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USE OF Eichhornia crassipes (Mart.) Solms IN TREATMENT SYSTEMS FOR TEXTILE MILL EFFLUENTS WITH SPECIAL REFERENCE TO VEYANGODA TEXTILE MILL

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Thesis submitted in fulfillment of the requirement for the degree of Master of Philosophy of the Faculty of Applied Science, University of Sri Jayewardenapura, Nugegoda, Sri Lanka.

December, 1997

This is to certify that the work here submitted was carried out by the candidate himself. It is now approved for submission.

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DECLARATION

The work described in this thesis was carried out by me at University of Sri Jayewardenapura under the supervision of Dr. P A J Yapa, Department of Botany, University of Sri Jayewardenapura Nugegoda, Sri Lanka, and a report of this has not been submitted to any university for another degree.

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Date : 10.08.99

DEDICATED

TO

BELOVED PARENTS

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ABBREVIATIONS

BOD	-	Biochemical Oxygen Demand
COD	-	Chemical Oxygen Demand
DS	-	Dissolved Solids
mg/l	-	Milligrams per liter
TS	-	Total Solids
TSS	-	Total Suspended Solids
VS	-	Volatile Solids
TN	-	Total Nitrogen
kg/m^3	-	Kilograms per Cubic Meter
VTM	-	Veyangoda Textile Mill
CEA	-	Central Environmental Authority

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Use of Eichhornia crassipes (Mart) Solms in treatment systems for textile mill effluents with special reference to Veyangoda Textile Mill.

By

NIMAL SENARATH GAMAGE

ABSTRACT

Indiscriminate discharge of wastewater from textile processing industries in Sri Lanka has created environmental problems with regard to both ground water pollution and surface water pollution. Veyangoda Textile Mill - (VTM) which is the largest textile processing factory in the country has been using water hyacinth plants in its ponding system for treatment of wastewater. The use of Eichhornia crassipes (Mart) Solms (commonly known as water hyacinth) in treatment systems for textile mill effluents was investigated at the University of Sri Jayewardenapura of Sri Lanka.

Typically waste effluents of VTM contained 1356 mg/l of total solids, 159 mg/l of BOD, 92 mg/l of total nitrogen, 1.9 mg/l of nitrate, 53 mg/l phosphate, 37 mg/l of chloride, 61 mg/l of potassium, 1232 mg/l of dissolved solids, 973 mg/l of volatile solids 120 mg/l of suspended solids and 660 mg/l of COD.

The diluted VTM effluents was not suitable for the growth of water hyacinth. With increasing dilution, the percentage relative growth rate decreased and the doubling time increased, shoot:root ratio was found to decrease and plants were not able to produce offshoots. Dilution of VTM effluent lowers the nitrate ion concentration and retard the growth of water hyacinth plants.

The effect of nutrient deficiency on growth of water hyacinth was investigated using modified Hoagland solution. Nitrogen was essential for survival and satisfactory growth of plants. Under phosphorus deficient conditions the plants did not produce offshoots and the plant as a whole was unhealthy but produced few small leaves. In the absence of potassium, plants were stunted and the relative growth rate was low.

An extensive monitoring study was carried out in order to find the efficiency of the existing treatment system at VTM for a period of one year. The reduction of total solid was 59.4%, volatile solids 72.6%, total suspended solids 46.6%, BOD 75%, COD 81.4%, total nitrogen 83.5%, phosphorus content 53.9%, chloride content 36%, sodium content 40.2% and potassium content 64.4%. An increase in nitrate content was observed in VTM treatment system.

A systematic laboratory study was made of the performance of water hyacinth in order to find the efficiency for improvement of quality of textile factory waste water. Simultaneously control experiments without water hyacinth were carried out for comparison. Water hyacinth performed as an excellent depollutant in a three tank model treatment system with a sand filter for textile factory wastewaters. The results indicated an improvement of 13.5 percent in total solids, 54.4 percent in COD, 84 percent in BOD, 51.4 percent in total nitrogen; 45.4 percent in phosphates, 26.1 percent in potassium and 13.9 percent in chloride due to water hyacinth culture with a retention time of a 30 day showing that the three tank treatment system with a sand filter and water hyacinths was highly satisfactory in reducing the pollution level of textile mill effluents. One drawback was the long retention time of 30 days.

In the circumstances, another trial was carried using a two tank model treatment system with a retention time of 20 days in order to see the possibilities of getting effluents treated with a reduced retention time. A reduction of 27.9% for BOD was achieved by the water hyacinth culture in the two tank treatment system whilst comparatively low reductions in COD (15.6%) and TS (12.5%) were observed after a continuous operation of 70 days. A remarkably high reduction in total nitrogen (27%) was also observed in the hyacinth cultured system compared to control system.

A further improvement in water quality was achieved by incorporation of a sand filter to the two tank system. With respect to the control system, water hyacinth treatment system was able to improve water quality in terms of COD by 26.9%, BOD by 30.4%, TS by 41.1% and TN by 89.9%.

In an attempt to further improve the efficiency of the treatment process the influent wastewater was treated with aluminium sulphate for coagulation of impurities. The improvement in total solid content that occurred in the water hyacinth system was 76.5%. Reductions of 26.9% in COD, 30.4% in BOD_3 and 24.7% in TN were also observed due to water hyacinth with respect to control system.

The results of this study show that both two tank system and three tank system with water hyacinth can be used for removal of pollutants in textile factory effluents. However, under ideal conditions with plants the three tank system was found to perform better than the two tank system, with pollutant parameters almost always satisfying the environmental standards, although the retention time is slightly longer (i.e 30 days).