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Biological Treatment for Industrial Wastewater using *Eichhornia Crassipes* (Water Hyacinth)

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Abstract

One of the major problems faced by mankind today is of water pollution. There are various methods available for treatment of waste water. The conventional and mechanical methods of treatment of industrial waste water quite expensive and are thus uneconomical for industries of lower turnover rate. The search is for economical and efficient methods. Use of vascular plants for pollution abatement is recent trend. The present work is directed towards the use of aquatic plant Eichhornia crassipes i.e., Water hyacinth for treatment of industrial waste and the objectives of work are to study feasibility of treatment, number of days required for the treatment, effect of operating tank depth, effect of pre-treatment and effect of Nutrients by observing change in various physical, chemical and biological parameters.

Keywords: *Water hyacinth, wastewater, aquatic treatment system*

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INTRODUCTION

Water of high quality is essential to human life and water of acceptable quality is essential for agriculture, industrial, domestic and commercial uses. All these activities are also responsible for polluting the water. Billions of gallons of waste from all these sources are thrown to freshwater bodies' every day. The requirement for water is increasing while slowly all the water resources are becoming unfit for use due to improper waste disposal. The task of providing proper treatment facility for all polluting sources is difficult and also expensive, hence there is pressing demand for innovative technologies which are low cost, require low maintenance and are energy efficient. The use of aquatic macrophytes (large aquatic plant) thus came in existence. The vascular plant like Salvinia, Lemna, Pistia, Spirogyra and water hyacinth posses a tremendous capacity of absorbing nutrients and other components from water and hence bring down the pollution load down. Among all the aquatic weeds water hyacinth has been found to be most promising weed for waste water treatment. It is most obnoxious weed commonly present in lakes, river, reservoirs, pools and puddles. Its consequences on fresh water ecosystem are disastrous. Large number of attempts have been to control this plant but with little success. So now emphasis is on utilization of the plant for pollution control as large number of studies confirmed that it can remove suspended solids, dissolved solids, nutrients, organic matter, heavy metals, toxicants and micro-organisms from wastewater [1–5].

MATERIAL AND METHODOLOGY

Waste water from Dairy industrial is used for all the experiments. Changes in the parameter like PH, conductivity, BOD, COD, TSS, TDS etc. are observed after each experiment [4–9]. Each part of the water hyacinth plant takes part in the process of reducing pollutants as shown in the table below:

S. No	Effects	Cause
1	BOD removal	Microbial activity at roots and on stems
2	Removal of settleable and floatable	Long retention time useful. Bactria are important in ultimate removal
3	Nitrogen removal	(i) Uptake by plants and subsequent. harvesting of them (ii) Volatilization of NH3. (iii) Bacterial nitrification and denitrification)
4	Phosphorus removal	(i) Plant uptake. (ii) Chemical adsorption and precipitation. (iii) Ultimate disposal of P is by harvesting of plants and degrading of sediments
5	Heavy metals removal	(i) Plant uptake. (ii) Precipitation as oxide, hydroxides, Carbonates, phosphates, sulfides. (iii) Ion exchange, adsorption.

RESULTS AND DISCUSSION

Effects of Various Waste Concentration

The plant was daily harvested in samples of 100%, 75 % and 50% concentration for four day which showed very encouraging result with regard to BOD, COD, TDS, TSS, DO and Nitrogen as shown in graph 1. Water hyacinth was capable of completely neutralizing the BOD of 50% concentration of the waste in 96 h.

Fig. 1: *Water Hyacinth Sample Collection.*

Effects of Prior Setting of the Waste

The impact of settling was studied on the efficiency of water hyacinth in treating dairy wastes.24 hours of settling was provided as a pre-treatment Which has shown considerable reduction in TDS,TSS,BOD, COD ,Calcium and Nitrogen. This result is of sedimentation and microbial settling in one day as shown in graph 2. However one day settling means increase in time of treatment by one day, thus prior settling could prove to be effective and advantageous.

Effects various Depths on Treatment Process

The effect of the depth of the system is very important aspect as water hyacinth is a free floating plant and in the deeper system it is not likely to have full contact with the waste as the roots of the plant are from 1-3 ft in length. In the present study the dissolved and suspended solids were reduced better in the shallow depth as compared to higher depth. However, this difference was not marked much in case of BOD and COD as shown in graph 3. Only reason of this could be highly decomposable nature of dairy waste which gets decomposed very fast even without hyacinth.

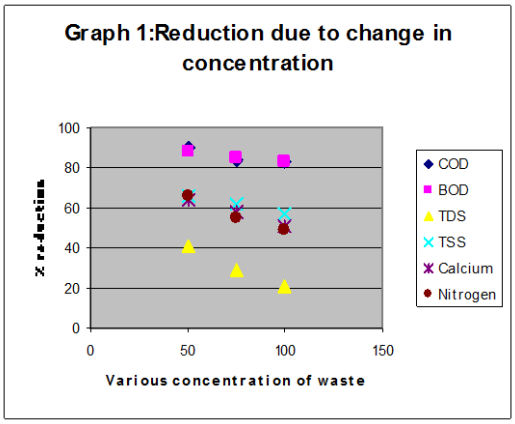
Effects of Nutrient Added

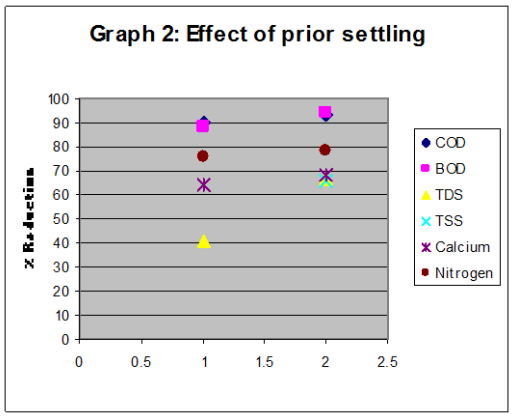
In the present study nitrogen, phosphorous and potassium were taken in equal proportions, i.e. N.P.K. all 19 was taken. Interesting results were obtained in this study. The efficiency of removal of BOD and COD the two most

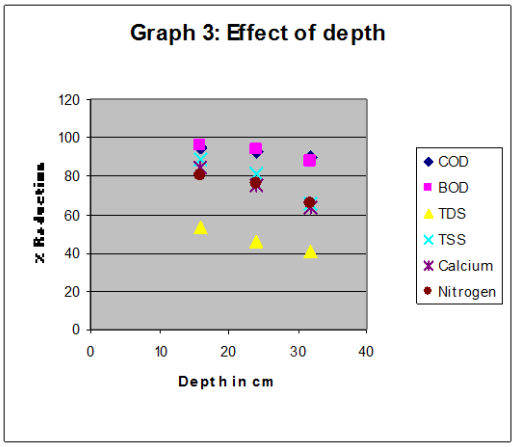
important components of the waste considerably increased with 10 mg/L of all 19 but the effect of higher dose i.e. 20 mg/L of all 19 does not showed further reduction in parameters. The reduction in suspended solids was much better in addition of nutrients although they seem to be link in between addition of nutrients and solid production.

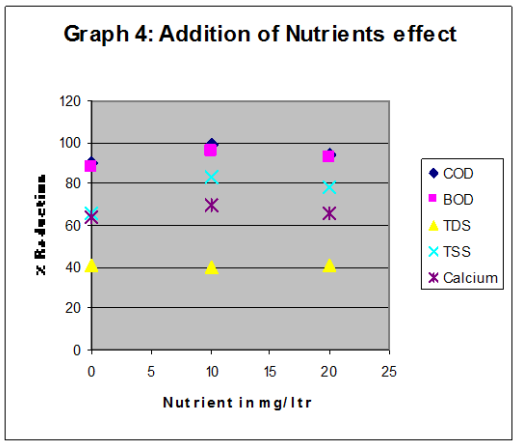
Fig. 2: *Nutrient Added to Water Hyacinth Samples.*

GRAPHS









CONCLUSIONS

Water hyacinth is capable of treating dairy industry waste for most of the constituents like Total Dissolved Solids, Total Suspended

Solids, Biochemical Oxygen Demand and Chemical Oxygen Demand. In most of the cases three to four days retention time has been found to be adequate for treatment to reach the permissible limit of pollution control boards. Fifty percent concentration gave results as compared to 100 % and 75 % Concentration. Giving pre settlement (preliminary treatment) to the waste and taking the Supernatant for treatment gave good results. Shallow depth was found to give better results but the depth of 32 cm was considered as best from the available from economic point of view. The addition of nutrient concentration of 10 mg per liter was found to be the best. The wastewater after treatment can be recycled and used as dilution water and remaining can be used for other purpose after required treatment or disinfection or even released into fresh waters.

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