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BIOREMEDIATION OF SUGAR INDUSTRIAL WATER EFFLUENT USING HYDROPHYTIC PLANTS

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Abstract - *The fastest development in the industrial area leading to extreme changes in the environmental balance and is the main challenge to environmentalist as the natural resources are very valuable. The sugar industrial effluent water has an harmful effect on the water quality parameters like pH, dissolved oxygen(DO), biological oxygen demand(BOD), chemical oxygen demand(COD), temperature and colour. The unusual level of these parameters causes pollution in the discharging water bodies and causes searious hazard to the living organisms. Bioremediation techniques are found to be useful to absorb toxicity in the water effluent. The main objective of the paper is to investigate the capacity of the hydrophytic plants viz echhornia crassipes, pistia stratiotes in the removal of toxicity in the effluent water*.

Key words: Hydrophytic plants, Bioremediation, Eichhornia crassipes, Pistia stratiotes, Sugar industrial effluent.

1. INTRODUCTION

India is the world's largest sugar-consuming country and the second largest in terms of sugar production. The growth of sugar industries has attained a drastic growth in India. Sugar cane cultivation land area are increased to 5,354,000 hectares in 2012-2013. There were 516 sugar industries in operation at 2007-2008. Currently, in 2012-2013, this range increased to 526, producing 25.14 million tons of sugar. Consequently, the amount of waste water generated from those industries has also increased. Sugar cane is a major commercial crops grown in Tamilnadu and is the major sources of income to most of the farmers in Tamilnadu. The production of sugar from sugarcane involves a lot energy and water. Water is mainly used in the processes like washing the cane, cleaning the evaporators, clarification of juice, heaters, cooling systems, purging boilers, hygienic services are discarded. Sugar industrial waste water are characterized by high amount of biological oxygen demand(BOD), chemical oxygen demand(COD and total dissolved solids(TDS). They generate 0.2-1.8 m3/ton waste water with COD 1800 to 3200 mg/L, BOD 720 - 1500 mg/L. waste water from sugar industry generally contains high amount of grease, heavy metals, nitrate, sulphate, nutrients, carbohydrates and oil. The aquatic plants used in this are Eichhornia crassipes and Pistia stratiotes. These to aqautic plants are generally available in Tamilnadu in lakes and rivers. They have long roots which have the capacity to absorb toxic from the waste water.

1.1 NEED AND SCOPE OF STUDY

Wastewater released from the sugar industry contains different groups of chemicals and harmful substances that may directly or indirectly destroys the ecosystem. The effluent also contaminate the groundwater and cause soil pollution in the surrounding environment. The detrimental effects have led the Indian government to pass stringent laws to abate the pollution problem arising from the sugar industry effluents. The benefits of hydrophytic plants are well-known, the use of eco-friendly, inexpensive, stable and hydrophytic plants is important for sustainable development and implementation of this technique in industries.

1.3 OBJECTIVES

The main objective of the project is to
Ø To determine the polluted water treatment efficiency of Eichhornia Crassipes and Pistia Stratiotes in the water sample.
Ø To collect hydrophytic plants i.e Eichhornia Crassipes and Pistia Stratiotes.
Ø To determine physical parameters of waste water before and after treatments.
Ø To determine chemical (pH, Conductivity, Biological Oxygen Demand, Nitrate, Phosphate, Chloride, Hardness, Alkalinity) parameters of waste water before and after treatments.

2. MATERIALS

2.1 COLLECTED RAW EFFLUENT

The raw sugar effluent wastewater has been collected from EID PARRY SUGAR PUGALUR, ERODE. The effluent was collected from the secondary tank. After that the

collected samples were brought to laboratory from the secondary tank. The effluent is stored at 4 degree celsius in the deep freezer available in the laboratory. The raw effluent contains high amount of COD, BOD, TDS, sulfates, nitrates and chlorides etc. When it is left untreated and discharged into the water streams it affect the marine life living in the water streams. So it is necessary to the effluent.

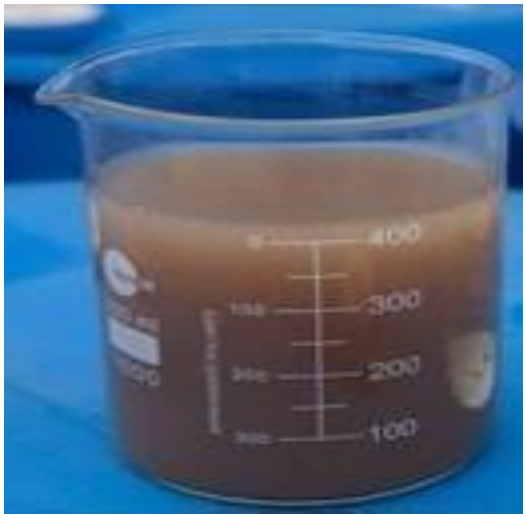

Fig 1 collected raw effluent

2.2 HYDROPHYTIC PLANTS

Plants used for this study are commonly available aquatic plants. Eichhornia crassipes, Pistia stratoites in agricultural canals. These hydrophytes are collected from vaigai channel, north Madurai district. Eichhornia crassipes is also known as water hyacinth, there roots are highly capable of absorbing toxic from the water which is appropriate for bio cleaning of industrial water. Pistia stratiotes have long roots which absorbs the heavy metals form the water. This plant also control the algal blooms.

Fig 1 Eichhornia crassipes

Fig 2 Pistia Stratiotes

3. METHODOLOGY

To study the effect of hydrophytic plants on treating the sugar industrial waste water the hydrophytic plants such as Eichhornia crassipes and Pistia stratiotes is grown on the water samples. The hydrophytic plants are made floated in the water samples. The water sample is taken in a plastic container of capacity 20 litres and hydrophytic plants are floated on it. After a time intervals the water is tested to find temperature, pH, DO, chlorides, TDS, BOD, COD, nitrate, sulphates and colour. To study the capacity of the plants in the treatment of effluent water, the experiment was conducted in the laboratory. The weight of aquatic plants are noted separately. The plants are placed separately in the plastic containers having 20 litres capacity containing 18 litres of raw effluent water collected form the secondary tank of the treatment plant. Before transferring the test plants into respective plastic containers, the initial chemical, physical and biological parameters of effluent are analyzed. The water under treatment are observed every 3 days up to 15 days.

4. EXPERIMENTAL RESULTS

With treatment with hydrophytic plants such as Eichhornia crassipes, Pistia stratiotes the parameters of the effluent water has attained to permissible levels.

4.1 Determination of pH

The pH of the test samples were recorded and the values are listed in the table.

S.NO	TIME PERIOD (DAYS)	EICHHORNIA CRASSIPES	PISTIA STRATIOTES
1	0	6.5	6.5
2	3	6.8	6.7

3	6	6.9	6.8
4	9	7.0	7.1
5	12	7.2	7.31
6	15	7.39	7.4

TABLE 1 pH VALUE

4.2 Determination of colour

The waste water colour parameter is determined by direct visibility and UV Spectrophotometer of wave length 430 nm. The colour of the waste water sample is dark brown in colour.

S.NO	TIME PERIOD(DAYS)	EICHHORNIA CRASSIPES	PISTIA STRATIOTES
1	0	Dark brown	Dark brown
2	3	Dark brown	Dark brown
3	6	Brown	Brown
4	9	Light brown	Light brown
5	12	Yellow	Yellow
6	15	Yellow brown	Light yellow

Table 2 colour changes

4.3 DISSOLVED OXYGEN

oxygen is very important for supporting the life of all organisms in the world. The water sample is tested for DO and results were shown.

S.No	TIME PERIOD(DAYS)	EICHHORNIA CRASSIPES (mg/l)	PISTIA STRATIOTE (mg/l)
1	0	1.29	1.29
2	3	1.35	1.31
3	6	1.50	1.45
4	9	1.98	1.75
5	12	2.5	2.1
6	15	2.8	2.44

Table 3 DISSOLVED OXYGEN

4.4 BIOLOGICAL OXYGEN DEMAND

BOD of the water samples are observed and listed in the table below.

S.NO	TIME PERIOD(DAYS)	EICHHORNIA CRASSIPES (mg/l)	PISTIA STRATIOTES (mg/l)
1	0	90	90
2	3	85	89
3	6	78	86
4	9	69	75
5	12	66	69
6	15	52	63

Table 4 BIOLOGICAL OXYGEN DEMAND

4.5 CHEMICAL OXYGEN DEMAND

COD of the water sample are observed and listed in the table below

S.NO	TIME PERIOD(DAYS)	EICHHNORNIA CRASSIPES (mg/l)	PISTIA STRATIOTES (mg/l)
1	0	345	345
2	3	301	330
3	6	298	301
4	9	256	295
5	12	210	284
6	15	212	278

Table 5 COD

4.6 TOTAL DISSOLVED SOLIDS

Total dissolved solids is the measure of impurities present in the water sample.

S.NO	TIME PERIOD(DAYS)	EICHHORNIA CRASSIPES (mg/l)	PISTIA STRATIOTES (mg/l)
1	0	2740	2740
2	3	2565	2680
3	6	2325	2596
4	9	2010	2264
5	12	1940	2100
6	15	1835	1998

TABLE 6 TOTAL DISSOVED SOLIDS

4.7 CHLORIDES

Chloride in water is originated from natural resources in the form of NaCl, KCl etc. The increased concentration of chloride is considered as an indicator of eutrophication and pollution due to sewage. If chloride is present in useful amount, they help in purification of

water against infectious germs and make water suitable for drinking fishery, irrigation and other various purposes.

S.NO	TIME PERIOD(DAYS)	EICHHORNIA CRASSIPES (mg/l)	PISTIA STRATIOTES (mg/l)
1	0	201	201
2	3	195	199
3	6	184	197
4	9	175	183
5	12	172	176
6	15	168	177

Table 7 CHLORIDES

4.8 SULPHATES

In treatment with the hydropytes the sulphate reaches the permissible level which is listed in the table below.

S.NO	TIME PERIOD(DAYS)	EICHHORNIA CRASSIPES (mg/l)	PISTIA STRATIOTES (mg/l)
1	0	648	648
2	3	596	624
3	6	520	600
4	9	497	585
5	12	398	497
6	15	305	354

Table 4.8 sulphate Test

5. CONCLUSION

The bioremediation is very effective and eco friendly technology and protect as most successful method in the industrial effluent treatment. The experimental data highlights that all the test plants eichhornia crassipes, pistia stratiotes have effectively reduced almost all the physical, chemical parameters like pH, TDS, DO, BOD, COD, Chlorides, sulphates and biological parameters of the effluent water effluent water to a significant level. However, the concentration of dissolved oxygen gradually increased as time increases during the period of effluent treatment. In order to control the secondary pollution this method can be adopted as this method is a eco friendly one.

REFERENCES

[1] Randhir Bute (2017), 'Treatment Of Grey Water Using Technique Of Phytoremediation', Volume 04, Issue 03, Mar -2017.
[2] Vandana Gupta, B. Mazumdar and Neela Acharya (2017), 'COD and colour reduction of sugar industry effluent by electrochemical treatment', Vol 13, Nos 1/2, pp 177-187.
[3] Kamlesh (2017), 'Response of Pea (Pisum sativum) to Sugar Industry Effluent Treatment', Vol-2, Issue-1, Jan-Feb- 2017.
[4] Pallavi Behera (2017), 'Phytoremediation Of Chromium From Industrial Effluent By Waterhyacinth', volume 7, issue 2.
[5] Randhir Kumar (2017), 'Removal Of Arsenic In Water By Phytoremediation Process With lemna minor, azollapinnata and hydrilla verticillata', Doi: 10.5772/intechopen.72238.
[6] Theeta Sricoth (2017), 'The Ability To Remove Nutrients, Organics, And Heavy Metals From Wastewater By Mixture Of Eichhorniacrassipes And Typha Angustifolia', vol 2, issue 12, pp 16-27.
[7] Tarek M. Galal (2017), 'Bioaccumulation and Rhizo Filtration Potential of Pistia Stratiotes for Mitigation Water Pollution in the Egyptian Wetlands', volume 10, Pp 440-447.
[8] Chinchu.S.Nair and K.Mophin Kani (2016), 'Phytoremediation of Dairy Effluent Using Aquatic Macrophytes', International Journal of Scientific & Engineering Research, Volume 7, Issue 4, April-2016, 253ISSN 2229-5518.
[9] Pamila.D, Dinesh Kumar (2016), 'Green Revolution-Removal of Lead from Battery Industrial Effluent by Phytoremediation using EichhorniaCrassipes', IJSRD International Journal for Scientific Research & Development, Vol. 3, Issue 11, ISSN 2321-0613.
[10] Danilo Sinhei Iha (2015), 'Phytoremediation of Cd,Ni,Pb and Zn by Salvinia Minima', volume 17, Pp 37-41.