Research Article……..

International Journal of Agricultural Invention

(online available at www.agriinventionjournal.com)

***International Journal of Agricultural Invention* 8(2): 273-278: December, 2023**

ISSN: 2456 – 1797 (P)

Assessment and EDTA assisted enhancement remediation of physicochemical parameters using *Eichhornia crassipes* on Yamuna River

***Harihar, Talad Khan, Samuel Gorden Singh**

Department of Botany, St. John's College (Dr. Bhimrao Ambedkar University, Agra) UP, India

***Corresponding email**: *jai544909@gmail.com*

ARTICLE INFO

Research Article

Received on September 10, 2023

Revised on September 16, 2023

Accepted on October 25, 2023

Published on November 01, 2023

Article Authors

Harihar, Talad Khan,

Samuel Gorden Singh

Corresponding Author Email

jai544909@gmail.com

PUBLICATION INFO

International Journal of Agricultural Invention (IJAI)

RNI: UPENG/2016/70091

ISSN: 2456-1797 (P)

Vol.: 8, **Issue:** 2, **Pages:** 273-278

Journal Homepage URL

http://agriinventionjournal.com/

DOI: 10.46492/IJAI/2023.8.2.20

ABSTRACT

Water is synonym of life. Industrialization, irregular agricultural practices, urbanization and increase in population are the main reasons for degradation of water quality. Yamuna River is one of the most important rivers of India originating from Yamunotri glacier of Himalaya. The importance of Yamuna River can be understood from the fact that it provides water to Uttrakhand, Delhi NCR and may cities of Uttar Pradesh. Yamuna River is most polluted river in north India. Its water flows from Bandar Punch, Yamuna Nagar, Sonepat, Delhi, Gautam Buddh Nagar, Faridabad, Palwal, Aligarh, Mathura and Agra. For this study, water samples were collected from Dhandupura STP, Agra. The plant selected for this study was *Eichhornia crassipes* and it was grown in contaminated Yamuna water with two different concentrations of EDTA i.e., 1mg/l and 10 mg/l. The result shows that EDTA remediated and repaired the physicochemical parameters *viz.* pH, total hardness, electrical conductivity, TDS, biological oxygen demand, chemical oxygen demand, total alkalinity and increased the level of dissolved oxygen of given samples.

KEYWORDS

Water Pollution, Yamuna River, Physico-Chemical Parameters, EDTA

HOW TO CITE THIS ARTICLE

Harihar, Khan, T., Singh, S. G. (2023) Assessment and EDTA assisted enhancement remediation of physicochemical parameters using *Eichhornia crassipes* on Yamuna River, *International Journal of Agricultural Invention*, 8(2): 273-278. DOI: 10.46492/IJAI/2023.8.2.20

Water pollution is a major problem in the global context. Rapid urbanization and industrialization has led to increased disposal of pollutants in to water bodies. The pollutant originates from several sources to get spread in water, air and soil that causes water, air and soil pollution respectively (Parmar and Bhardwaj, 2014, Jaiswal *et al*., 2014). People from several northern state of India relies on the River Yamuna as the water source for domestic purposes and agricultural applications, fulfilling more than 90% of the total water demand in several districts Industrial waste, domestic waste and agricultural activities are the some of the major sources of water pollution.

Yamuna River is not only a river but also a symbol of our prosperity, our culture, civilization and our philosophy. In Agra the Yamuna River has always been the most important and only source of freshwater resource. Water of River Yamuna is being used by every sector of development like agriculture, industry, transportation, public water supply etc. Huge load of wastewater from industries, domestic sewage and agricultural practices find their way in to Yamuna River, resulting in large-scale deterioration of the quality of water and affect the physicochemical parameters of water (Mohanta *et al*., 2014).

Industries like sugar, fertilizer, cement, fermentation, thermal power, caustic soda, oil refineries, pulp, paper, dye, pesticides, pharmaceutical etc. are the reason behind pollution of Yamuna River. Wastewater from bleaching operation contains high BOD and dissolved organic and inorganic materials. Unfortunately, in recent years the Yamuna River and its major tributaries and catchment area have suffered from severe pollution due to the discharge of untreated or partially treated wastewater containing undesirable levels of toxic heavy metals (Valdes *et al*., 2014).

Phytoremediation is a process used by plants to degrade or accumulate harmful substances that are found in ecosystem (Yang *et al*., 2015, Tauqeer *et al*., 2016, Sarwar *et al*., 2017). Native plants and trees have great potential to purify contaminated water as they can survive in that environment and tolerate every type of stress (Panday and Mishra, 2018). Aquatic plants have been effectively used to reduce pollution level and treatment of BOD, COD, total alkalinity, total hardness, TDS and metal from industrial wastewater. Some examples of aquatic plants used for phytoremediation are *Lemna* sp., *Vallisnaria* sp., *Ceratophyllum* sp., *Potamogeton* sp., *Sagittaria* sp. etc. For this study, *Eichhornia crassipes* is taken because of their easy availability, fast growth rate and large uptake of nutrients and contaminants. This research work is mainly focused on the approaches by which pollution level of Yamuna River will be minimized and physico-chemical parameter of water will remediate with help of phytoremediation process.

Materials and Methods

Collection and analyses of water sample: Samples were collected from Dhandupura STP of Yamuna River at Agra in the summer season during 2022. Water samples were collected in a plastic bottle at freezing temperature (6-8^{o}C) and transported to the laboratory for analysis of physicochemical parameters. The physicochemical parameters investigated in this study include pH, electrical conductivity, TDS, total hardness, total alkalinity, DO, BOD, COD (table 1).

Plant Material

Young plant of aquatic weed *Eichhornia crassipes* (water hyacinth) was collected from Yamuna River. Plant was washed thoroughly with running tap water followed by distilled water to avoid any surface contamination. The plant material was cleaned with bloating paper for any surface moisture avoiding damage to root and leaves. The plant was then grown in the same Yamuna water in plastic tub and similar native condition were provided to them.

Experimental Set-up

Experiment was performed in 27 plastic tubs of 5 liters capacity each with two different concentrations of EDTA i.e. 1 mg/l, 10 mg/l and 3 tubs as control without EDTA in triplicates for 30 days from all sites.

Statistical Analysis

Data were expressed as mean and standard deviation.

Table 1. Initial physicochemical parameters of water samples (n=3, mean ± SD) collected from selected site of Yamuna River summer season

Parameters	Dhandupura STP
pH	8.0 ± 0.152
Electrical Conductivity µs	1223 ± 2
TDS mg/l	1043 ± 3
Total Alkalinity mg/l	301.3 ± 3.511
Total Hardness mg/l	329 ± 2.645
Dissolve oxygen mg/l	3.6 ± 0.321
BOD mg/l	15.3 ± 5.033
COD mg/l	106.3 ± 5.507

Results and Discussion

Several chelating agents such as EDTA, EGTA (Ethylene glycol tetra acetic acid), EDDS (ethylenediamine disuccinate), NTA and citric acid, have been found to enhance phytoremediation and increase metal accumulation (Dasgupta *et al*., 2011 and Singh *et al*., 2013). In present study EDTA has proven effectiveness in phytoremediation process, it not only remediate water but also enhance plant biomass and height. The result shows that the level of physicochemical parameters of Yamuna water treated by *Eichhornia crassipes* after EDTA treatment had better result than control plant.

The concentration of dissolved oxygen was seems to be increased with EDTA than control i.e. without EDTA. The concentration of BOD in Yamuna River water was 15.3 mg/l level of BOD was higher than permissible limit. When 1 mg/l of EDTA was added, the concentration was decreased and became 12mg/l in 10 days after treatment and gone to 10 mg/l in 30 days. It was further decreased with treatment 10mg/l of EDTA. The mean value of Yamuna River water dissolved oxygen was 3.6 mg/l.

Without EDTA or control plant leads this value increased 4.5 mg/l in 30 days and afterword EDTA assisted treatment increased level of dissolved oxygen to 5.4 mg/l and 5.9 mg/l with 1 mg/l and 10 mg/l EDTA by *Eichhorna crassipes* respectively (table 2). It was found in experimental data with the introduction of EDTA assisted treatment, the levels of various physicochemical parameters were tends to move towards their normal limits. Detailed data of various physicochemical parameters have been shown in following graphical representations:

Table 2. Effect of EDTA on physicochemical parameters of treated Yamuna water (n=3, Mean ± SD)

		Site Dhandupura STP							
Treatment	**Days**	**pH**	**EC**	**TDS**	**TA**	**TH**	**D0**	**B0D**	**COD**
Control	10	7.6±0.1	1215±1.53	1040±1.53	249±3.21	328±2	4.0±0.1	16±2.08	96±1.53
	20	7.7±0.1	1174±2.52	963±1.52	227±2	287±4.35	4.2±0.15	14±2.52	92±3
	30	7.4±0.15	1045±0.57	914±1.52	195±2.30	255±1	4.5±0.21	14±1.53	83±2.08
1 mg/l EDTA	10	7.5±0.1	1033±3.5	1017±3	213±3.78	257±4.16	4.3±0.21	12±3.05	97±1.52
	20	7.3±0.05	956±2	938±2.08	184±4.04	249±2.52	4.8±0.31	10±2.52	82±1.53
	30	7.1±0.1	850±1.53	832±2.08	166±0.04	241±2	5.4±0.32	10±1.53	73±1
10 mg/l EDTA	10	7.7±0.17	1089±3.21	990±3.51	180±3.51	287±3	4.6±0.26	12±2.52	95±2.51
	20	7.8±0.1	937±2	896±4.04	159±3.05	209±2.51	4.7±0.21	10±2.08	80±2.65
	30	7.9±0.05	819±3.05	790±4	154±2	190±2.51	5.9±0.20	9±1.73	77±2.64

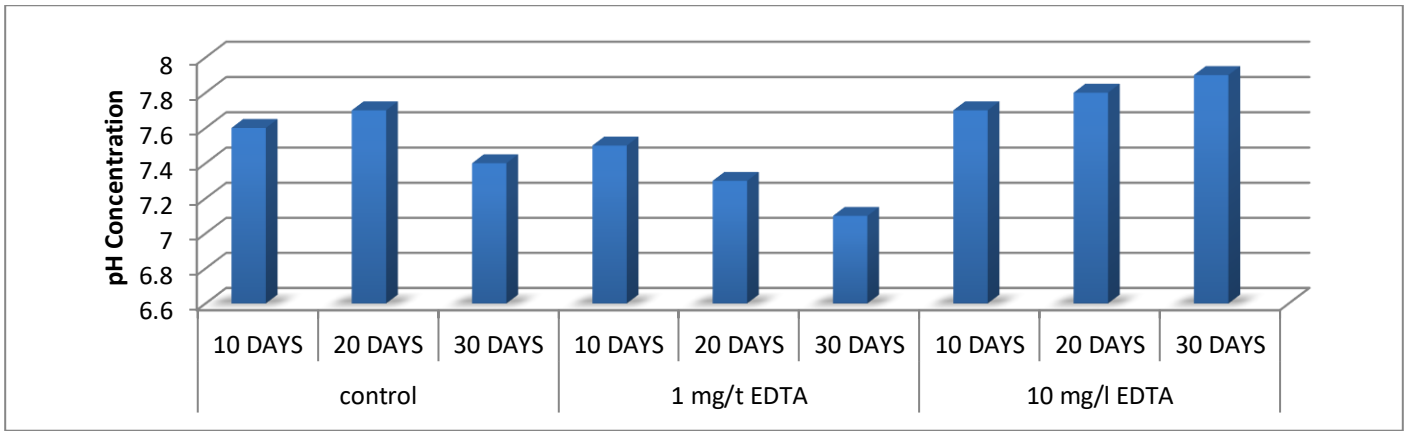

Fig 1. Graphical representation of pH from treated water sample

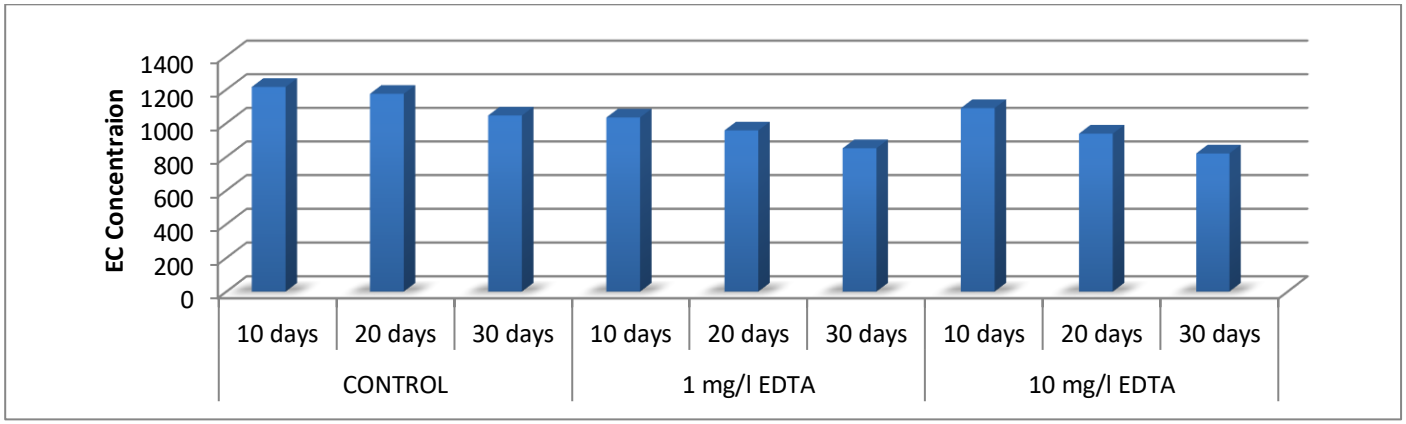

Fig 2. Graphical representation of Electrical conductivity from treated water sample

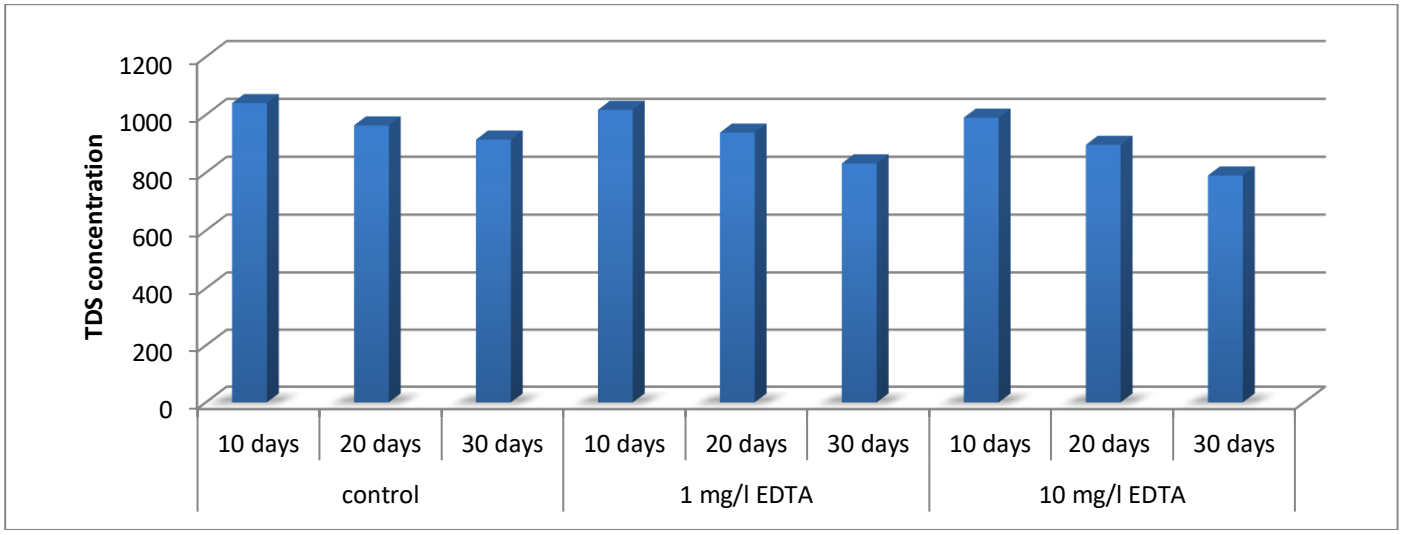

Fig 3. Graphical representation of TDS from treated water sample

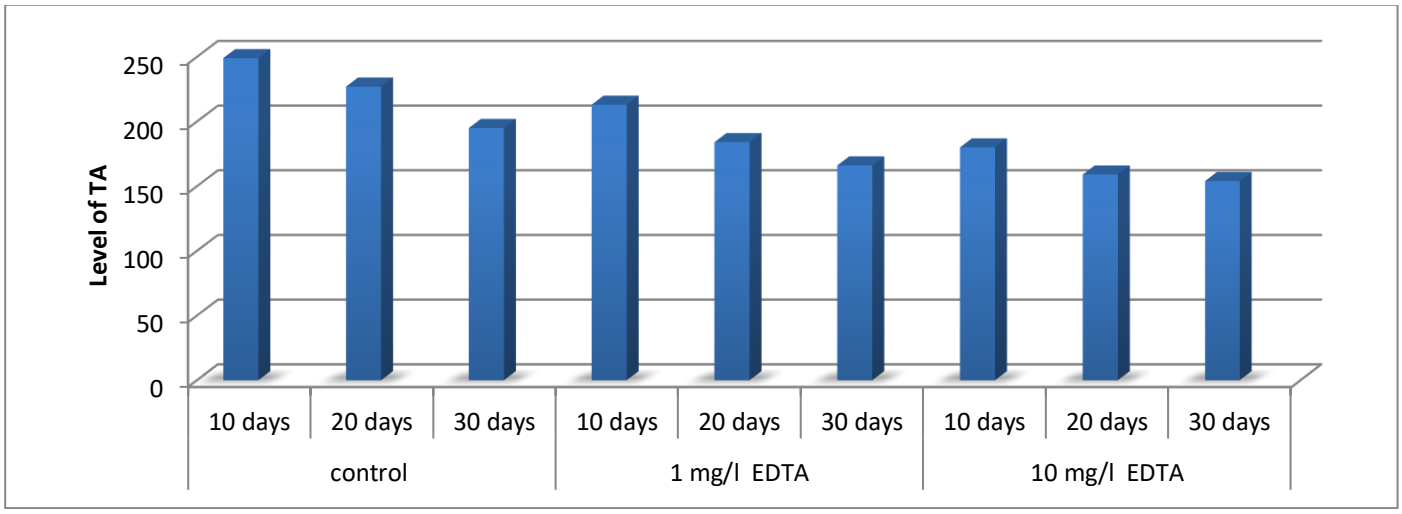

Fig 4. Graphical representation of Total alkalinity from treated water sample

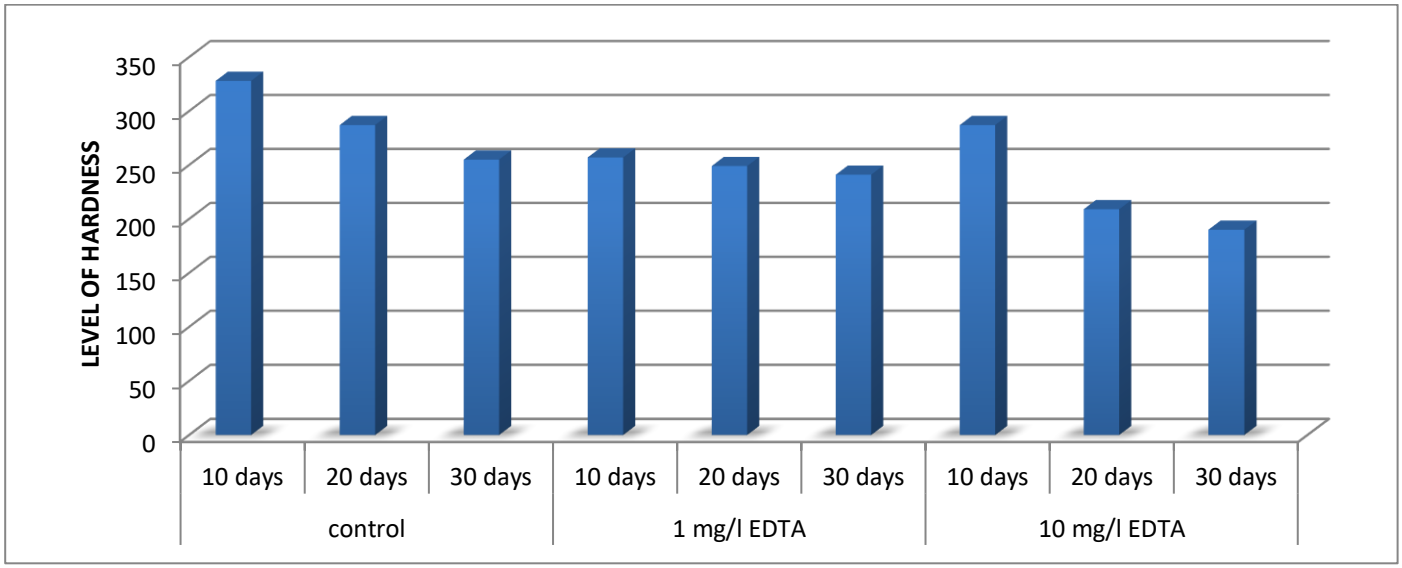

Fig 5. Graphical representation of Total hardness from treated water sample

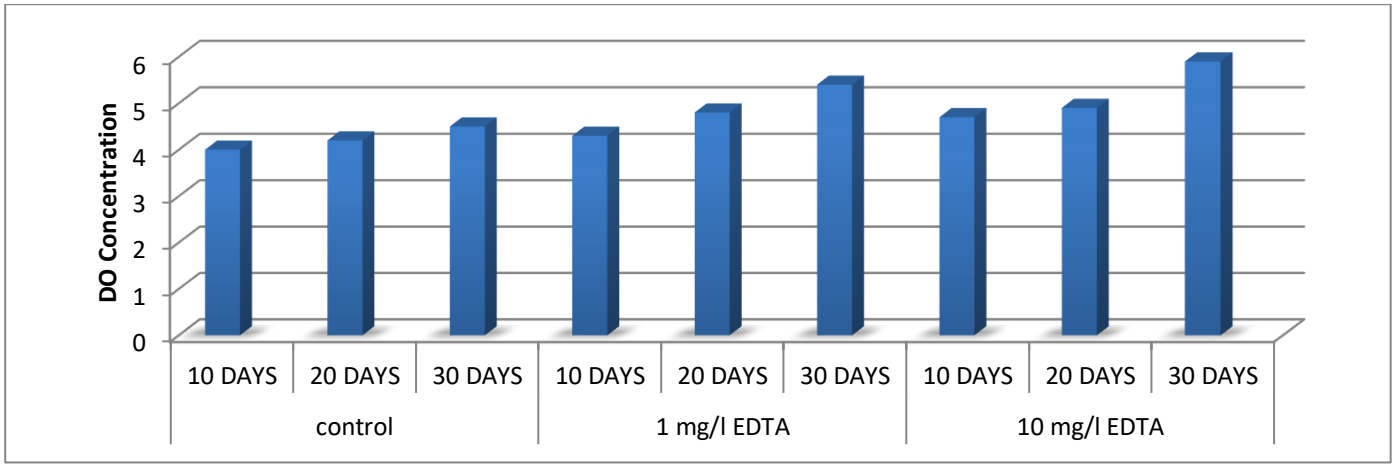

Fig 6. Graphical representation of Dissolved oxygen from treated water sample

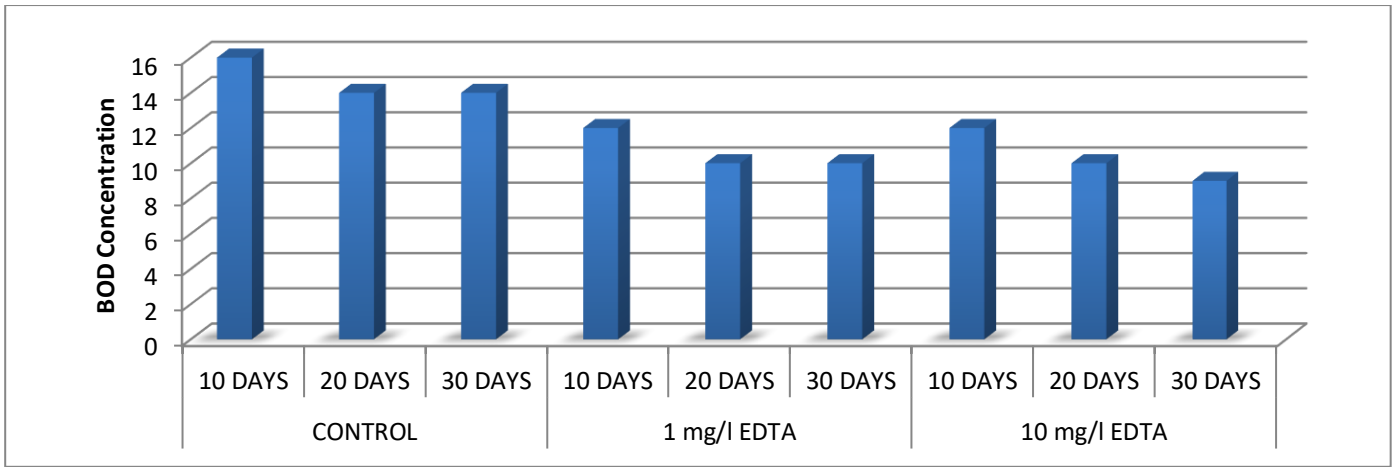

Fig 7. Graphical representation of BOD from treated water sample

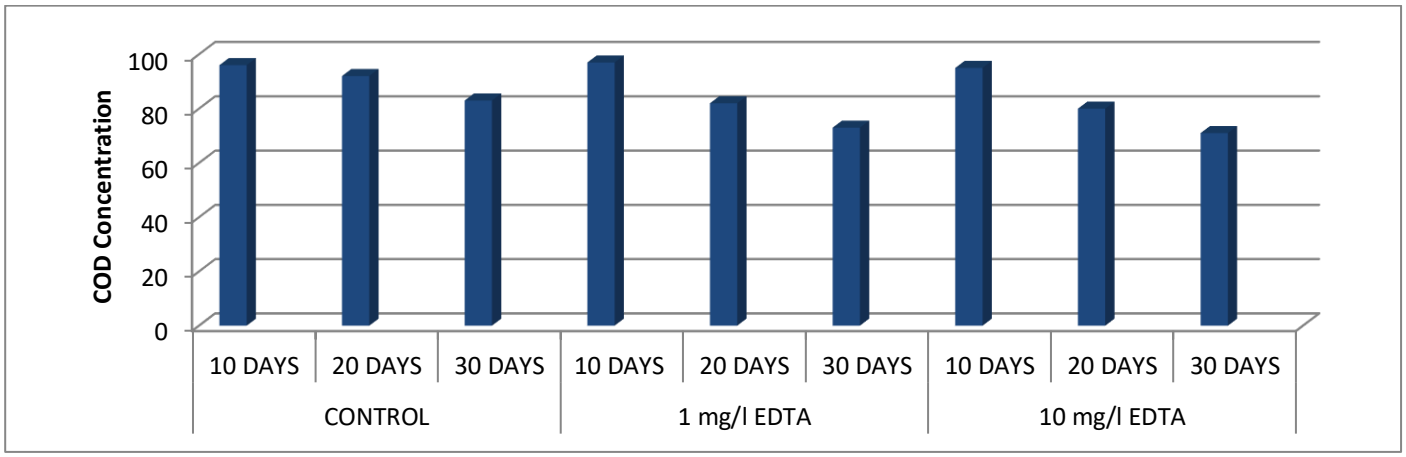

Fig 8. Graphical representation of COD from treated water sample

Conclusion

Experiments on the remediation of physicochemical parameters by phytoremediation technology proved that the plant *Eichhornia crassipes can* be used effectively as it was able to improve the physicochemical parameters include pH, electrical conductivity, TDS, total alkalinity, total hardness, dissolved oxygen, BOD and COD. In summary, the addition of EDTA to contaminated water of Yamuna River can enhance the phytoremediation process and treatment of physicochemical parameters.

Acknowledgment

The authors acknowledged with gratitude the help and support from Professor S. P. Singh, Principal, St. John's College, Agra, Uttar Pradesh, India.

References

Dasgupta, S., Satvat, P. S. and Mahindrakar, A. B. (2011) Ability of *Cicer arietinum* (L.) for bio-removal of lead and chromium from soil, *International Journal of Technology and Engineering System*, **24**: 338-341.

Jaiswal, M., Hussain, J., Gupta, S. K., Nasr, M., Nema, A. K. (2014) Comprehensive evaluation of water quality status for the entire stretch of Yamuna River, India, *Environ. Monit. Assess*., **191**: 208. https://doi.org/10.1007/s10661-019-7312-8PMID: 30847649.

Mohanta, V. L., Singh, S., Mishra, B. K. (2014) Human health risk assessment of fluoride-rich groundwater using fuzzy-analytical process over the conventional technique, *Groundwater Sustainable Development*, 10: 100291. https://doi.org/10.1016/j.gsd.2019.100291.

Panday, A. and Mishra, S. (2018) Purification of Yamuna River water by native plants and trees, A review: *International Journal of Science and Research*, **8**: 1835-1839.

Parmar, K., Bhardwaj, R. (2014) Statistical, time series, and fractal analysis of full stretch of river Yamuna (India) for water quality management, *Enviro. Sci. Pollut. Res*., **22**: 397-414. https://doi.org/10.1007/ s11356-014-3346-1

Sarwar, N., Imran, M., Shaheen, M. R., Ishaque, W. Kamran, M. A., Matloob, A., Hussain, S. (2017) Phytoremediation strategies for soils contaminated with heavy metals: Modifications and future perspectives, *Chemosphere*, **17**: 710-721.

Singh, R. K., Kumar, D. P., Solanki, M. K., Singh, P., Srivastva, A. K., Kumar, S., Kashyap, P. L., Saxena, A. K., Singhal, P. K. and Arora, D. K. (2013) Optimization of media components for chitinase production by chickpea rhizosphere associated *Lysinibacillus fusiformis* B-CM18, *Journal of Basic Microbiology*, 153(**5**): 451-460.

Tauqeer, H. M., Ali, S., Rizwan, M., Ali, Q., Saeed, R., Iftikhar, U. and Abbasi, G. H. (2016) Phytoremediation of heavy metals by *Alternanthera bettzickiana*: growth and physiological response, *Ecotoxicology and Environmental Safety*, **126**: 138-146.

Valde´s, J., Guinez, M., Castillo, A., Vega, S. E., (2014) Cu, Pb and Zn content in sediments and benthic organisms from San Jorge Bay (northern Chile): accumulation and bio-transference in subtidal coastal systems, *Cienc Marin*as; **40**: 45-58. https://doi.org/10.7773/cm.v40i1.2318.

Yang, X., Ullah, S. Heng, M. F., Munis, H. and Fahad, S. (2015) Phytoremediation of heavy metals assisted by plant growth promoting (PGP) bacteria, A review: *Environmental and Experimental Botany*. 117: 28-40.