phytoremediation of waste water is the need of the time. Many activities of human and even natural incidences directly or indirectly create heavy pressure on water resources in the form of pollution. To solve the issues pertaining to water pollution plants play a great role to overcome the issues raised through the same. A systematic analysis was carried out in Aurangabad city of Maharashtra (India) to minimise the pollution load by phytoremediation method. 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. The Physicochemical parameters estimated before and after Phytoremediation treatment were total alkalinity, total dissolved solids, turbidity and total hardness. Chloride, calcium, BOD and COD. The analysis of parameters after the phytoremediation shows variation in almost all the parameters. Highest control in the Total Alkalinity values found in the September month i.e. 84.1 mg/litre. Highest recovery in the TDS values found in the July month i.e. 130.3 mg/litre. Highest recovery in the Turbidity values found in the October month i.e. 5.74 NTU. Highest minimisation rate in the Total Hardness values found in November month i.e. 118.9 mg/litre. Highest recovery in the BOD values found in the September month i.e. 29.7mg/litre. Highest removal rate in the COD values found in November month i.e. 26.3 mg/litre. Highest minimisation was found in the Chloride values in the October month i.e. 39.8 mg/litre. Calcium minimisation found in the high percentage in the July month i.e. 53.7 mg/litre. The present research work will be very beneficial to the budding researchers in the water pollution control and management areas.

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