Removal of Total Dissolved Solids by Using Rhizphora Mucronata for Treating Textile Wastewater

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Abstract - Environmental Pollution is becoming a major threat around the world due to the release of toxic and hazardous substances. Anthropogenic influence of water resource is a global problem. The major pollutants such as dye stuffs from the textile industries affect the aquatic ecosystem. The discharge of toxic effluents from various industries adversely affects water resources, soil fertility, aquatic organisms and ecosystem integrity. Phytoremediation aquatic macrophytes through treatment system for the removal of pollutants and contaminants from various natural resources is a well developed environmental protection technique. Mangrove plant Rhizophora mucronata, a best innovative aquatics weed has been utilized for various research activities over the last few decades. The biosorption capacity of the mangrove in minimizing various contaminants present in the industrial wastewater was well studied. Textile industry wastewater carries the contaminants responsible for the continuous pollution of the environment. Textile wastewater contains substantial pollution loads in terms of total dissolved solids (TDS). The Present research investigates the reduction of total dissolved solids (TDS) of raw textile wastewater by using Rhizophora mucronata.

Keywords : Environmental Pollution, Rhizophora Mucronata, Phytoremediation, Total Dissolved Solids, etc.

Introduction

Pollution may be defined as the unfavorable alteration of our surroundings. It changes the quality of air, water and land which interferes with the health of humans and other life on earth. In biodegradable pollutants decompose rapidly processes and non-biodegradable pollutants do not decompose slowly in the environment. Environment is defined as the sum of total of all living and non-living around us influencing one other. Degradation of the environment has become a serious problem. Pollution of soil, water and air leads to loss of valuable natural resources.

Scope of environment

- To get an awareness and sensitivity to the total environment and its related problem.
- To motivate the active participation in environment protection and improvement.
- To develop skills for identifying and solving environment problems.

The textile industry consumes large quantities of water and produces large volume of wastewater from different steps in the dyeing and finishing processes. Waste water from printing and dyeing units is often rich in color, containing resides to reactive dyes and chemical and requires proper treatment before being released into the environment [3]. The toxic effects of dyestuffs and other organic compounds as well as acidic and alkaline contaminants, from industrial establishment on the general public are widely accepted. Increasing public concern about environmental issues had led to closure of several small-scale industries [9].The conventional treatment systems like physic chemical treatment and physic-chemical treatment followed by biological treatment system are installed in majority of textile industries. The first step in the waste treatment is to mix and equalize the wastewater steams that discharged at different time, and different intervals from different stages in the processes. Equalization ensures that the effluents have uniform characteristics in terms of pollution load and temperature. The effluent is subject to flash mixing for the addition of coagulants such lime, alum, ferrous sulphate, ferric chloride, poly-electrolyte and processed through clariflocculator or flocculate and settling tank. Selection of appropriate coagulants and does chemical are determined on the basis of treatability study of effluent samples. The chemical treatment helps in reduction of color and suspended solids. In biological methods is often the preferred choice for treatment of wastewater [5]. Biological treatment is the most common treatment for textile wastewater now a day's most organisms that can degrade azo dyes are necessary for efficient treatment of textile wastewater. This micro organism need to have enzymes such as azo reductases and oxidizes. The enzymes are required to cleave the azo bonds and make the aromatic amines more accessing Oxidizes are fundamental to break down the previously released aromatic amines. The challenges to find micro organisms endowed with disease that can break down all azo dyes [6]. Phytoremediation is a cost-effective plant-based approach of remediation that takes advantage of the ability of plants to concentrate elements and compounds from the environment and to metabolize various molecules in their tissues. It refers to the natural ability of certain plants called hyper accumulators to bioaccumulation, degrade, or render harmless contaminants in soils, water, or air [7]. Toxic heavy metals and organic pollutants are the major targets for phytoremediation. In addition, several field trials confirmed the feasibility of using plants for environmental cleanup. The basic principle behind phytoremediation is that

plants (such as algae, fungi, grasses, forbs, shrubs, trees, etc.) to extract pollutants found in soil, water and air. In phytoremediation system are to clean up contaminated water which includes identification and implementation of efficient aquatic plants uptake of dissolved nutrients and heavy metal by the growing plants and harvest and beneficial use of the plant biomass produced from the remediation system[2]. The recent edition of standard method of examination of water and wastewater for removal of total dissolved solids by using Rhizphora Mucronota for treating textile wastewater [1].

Rhizophora mucronata is a small to medium size evergreen tree growing to a height of about 20to25 meters (66to82 ft) on the banks of rivers. On the fringes of the sea 10 or 15 metres (33to49ft) is a more typical height. The tallest trees are closest to the water and shorter tree are further inland. The tree has a large number of aerial stilt roots buttressing the trunk. The leaves are elliptical and usually and 6 centimetres (2.4 inches) wide. They have elongated tips but these of ten break off. There are corky warts on the pale undersides of the leaves. Each has a hard cream-coloured calyx with four sepals and four white, hairy petals. The seeds are viviparous and start to develop whilst still attached to the tree. The root begins to elongate and may reach a length of a metric (yard) or more. The propagule then becomes detached from the branch when sufficiently well developed to root in the mud below. The flowers develop in auxiliary clusters on the twigs.

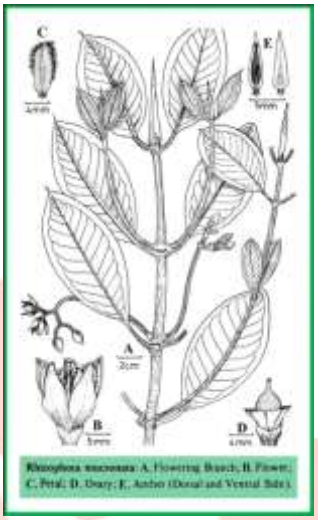


Figure.1 schematic diagram for Rhizophora mucronata plant species.

Experimental setup

The steps in this procedure can be follows:

1) A plexi glass phytoremediation reactor was designed for proper settling and separation textile wastewater.
2) Selection of plants like *Rhizophora mucronata* was done.
3) The textile wastewater flows at constant rate of 1 litre per hour.
4) After 15 days of detention time for the treated wastewater was collected.
5) We can observed only total dissolved solids for before and after treatment for wastewater.

Experimental run

To study the survival of acclimatized mangrove in raw effluent, the preliminary test was conducted. After introducing into the raw textile dye effluent. The aquatic plant was gradually started to change after 5 days and showed complete dryness of leaves and there was no mark of growth (death after 7 days). Hence in the present study, the effluent was diluted in the ratio of 1:3 (tap water : textile effluent) and used for phytoremediation experiments and the same dilution again used for the rest of other two experiments. Among this, the experimental setup treated with Rhizophora mucronata were operated at 12:12 ratio (L:D) photoperiod for plant growth.

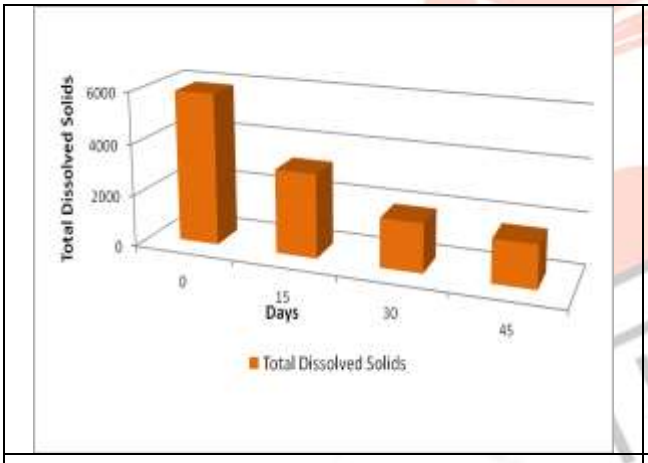
The experiments were conducted for a period of 45days, at regular intervals of 15days. After every 15days, the samples were taken from each experimental setup for the analysis of TDS.

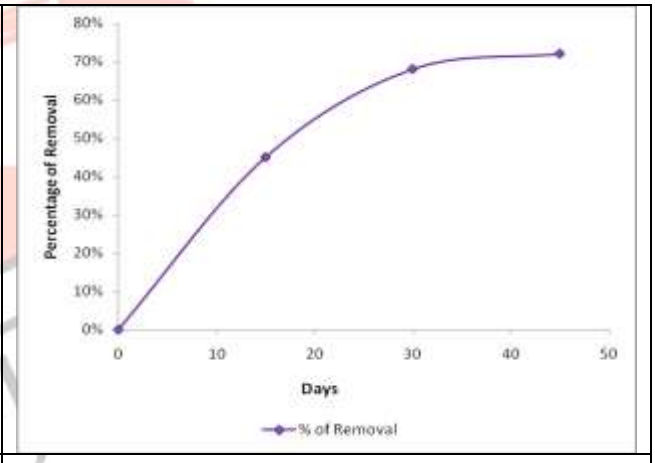
Figure.2 Schematic diagram for phytoremediation reactor

Results and Discussion

Table.No.1 %Removal of TDS.

Days	Total Dissolved Solid	% of Removal
0	5890.00	0%
15	3239.48	45%
30	1889.42	68%
45	1649.22	72%





TDS of the textile wastewater showed a greater decrease towards the growth of the *Rhizophora mucronata.* Initially the growth of the plant is faster for the first 15 days and gradually the growth of the plant was reduced when compared for the first 15 days consecutively for the next 15 days cycle also. Hence the %removal of the TDS was 45% in the first 15 days and started reduced for the next 30 days and achieved to 72% finally at 45 days which is satisfactory for the reduction of TDS of the textile wastewater when compared for the other conventional textile wastewater treatment in reduction of TDS.

Conclusion:

Rhizophora mucronata species can be used for treating the textile wastewater in reducing the TDS. TDS removal a greater problem in the treatment of textile wastewater and being a greater challenge for the conventional treatment systems by alarming the disposal of the reject to the environment from the filtration techniques which is a very expensive technique. Study concludes that Phytoremediation technique by using the *Rhizophora mucronata* species is the cost effective techniques used for achieving the higher TDS removal percentage of 72%.

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