TREATMENT OF PRAWN FARM WASTEWATER BY UNDER COMMON CATTAIL (TYPHA LATIFOLIA) DIFFERENT RETENTION TIME.

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INTRODUCTION

Changes in the quality of natural waters are constantly being brought about as direct and indirect results of human activities. (Timmy Katyal and Satake, 1998). In Sri Lanka most of the industries release wastewater into the environment without any treatment. Untreated wastes, hazardous to health and environment generated from numerous industries in Sri Lanka can be categorized as Milk and Food processing industries, Textile and Rubber industries, Prawn farming, Paper and Pulp industries, Tannery industries and Fertilizer and Pesticide formulating industries,

In Batticaloa district Manmunai North, Kattankudy and Eravur town Divisional Secretariat areas are the most important areas where abundant wastewater are

generated. For an example, in 2000, Number of wastewater generating sources and Total volume of wastewater generated from the above three D.S. Divisions are shown below.

Table 1.1 Number of wastewater generating sources in the Batticaloa area (Sugirtharan et ai, 200I)

Wastewater	Manmunai north D.S.Division	Kattankudy D.S.Division	Eravur town D.S.Division
Prawn farm	15	-	-
Service station	05	-	01
Small hotel	19	09	08
Large Hotel (Inns)	02	-	-
Rice mill	05	09	05
Ice cream factory	01	04	03
Slaughter house	01	01	01
General / District Hospital	01	01	01

Table 1.2 Total volume of wastewater generation in one year from the Batticaloa area (Sugiliharan et al, 2001)

Waste Wastewater source	Total volume of wastewater (m^3 / year)		
	Manmunai north	Kattankudy	Eravur town
Prawn farm	327803.69	--	--
Service station	6426	--	1134
Small hotel	3467.5	1314	1168
Inns	1458.54	--	--
Rice mill	32476.35	86937.03	32497.2
Ice cream factory	91	273.6	103.4
Slaughter house	473.04	236.52	236.52
Hospital	275940.4	9855	9855
Textile mill	294.84	--	--

The improper disposal of industrial wastewater especially the effluents from prawn farm. rice mill and paper mills creates several problems in the Batticaloa district and makes pollution on ground water, lagoon and environment.

The major cause of lagoon water pollution in Batticaloa district especially i Manmunai north area is due to the wastewater that is generated from prawn fame In prawn farms they discharge the wastewater in huge volume into the lagoon without any treatment. In 2001, more than 0.3 million m3 of wastewater wer discharged in to the lagoon from only 15 prawn farms at Manmunai North. Which causes the water pollution in terms of having more COD, Salinity, Nitrate an phosphate. This wastewater is a major source of nutrients that can caus Eutrophication of lakes and streams and deterioration of water quality.

Indeed more research effort has been concentrated on the ability of rooted aquati plants to perform this treatment function (Wathugala et ai, 1987). In a11 of these studies some nitrogen and phosphorus quantities and other pollutants were removed from wastewater when it flowed through the wetlands and it ha generally been found that treatment system that include emergent plants are mol' efficient than those without plants. In addition to the capacity of the plants t absorb nutrients, the creation of an aerobic zone around the root system of' interne air spaces allows both organic matter aerobic decomposition and growth c microbial population including nitrifying bacteria (Abissy el al, 1999).

In recent years interest has increased in wastewater treatment through constructed wetlands because of their low cost and energy requirement (Gersberg el ai, 1986 Several investigators have reported that wetlands may act as efficient water purification systems and nutrient sinks (Tilton and Kadlac, 1999; Dolen el a 1981; Nicholas, 1983). Wetlands remove aquatic pollutants through bacterial transformations and physicochemical processes like adsorption, precipitation an sedimentation (Chan et al, 1982).

Constructed wetlands are of low cost, simple to operate and are more suitable for treatment of domestic wastewater. However, insufficient information is available on the design and operation of wetlands in this country. Therefore laborator investigations were carried out to asceliain the efficiency of constructed wetland in the renovation of wastewater using Typha latijalia.

In this study, Typha latilolia (Common cattail) is used to assess the ability of the plant, as laboratory scale work will produce an avenue to treat the wastewater before disposing them into environment. Typha latilolia is an aquatic plant found in wild rivers and ponds of temperate and tropical regions in shallow depth of 15 30 cm. The treatment process involves the usse of existing or planted root system of reeds so that the plants survive on the wastewater in the wastewater (Finlayson and moses. 1991).

MATERIALS AND METHODS.

The experiment was carried out at the outdoors of the Agricultural Engineering workshop, Eastern University, Sri Lanka during the period between July t September 2003. The climate is the mean temperature varies between 29-37°C.

The experimental system consists total of 6 basins (2treatment and 3 replicate planted with Typha latifolia. 12 tillers were planted in broad plastic basins with same soil. 3 replicates were maintained for each treatment and the basins were kept 3 feet above the ground level. They were supplied with prawn fan wastewater. Wastewater from the prawn farm was taken at the point of dispose and analyzed before feeding. 8 liters of wastewater was fed as influent to the plants and kept under sunlight. The effluent from the treatments were taken after day and 2 days retention time through a tube set at the bottom of the basin an measured for the parameters such as COD, TSS, Turbidity, Nitrate, phosphate an salinity using standard procedures. From the 4 weeks monitoring program carried out, 6 samples were collected and analyzed for each of the above parameters.

RESULTS AND DISCUSSION

From the four weeks monitoring programme carried out to investigate the efficiency of prawn farm wastewater under different retention time and the result were obtained for the following pollution parameters such as COD, TSS, nitrate(phosphate, salinity and turbidity. Here 6 samples were collected and analyzed of each of the parameters. Table 1.3 gives the summary of the average parameters of the two treatments.

Treatment 1- One-day retention time
Treatment 2- Two days retention time

Table 1.3 Average indicators of the treatment efficiencies in wetlands by usir Typha latifolia under different retention time.

Indicator	Inlet	One day retention time		Tow days retention time	
		Outlet	Removal %	Outlet	Removal %
TSS (mg/l)	30674	8296	73	5874	81
Nitrate (mg/l)	6.2	5.1	18	4.6	26
Phosphate (mg/l)	0.52	0.39	25	0.37	29
COD (mg/l)	1186	252	80	204	83
Turbidity (FAU)	93	21	77	16	83
Salinity (%)	21	16	24	15	29

The percentage reduction of the above mentioned parameters "are better in t] treatment 2. This may be attributed to the fact that treatment 2 the effluent retention time with Typha as longer.

Total Suspended Solids (TSS) and Chemical Oxygen Demand (COD)

TSS and COD concentration at the influent exhibited an important variation al varied from 28000-34000 mg/l and 1013-1412 mg/l respectively (Table 1.3). The mean % removal of TSS reached 73% and 81 % for one-day retention time and two'days retention time respectively. Decreases of TSS at' these treatments we probably due to sedimentation and filtration in the common cattail within t wetland.

The mean % removal of COD reached 80% and 83% for the retention time of 0 day and retention time of two days respectively. For the COD removal und different retention time, the difference was not significant. Organic matter removal is almost due entirely to physical processes (sedimentation, filtration) in addition to chemical processes and biological processes associated with the microbial community.

COD and TSS reduction in the Typha wetland may be caused by 3 phenomena (Leclerc & Duchenu, 1986; Radoux & Kemp, 1988): (I) Simple decantation, (Horizontal percolation of the particulate organic load. This may be due encumberment of the aquatic table as the consequence of a considerable of networking and the submerged parts of aerial stems. (3) The formation of a lea thick layer above the water surface, which brings about a considerable decrease of the solar energy necessary for the photo plankton

Nitrate

At one-day retention time total nitrate inlet and outlet concentrations very between 3.8-8.5 mg/I and 3.1-6.5 mg/l respectively. The average removal efficiency is onl~ 18% varying between 11-24%. Under 2 days retention time period total nitrate(outlet concentration vary between 2.7-5.9 mg/I. The average removal efficiency is only 26% varying between 19-30%.

Nitrogen can be eliminated by nitrification, denitrification followed by plan removal. In effect, emergent plants like Typha have internal aerial spaces large enough for translocating oxygen to the roots and rhizomes (Brix, 1988). Thl oxygen diffused by the roots stimulates the growth of nitrifying bacteria in the rhyzosphere (Kickuth, 1981; Armstrong and Armstrong, 1988).

Nitrification is the oxidation of ammonium to nitrate by nitrifying bacteria. Thi process is only operational under aerobic conditions. Denitrification is al anaerobic decomposition process in which organic matter is broken down by bacteria by using nitrate instead of oxygen as an electron acceptor. The process occurs in 2 steps. First nitrate is reduced to nitrous oxide, which is subsequently further reduced to atmospheric N. Both end products are gases, which are emitted into the atmosphere.

Phosphate

Under the retention time of one day, the average inlet and outlet values c phosphate are 0.52 and 0.39 mg/l respectively (Table 1.3). The average remove efficiency is only 25%. At the retention time of 2 days the average outlet value c phosphate is vary between 0.33-0.41 mg/I. The average removal efficiency is only 29% varying between 24-33%.

Phosphate elimination occurs by chemical precipitation into aerobic zones through combination with Ca2+, Fe3+ and A13~, which are naturally present in the so (Kickuth, 1981: Nicholas, 1983).

Turbidity

The mean turbidity depletion reached 77% and 83% respectively for the retention time of one day and retention time of 2 days. Both treatments had lower turbidi1 values at the outlet, probably due to the settling enhanced in the root zone (Typha latifolia and the wind effect was smaller. However. this difference was not significant but the treatment of 2 days retention time showed higher removal rates of turbidity than treatment of one-day retention time period.

Salinity When we consider the salinity reduction, on average salinity removal values were 24% and 29% under different retention time of one day and 2 days respectively.

In general the constructed wetland in this study showed suUIclent removal efficiency with respect to TSS, Turbidity and COD at the both treatments.

CONCLUSIONS

It is concluded that the plant Typha latifolia is an efficient species for treating wastewater especially prawn farm wastewater under local environmental conditions. It showed a good purifying efficiency mainly in the removal of COD, TSS and turbidity. Despite the small retention time, the system to work efficiently, probably due to the high temperature at study area. It is therefore expected that if the system is properly designed, maintained and operated with long retention time, it will result in high quality effort for water reuse such as that for irrigation. The constructed wetland seems to be a cost effective alternative to conventional treatment processes, which involve huge energy and cost. Being simple in installation and operation, a wetland system for wastewater treatment can be adopted in small towns and villages. Wetlands performance is affected by rainfall. temperature, etc. Since it is not site specific, the system can be implemented near the wastewater source. .

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