# *A SMALL SCALE TEXTILE WASTEWATER TREATMENT BY PHYTOREMEDIATION USING EICHHORNIA CRASSIPES*

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***Abstract*** **- Many industries such as paper, food, cosmetics, and textiles etc; use dye in order to colour their products. The presence of these dyes in water even at very low concentration is highly visible and undesirable. The present study focused on phytoremediation efficiency of water hyacinth for textile wastewater treatment. Textile industries release large amounts of wastewater containing various organic and inorganic pollutants. One of the major problems encountered in the textile industry is the production of large volumes of highly colored wastewater. They cause serious health hazard. Textile wastewater also contains substantial pollution loads which increase the Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Total Suspended solids (TSS), Total Dissolved Solids (TDS) and heavy metals. So pre-treatment is needed prior to discharge of these effluents. Phytoremediation has recently gained importance because of its cost-effectiveness, long-term applicability and ecological aspect. Among all method investigated presently, Phytoremediation by *Eichhornia Crassipes* is a well-established environmental protective technique and an eco-friendly approach too. The *Eichhornia Crassipes* efficiencies were monitored through the measurement of COD, BOD, TS, TDS, TSS, Chloride, Sulphate, Hardness, Calcium and Turbidity. This paper unveiled the highest removal efficiency of COD and BOD in the sample 1 was achieved at day 18 with 75% and 81%. pH value of all three samples were investigated and compared with permissible limits. The pH results were obtained as per standard limits. The maximum chloride removal efficiency was 68% unveiled in sample 2 and also 91% removal of turbidity in the sample 2. After phytoremediation the parameters like TS, TDS, TSS, Sulphate and calcium results were achieved within the permissible limits.**

***Keywords - Phytoremediation, Textile wastewater, Eichhornia Crassipes, Water Quality Parameters, COD, BOD***

## I. INTRODUCTION

Nowadays, nearly 100,000 synthetic dyes are produced commercially and available in market, almost one million tons of dyes are produced annually in which about 10% of dyes are released as waste into environment and natural resources[1]. Applications of dyes include in industries like textile, plastic, paper, concrete, medicine and rubber, with textile industry as the main consumer of dyes [4]. The improper disposal of waste causes direct contamination of ground water and surface water both. This wastewater has serious negative impact not only on land area but also on the aquatic ecological system. Due to usage of dyes and chemicals textile effluents are dark in colour, thus increasing the turbidity of the receiving water body. Metal pollution has harmful effect on biological systems and does not undergo biodegradation. The objective of the study:

- To analyze the characteristic reduction of Textile wastewater.
- To reduce the water consumption and reuse the treated wastewater.
- To study the phytoremediation efficiency of water hyacinth for Textile effluent treatment.
- To meet various sustainable development goals regarding clean and safe water, land protection, ecosystem and biodiversity.
- To study the proposed mechanism of selected plant contributed for remediation of textile waste water.

## II. LITERATURE REVIEW

**Ranai Jangwattana (2009),** studied Waste water from animal farm especially from poultry industry is one of the sources of non-point source water pollution in Thailand. Plants can be a practical tool for waste water treatment. Aquatic fern (Azollapinnata) has been used to for organic matter, nitrogen and phosphorus removal from waste water and can be good for increase soil fertility. **Arya Krishna and AnandLaliNeera (2013),** studied about the Process of plants for waste water remediation to find out the role of aquatic ferns for wastewater treatment. Water bodies are the main targets for disposing the pollutants directly or indirectly. **Mesania Rizwana et al., (2014),** carried out the treatment of wastewater by water

hyacinth. Textile wastewater also contains substantial pollution loads which increase the COD, BOD, TSS, TDS and heavy metals.

## III. MATERIALS AND METHODS

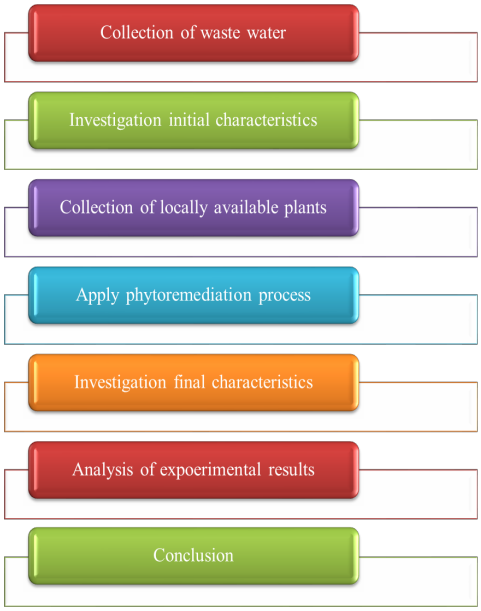


**Figure 1: Methodology**

### *A. COLLECTION OF MATERIALS*

The locally available *Eichhornia Crassipes* plants were collected and the characteristics of the plant were initially analyzed by laboratory.

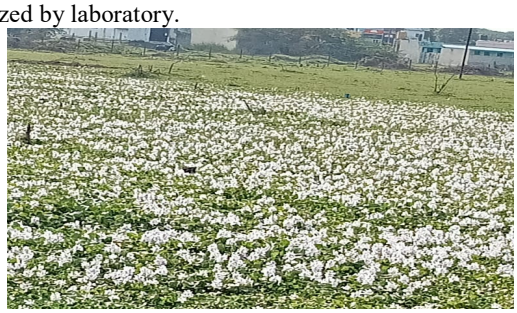

**Figure 2: Collection of Locally Available *Eichhornia Crassipes* Plant Materials**

### *B. COLLECTION OF WASTEWATER*

The textile wastewater was collected from small scale dying industry in and around Srivilliputhur, Viruthunagar District. When three samples of wastewater was collected and in three containers, the capacity of the container is nearer to 7 liters.

### *C. INVESTIGATION OF INITIAL CHARACTERTICS*

The three samples were analyzed and characterized as per the Standard Procedures given in APHA, Standard Methods for the Examination of Water and Wastewater 23rd Edition 2017. The collected sample have been analyzed to determine the some physicochemical characteristics like as pH, color, temperature, EC, COD, BOD, TDS, TSS, TS, DO etc.,

**Table 1: Initial Characteristics of Textile Wastewater**

| Sl.No. | Parameters | Sample 1 | Sample 2 | Sample 3 |
|---|---|---|---|---|
| 1 | pH | 8.9 | 8.75 | 9.6 |
| 2 | Color, Platinum-Cobalt Scale | Brown, 3400 | Dark Orange, | Reddish Brown, |
| 3 | Electrical Conductivity, ms/Cm | 1780 | 1900 | 1860 |
| 4 | COD, mg/l | 1042 | 957 | 1088 |
| 5 | $BOD_5$ @ 20°C, mg/l | 242 | 196 | 210 |
| 6 | Total Solids, mg/l | 1310 | 1250 | 1070 |
| 7 | TDS, mg/l | 940 | 995 | 790 |
| 8 | TSS, mg/l | 370 | 255 | 280 |
| 9 | Chloride, mg/l | 695 | 750 | 620 |
| 10 | Sulphate, mg/l | 525 | 470 | 590 |
| 11 | Hardness, mg/l | 560 | 478 | 410 |
| 12 | Calcium, mg/l | 252 | 175 | 236 |
| 13 | Turbidity, NTU | 15.1 | 14.5 | 16.3 |

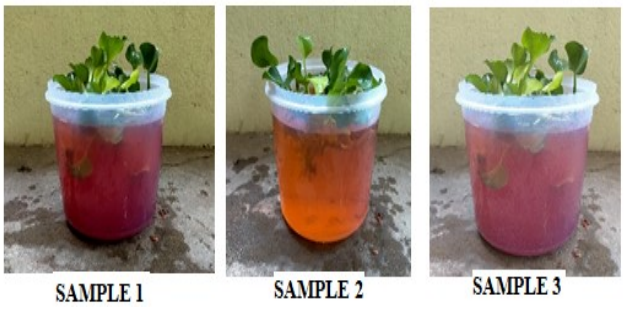


**Figure 3: *Sample with locally available Eichhornia Crassipes***

## IV. RESULTS AND DISCUSSIONS

All the three samples were treated by locally available plant *Eichhornia Crassipes.* The results were analyzed with the contact time interval of 3 days. Every three days the results are monitored and comparing with standards. On the trial, after 15 days of intervals periods the uptake potential of plants were obtained low and some of the characteristics were reach the maximum removal efficiency as per standards. All these are represented graphically below:

From figure 4, comparing of sample 1, 2 and 3 on the 18$^{th}$ day the pH value of all 3 samples were efficiently treated as per the permissible limits.


**Figure 4: Comparison of all three samples - pH value**

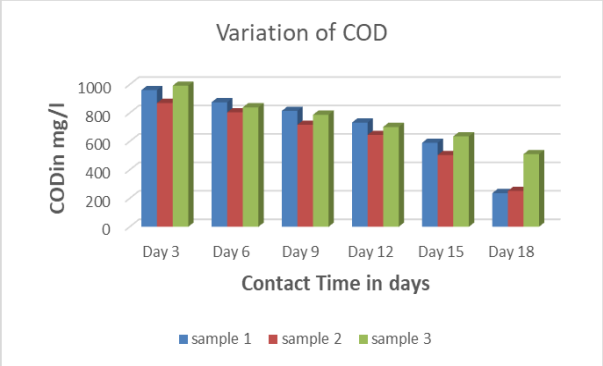


**Figure 5*:* Comparison of all three samples – COD**

As shown in Figure 5, the COD removal efficiency maximum at sample1 and sample2In 18th day, the efficiency upto 80% will be reduced.

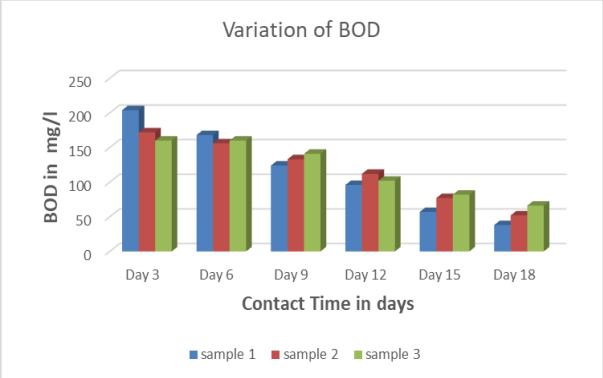


**Figure 6*:* Comparison of all three samples – BOD**

The maximum BOD removal efficiency is 81% in sample 1 compared with other samples as shown in Figure 6.

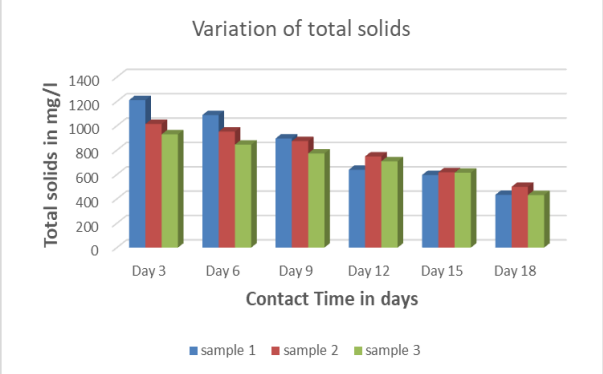


**Figure 7*:* Comparison of all three samples – Total Solids**

The Total solids removal efficiency maximum at Sample 1 and Sample 3 In 18th day, the efficiency upto 64% will be reduced**.**

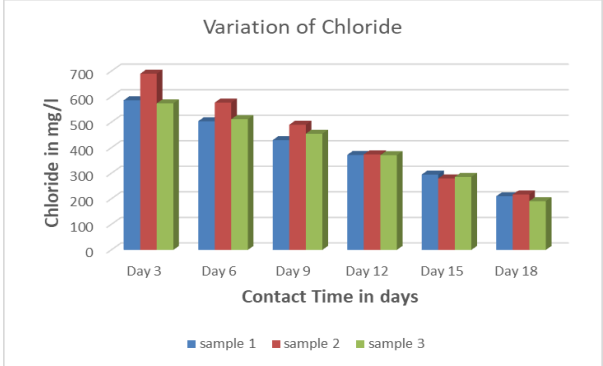


**Figure 7*:* Comparison of all three samples – Chloride**

The maximum Chloride removal efficiency is 58% in sample 3 compared with other samples as shown in Figure 7.

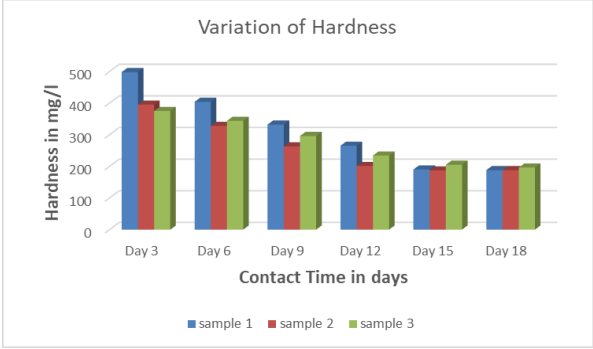


**Figure 8*:* Comparison of all three samples – Hardness**

The Hardness removal efficiency maximum at sample1and sample 2. In 15th day, the efficiency upto 60% will be reduced as shown in Figure 8.

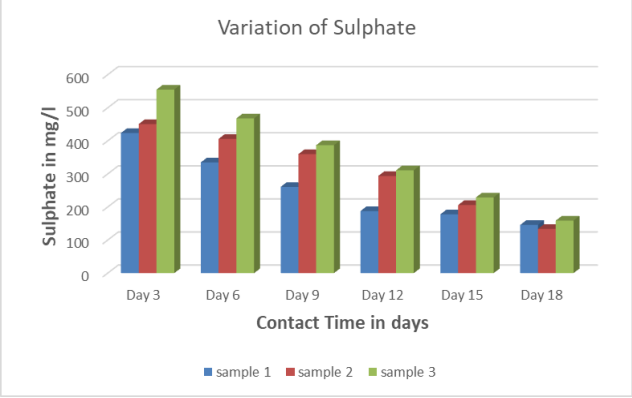


**Figure 9*:* Comparison of all three samples – Sulphate**

As shown in Figure 9, the maximum Sulphate removal efficiency is 71% in sample 3.

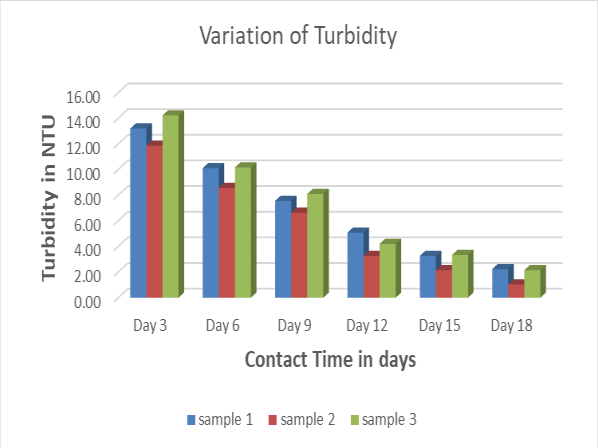


**Figure 10*:* Comparison of all three samples – Turbidity**

As shown in Figure 10, the Turbidity removal efficiency maximum at sample 2 on 18$^{th}$ day, the efficiency was 91% reduced.

## V. CONCLUSION

- ✓ Phytoremediation is a cost effective, safe, nontoxic ecofriendly technique which can be suited for small or either large scale.
- ✓ By company three textile waste water sampled , the parameter like PH were reduced as per standard .Also the other parameter turbidity of sample 2 was efficiently treated and maximum removal efficiency was achieved as 91% on 18th day .
- ✓ For the sample 1, the parameter like electricity conductivity was reduced upto 72% BOD as 81%and all the solids were reduced more than 60%.
- ✓ For the sample 2, the maximum chloride removal efficiency was obtained as 61% and the sample 2 and 3 the sulphate was reduced more than 70%of the initial value.
- ✓ For a contact time of 18 days most of the parameter are efficiency treated and attained the final values as per the permissible limits.

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