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Analysis of Physico Chemical Characteristics of Bioadsorbent Treated Paper Mill Effluent

Selvarathi P[1], Murugalakshmi Kumari R[2]

[1]Dean, College Development Council (CDC), Bharathiar University, Coimbatore-46, Tamil Nadu, India.

[2]Department of Botany, V.V.Vanniaperumal College for Women, Virudhunagar – 626 001, Tamil Nadu, India.

Abstract: ***The paper mill effluent containing heavy metals that are toxic to plants, reduces the plant yield and even the soil fertility, although these toxic substances could be removed by plants and dried plant materials. Agricultural waste remediation is an effective low cost biotechnological tool for cleaning polluted environment. Research work focused on the dye from the paper mill effluent was treated with dried powdered Datura, Calotropis, Abutilon and Typha. After the treatment, the physico-chemical characters were studied and compared with untreated effluent parameters. It showed drastic changes in physico-chemical characteristics over the untreated effluent and also the heavy metals were found to be absorbed from the paper mill effluent by dried weed plants. Dried weed plants are low cost bio adsorbent for removing heavy metals from paper mill effluent.***

Keywords: *Datura, Calotropis, Abutilon, Typha* and Paper mill effluent**.**

1. Introduction

The World's ever increasing population and her progressive adoption of industrial based life style have inevitably led to an increased anthropogenic impact on the biosphere and hence environmental degradation has emerged as a common global menace. The fast pace of industrialization, the galloping demand for energy and the reckless exploitation of natural resources during the last century have been mainly responsible for aggravating the problem of environmental pollution. Urbanization and industrialization have yielded large quantities of sewage and effluent, which pose serious threat to biodiversity and ecosystem.

Water is indispensable and the most precious on the earth. Everything originated in water and everything is sustained by water. The disposal waste water from the industries has a serious havoc as receiving river stream has become coloured. Sivakasi is an industrial town in Virudhunagar district. The town alone has nearly 250 fireworks, 200 litho and offset, 700 match units and 150 other industries including textile, dye, printing ink, chemical cardboard, metal plate making and chemical plate grinding industries. Quite a large number of chemicals have constantly used for manufacturing process[1]. The industrial effluents contain especially inorganic content and colour, which impart objectionable colour to the water bodies. Presence of colour reduces the light penetration and photosynthetic activities of water bodies, some of the Plate makings used in the textile industries are found to be carcinogenic [2].

There is an urgent need to apply bioadsorption technology, using dried natural plant biomass to decontaminate the polluted water bodies in the world. This will be effective in bringing new resources and technology to solve environmental problems in India, generated by industries [3].

These waste effluents can be treated by treatment methods like ozonation, chemical coagulation, adsorption and electrochemical technology. These chemical treatment methods require costly chemicals and also generable hazardous sludge, so use of plants to degrade, assimilate, metabolize or detoxify contaminants is cost effective and ecologically sounds for the restoration and management of our natural water resourcesEnvironmental pollution, especially by chemicals, has received a great deal of attention in recent years. Among all chemical pollutants, heavy metal have specific ecological, biological and health significance. Physico-chemical process of waste water treatment system achieve removal of heavy metals from metal binding waste water, before discharging the effluent into natural water body system. But conventional technologies (Precipitation and coagulation) become less effective and more expensive. Adsorption by activated carbon is a recognized method for removal of heavy metal from waste water. The high cost of activated carbon, limits its use in adsorption studies. Now a days the new technology bioadsorption was emerged with the use of plants to remediate environmental toxicity. Some of the aquatic plants like water hyacinth and duck weed were reported as biological filters and efficient pollutant adsorbents by [4]. The adsorption capacity of various aquatic and land plants were will established by [5]. Hence it is aimed to develop a agricultural dried weed plant waste for remediation to make suitable change in some physico-chemical characteristics of effluent treatment.

2. Materials and Method

The effluent sample was collected from outlet of paper mill industry and its physico-chemical characteristics were analysed as per the standard procedure prescribed by [6]. The parameters like PH, temperature and electrical conductivity were analysed and other parameters were analysed within 24 hours.

10 g of each dried, powdered samples of *Datura, Calotropis, Abutilon* and *Typha* was added to 500 ml of the paper mill effluent and kept in mechanical shaker for 2 hours. After that, the agricultural weed plant waste materials were filtered and studied the physico-chemical parameters.

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3. Result and Discussion

The physico-chemical characteristics analysed in treated effluent were indicated in Table 1. Of the various physico-chemical factor studied, pH was found to change after the treatment with biological filters, because of the possible adsorption of the free anions and cat ions resulting in neutralization of pH. [7] reported that the use of sago waste for sorption of lead and copper from solution. [8] reported the removal of hexavalent chromium from waste water by the adsorption using bagasse and coconut jute. The electrical conductivity was substantially reduced in bio adsorbent treatment compared to reduction in total solids, total suspended solids and complete absence of oil and grease matter as well this was however quite contradictory to the untreated paper mill effluent having high concentration of total solids, total dissolved solids, total suspended solids and complete absence of oil and grease matter as well as this was however quite contradictory to the untreated dye effluent having high concentration of total solids, total dissolved solids, total suspended solids and sodium, these finding coincide with the report of [9] who noticed decrease in COD, BOD, solid content and sodium concentration after the application of dried plant biomass in paper mill effluent. Further removal and reduction of heavy meals like Zinc, COD, BOD, colour etc, from the industrial effluent using water hyacinth and other leaf materials by [10] and a report of low dissolved oxygen and dissolved CO2 content in trcated effluent, due to reduction of total solids by [11]confirm our findings.

Water quality improving ability of plants namely *Azadiracta* and *Calotropis sps* may be attributed to some phenolic compounds produced from their leaf surface and which place the degradation role [12].

Among the four dried weed plant biomass, *Datura* was a very good low cost bio adsorbent and most efficient to reduce the pollution level followed by *Calotropis*. From this study it can be concluded that, commonly available low cost bio adsorbent material such as weed plant biomass such as *Datura*, *Calotropis*, *Abutilon* and *Typha* can be utilized as alternative method for the purification and reduction of the toxicity of textile dye effluent

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Table 1

The Physico Chemical Characteristics of Bioadsorbent treated Paper Mill Effluent

S. No.	*Parameters*	*Water*	*Control (Effluent)*	*Datura*	*Calotropis*	*Abutilon*	*Typha*
1.	Temperature	-	30^0C	29^0C	30^0C	30^0C	30^0C
2.	pH	7 to 8.5	4.7	6.8	6.4	6.0	5.7
3.	Electrical Conductivity	400	10,500	4,300	4,800	5,700	6,600
4.	Total Solids	-	9,800	3,400	4,200	5,300	6,200
5.	Total Dissolved Solids	500	9,975	5,700	6,810	7,325	8,150

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6.	Total Suspended Solids	-	9,175	6,130	7,110	8,200	8,875
7.	Total hardness	300	1,365	545	630	690	785
8.	Salinity	-	26.2	13.2	15.62	17.31	19.4
9.	Potassium	20	85.2	32.61	40.81	49.54	61.4
10.	Sodium	20	1,250	854	921	969	1,045
11.	Calcium	75	36.2	19.51	22.15	26.21	37.15
12.	Magnesium	30	15.7	6.54	8.31	9.42	10.31
13.	Sulphate	150	26.2	15.43	17.35	19.27	21.20
14.	Chloride	250	4,000	1,500	2,100	2,450	3,100
15.	Bicarbonate	-	7.6	5.43	6.23	6.58	7.10
16.	Phosphate	-	22.1	12.15	14.35	16.27	18.15
17.	Nitrogen	-	6.2	3.81	4.15	4.83	5.16
18.	Dissolved oxygen	-	4.5	2.86	3.13	3.85	4.10
19.	Dissolved carbon di oxide	-	41.2	25.43	28.01	31.46	36.31
20.	COD	-	850	416	485	574	627
21.	BOD	-	95.2	29.5	38.4	46.4	53.1
22.	Oil and grease	-	0.017	-	0.012	0.013	0.015
23.	Water Quality Index	-	50	73	69	62	54

* All the values are expressed in mg/L, except pH and Electrical Conductivity.

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