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Characterization and Treatment of Textile Industry Effluent by Phytoremediation Technique

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Abstract: ***The present work is designed to analyse the physico chemical properties of textile effluents and to evolve the effective and economically low-cost method for textile waste. Here the suitability of plants to remove containments are compared by two types of flow in which waste water is passed through the root zone by horizontal and vertical flow and suitability of plants to remove contaminant depends upon retention time or velocity of effluent which passes from one end to another end of the container. In India now a day, several efforts have been driven to control the pollution to enjoy the citizen, the disease-free environment. Mainly in this paper, we discuss about the pollution created by the Textile industry Effluent generated by this industry is one of the sources of pollution which contained air, soil and water. The main Contamination of soil and water bodies by the discharge of this industry are due to the Heavy metals & colour (dyes). This discharge if allowed on ground or water bodies, it percolates through the soil and pollute the fertile soil which effects the Agriculture and further this contaminates the ground water table and an aquatic life by toxication of water and this effects the human health and vegetation. The industry related with this study is of raw cotton based here cotton used is from ginning and pressing operation.***
Keywords: Phytoremediation, Hydrophydes, Toxication, Textile Effluent

I. INTRODUCTION

This section conducts the Experiment which is related with Textile Mill effluent, its characteristics and the results of phytoremediation technique which is conducted on the hydrophydes. By contained of colour/dyes, Chemical Oxygen Demand, total solid, pH, and turbidity. Traded with the phytoremediation technique. In textile waste water colour is the main ingredient and which is very toxic and harmful to human health. Generally, the effluent percolates through the soil and contaminates the ground water table. It is necessary to find the most suitable treatment method for textile waste water that will minimize the production and investment costs of waste water treatment plants. One of the most harmful content of the discharge of Textile mill is dye since the colour load of dyed waste water is high and its biological degradation is difficult, is very difficult for treat it.

A. Characteristics of Dye Wastewater

The textile industry generates wastewater mainly from the wet-processing originates from bleaching and washing section these processes generate waste water of great chemical complexity and diversity. Textile industry effluents are known to present extreme variations of pH, high temperature and high concentration of dissolved solids, suspended solid and dissolved salts. Textile dye wastewater can be classified in 3 classes according to Chemical Oxygen Demand (COD) content and color density that is high, average and low intense wastewater. High intense wastewater has COD concentration over 1500 mg/l and very low light permeability. Average intense wastewater has under800mg/i COD content. In general, most of the wastewater are place in average or lower intense wastewater class (Lm and Pang, 1994).

Following are the major polluting components of Textile effluent.

1) *Color:* Presence of color in the waste is one of the main problems in textile industry. Color is easily visible to human eyes, even at very low concentration; hence color from the textile wastes carries significant esthetic importance. Most of the dyes are stable. Not easily degradable by the conventional treatment methods. Removal of dyes from the effluent is major problem in most of textile industries.
2) *Dissolved Solids:* Dissolved solids contained in the industry effluent are also a critical parameter. Use of common salt etc. in the processes, percentage of line increase total dissolved solids (TDS) level in the effluent TDS are difficult to be treated with conventional treatment systems. Disposal of high TDS bearing effluent can lead to increase in TDS of ground water and surface water, Dissolved solids in effluent may also be harmful to vegetation and restrict for use of agricultural purpose.
3) *Toxic Metals:* Wastewater of textiles is not free from metal contents. There are mainly two sources of metals. Firstly, the metals may come as impurity with the chemicals used during processing such as caustic soda, sodium carbonate and salts. For instance, caustic soda may contain Mercury if produced using Mercury cell processes. Secondly, the source of metal could be dye stuffs like metalized modern dyes. The metal Complex dyes are mostly based on chromium.

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4) *Residual chlorine:* The use of chlorine compounds in textile processing results in residual chlorine in the waste stream. The waste water (if disposal without treatment) depletes dissolved oxygen in the receiving water body and as such aquatic life gets affected. Residual chlorine may also react with other compounds in the wastewater stream to form chlorine derivatives.
5) *Organic Pollutants:* Organic pollutants originating from organic compound of dyestuffs, acids, sizing materials, enzymes etc. are also found in textile effluent. Such impurities are reflected in the analysis of bio-chemical oxygen demand (BOD) and COD. In many textile units, particularly engage in synthetic processing, low BOD/COD ratio of effluent is observed which makes even biological treatment it not a ready position.

B. Aim and Objectives

The aim of this study is to remove the parameter like turbidity, Chemical Oxygen Demand, total solid, dissolved solid and colour from the textile mill effluent and to points the variation in pH by using the phytoremediation technique.

The plants involved in this study are Canna Indica and colocasia esculenta overcome the clarcity of water Recycling is very low. This study has been performed keeping in view the following objective

1) To conduct the study on different category of wild hydrophytes for removal of solids and colour present in textile effluent.
2) To study the feasibility of the the locally available wild hydrophytes for treatment of textile waste under the environmental condition of Amravati region.
3) To study the variation in characteristic of various parameters while treatment process
4) To study the potential of selected plants for removal efficiency for Colour and other II parameters compare their efficiency

II. MATERIALS AND METHODS

A. Equipment's used

1) UV spectrophotometer (Biochrom Libra, S11).
2) Digital pH meter to test for pH of treated wastewater.
3) Filter paper 42 micron.
4) Turbidity metre (JTU)
5) Heating oven
6) A necessary small tools and instruments and chemical for Titration etc.

B. Experimental Procedure

1) *Collection of Plants:* Plants named Colocasia Esculenta were collected from local Amravati City. The plant was plucked from Nala Bank and from area with Marshy land containing these types of plants. The places selected where like Badnera Amravati main road, Kathora road, University Road etc. And the plants name Cana Indica were plucked from Nala And marshy land found at village Darapur and Amravati local. These both plants were plucked when the height of plants were 12 Inches.
2) *Observation of Plants:* Plants where minutely observe for their natural changes in their physical character as they were rooted in new environment. Initially for about 15 days the plants seem to be in nearly dead condition. Their colour become yellowish and become weak. But there after 15 days later, the plants start to flourish slowly and after 3 months they reach to fully developed and healthy plants heighted up to about 0.60m.
3) *Collection of Media:* Collection of soil for the bed of plants was from local area or from nearby areas experimental setup was existing. The soil was of mixture of yellowish, redish and white type sandy soil. This soil was such that the effluent can be easily passed through the soil media root zone.
4) *Preparation of Setup for Experiment:* First of all, Horizontal container of GI Sheet of size 3.0 x0.38x0.38m is used to plant Colocasia Esculenta fill with soil as media, Which is used for first cycle treatment of west for horizontal flow. Secondly other horizontal conterminal of 6.1 Sheet of size 3.0 x0.38x0.38m. Were used for the plants of Cana Indica which is used for 2nd cycle or polished treatment waste water for horizontal flow. Both the containers were fix with a tap of P.V.C. for discharge of treated wastewater and the waste water is pass through a rubber pipe connected with a bucket and this bucket which is placed at elevated spot about 3.0m height from container as shown in photographs. This horizontal type container consist of two different perforated partition walls of G.I. sheet so that the water may pass in zigzag manner and take sufficient time to pass from one end to other. For vertical flow test, both types of plants were rooted in a vertical contour of P.V.C. having dia of 0.33m and height with0.3 m for effluent placement of 0.66m and both containers are filled with soil and planted with both types of plants respectively.

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5) *Collection of Effluent:* The effluent is connected from Suryalakshmi cotton mills Ltd. Ramtek, District Nagpur (MS). For experiment about 200 litres of composite type of effluent is collected in plastic barrels.
6) *Procedure of Experiment:* The actual experiment is started after 3 months from planting the plants. By the time, the plants were in developed and healthy condition in environment.
7) *Process of Horizontal Flow:* First off all the original effluent is diluted. Thus 50% original effluent and 50% fresh water is mixed and this mixture is allowed to pass from a action ½" pipe from a bucket placed at the higher elevation then the container of plant named Colocasia esculenta about 3.0 m height from the height of the velocity is controlled by the tap fitted in the bucket and waste water is allowed to pass slowly from one end to other end. And because of the perforated partition, the waste water flows in zig-zag manner so that the root of plants get sufficient time to absorb the impurities of waste water as the water get sufficient retention time to pass from inlet to outlet. After observing the physical condition of plants, the final sample is left to pass from both the containers planted by Colocasia Esculenta and Cana Indica respectively. And sample of treated water is taken regeneraly at a internal of 24hr. for 7 days. After this Experiment final test is taken. Here the original waste water of Mill is passed in Horizontal manner from both containers carrying both types of plants at a time and the Retention time is kept up to 7 days and samples are collected from outlet tap for daily analysis.
8) *Process of Vertical Flow:* In this type of flow the planted container is filled with waste water up to top level to allow the vertical flow of waste water towards the bottom of container thus the waste water passes slowly from top to bottom of a container. Thus, the root of plants uptake the contaminants and purify the passing waste water. For this purpose's small perforation of about 5mm diameter were kept to pass the treated water and thus sample of treated waste water is collected for 7 days by regular interval 24 hrs.
9) *Collection of Simple:* The sample is collected from outlet tap for Horizontal flow which is filled at the lower level of container and for vertical flow,sample is collected from the perforation made at the base of vertical container and soon the samples are taken to different labs for analysis of pH, Turbidity, COD, total solids, dissolved solid.

C. Method of Analysis of Waste Water Parameters

1) pH Analysis

Procedure: Electrometric method

The pH is determined by measurement of the electromotive force of a sale comprising an indicator electrode (an electrode responsive to hydrogen ions such an glass electrodes immersed in a test solution and a reference electrode (Mercury Calomed Electrode) contact between the test solution and the reference electrode is usually achieved by means Of liquid junction which forms a part of reference electrodes. The emf or cell measured with this pH meter. This is a high impedance electrometer calibrated in terms of PH

a) Calibrate the electrodes with 2 standard buffer solution of PH 4.0 and 9.2
b) The sample temperature is a determined at the same time and is entered into metre to allow for a temperature correction.
c) Rinse the electrodes thoroughly with deionized with distilled water and carefully wipe with the tissue paper.
d) Dip the electrodes into the sample solution swirl the solution and wait up to 1 minute for steady reading.
e) The reading is taken after the indicated value remains constant for about a minute.

2) *Analysis of Turbidity by Jackson Turbidity Metre:* For measuring turbidity of sample, after lighting the candle, slowly pour the sample into graduated tube and simultaneously observed the light of the candle flame from the top. A stage will come where the light source will disappear from eye right. Now stop pouring sample at this stage. Corresponding reading on the gradually tube will be the turbidity of sample.
3) *Analysis of solids Procedure*

a) For total solids

- Weigh the given porcelain dish and record its weight (W_1) gm.
- Take 100ml of sample in porcelain dish.
- Place the dish in an over.
- Evaporate to dryness in an over at 103º C to 105ºC for about 24hrs.
- Cool the dish and weight it (W_2) gm.

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b) For Suspended solids

- Take wattmans filter paper no. 42 and records it weight (W_3) gm.
- Filter 100ml sample of water by using aboke filter paper.
- Place the filter paper with residue in an oven and evaporate it to dryness.
- Road the weight of the filter and Rosidne (W_4)

➢ Concentration of total solid(mg/l)

$$= \frac{(W_2 - W_1) \times 1000 \times 1000}{\text{Volume of sample in ml}}$$

➢ Concentration of suspended solid(mg/l)

$$= \frac{(W_4 - W_3) \times 1000 \times 1000}{\text{Volume of sample in ml}}$$

➢ Concentration of total dissolved solid (mg/lit)

= Total solid - Suspended solid

➢ *Analysis for Chemical Oxygen Demand*

- Place 0.4 g Hg SO_4 in a reflux flask.
- Add 20 ml Sample or dilute to 20 ml with distilled water.
- Add glass bids.
- Add 10 ml std. $K_2 Cr_2 O_7$
- Add slowly 30 ml H_2SO_4
- Mix well and connect the flask to condenser of reflux apparatus.
- Reflux for 2 hours

c) Sample Calculations

$$\text{COD} = \frac{(a-b) \times N \times 8000}{\text{Ml of Sample}}$$

a= ml ferrous ammonium sulphate for blank
b= ml ferrous ammonium sulphate for sample
N= Normality of ferrous ammonium sulphate

$$\text{COD mg/l} = \frac{(a-b) \times 0.1 \times 8000}{20}$$

d) Analysis of Colour by UV- Spectrophotometer: Using distilled water as a blank, set up the spectrophotometer for Rhodamine B calibration. Take the absorbance reading at about 800 nm where absorbance is at maximum. Castly, take the absorbance reading of each of the soil samples is treated. In this method, dye solutions of different concentrations are prepared. Absorbance of each sample is measured at its maximum absorbance wavelength λ_{max} and Curve is plotted. MB the in the aqueous solution was analyse using UV spectrophotometer. A standard solution of the MB was scanned to determine the wavelength λ_{max} corresponding to maximum absorbance. The wavelength corresponding to maximum absorbance was 800mm. Once the wavelength found by dye solutions of 1, 2, 3,4,5 mg/l was scanned at absorbance for each was found. The best fitted graph of dye solution concentration and correspondence absorbance was plotted which is used as calibration cure. If the absorbance of dye solution is known by using spectrophotometer, the concentration dye in that particular sample can be calculated using equation of the line.

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III.OBSERVATION

Treated waste water samples from the container of Colocasia esculenta and Canna Indica were collected on daily bases for 7 days analyzed in laboratory for the parameters like pH, Turbidity, COD, Total solid, dissolved solid and colour. The details of observation observed in analysis are shown in the following table.

Table 3.1 Observation table for variation of P^H
Initial value of untreated sample = 9

Sr. No.	Retention time in days	P^H for the plant of Colocasia esculenta For Horizontal Flow	P^H for the plant of Canna Indica For Horizontal Flow	P^H for the plant of Colocasia esculenta For Vertical Flow	P^H for the plant of Canna Indica For Vertical Flow
1	1	8.75	8.75	8.75	8.75
2	2	8.50	8.50	8.50	8.50
3	3	8.25	8.25	8.30	8.00
4	4	7.75	7.75	7.50	7.50
5	5	7.50	7.50	7.25	7.25
6	6	7.25	7.25	7.20	7.00
7	7	7.50	7.50	7.50	7.25

Table 3.2 Observation table for Concentration of Turbidity (JTU)
Initial value of untreated sample = 800 (JTU)

Sr. No	Retention time in days	Concentration of Turbidity for the plant of Colocasia esculenta For Horizontal Flow	Concentration of Turbidity for the plant of Canna Indica For Horizontal Flow	Concentration of Turbidity for the plant of Colocasia esculenta For Vertical Flow	Concentration of Turbidity for the plant of Canna Indica For Vertical Flow
1	0	800	800	800	800
2	1	685	0	600	0
3	2	500	0	500	0
4	3	400	0	400	0
5	4	350	0	300	0
6	5	200	0	150	0
7	6	100	0	100	0
8	7	0	0	0	0

Table 3.3 Observation table for Concentration of Chemical Oxygen Demand (mg/L)
Initial value of untreated sample = 304 (mg/L)

Sr. No	Retention time in days	Concentration of COD for the plant of Colocasia esculenta For Horizontal Flow	Concentration of COD for the plant of Canna Indica For Horizontal Flow	Concentration of COD for the plant of Colocasia esculenta For Vertical Flow	Concentration of COD for the plant of Canna Indica For Vertical Flow
1	0	304	304	304	304
2	1	293	284	282	280
3	2	283	270	263	254
4	3	272	256	224	228
5	4	262	242	225	202
6	5	252	228	206	176
7	6	242	214	187	150
8	7	232	200	168	124

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Table 3.4 Observation table for Concentration of total solid (mg/L)
Initial value of untreated sample = 7400 (mg/L)

Sr. No	Retention time in days	Concentration of total solid for the plant of Colocasia esculenta For Horizontal Flow	Concentration of total solid for the plant of Canna Indica For Horizontal Flow	Concentration of total solid for the plant of Colocasia esculenta For Vertical Flow	Concentration of total solid for the plant of Canna Indica For Vertical Flow
1	0	7400	7400	7400	7400
2	1	7230	6817	6942	6900
3	2	7064	6234	6484	6400
4	3	6890	5651	6026	5900
5	4	6730	5068	5568	5400
6	5	6560	4485	5110	4900
7	6	6400	3902	4652	4400
8	7	6240	3320	4220	3900

Table 3.5 Observation table for Concentration of Dissolved solid (mg/L)
Initial value of untreated sample = 7340 (mg/L)

Sr. No	Retention time in days	Concentration of dissolved solid for the plant of Colocasia esculenta For Horizontal Flow	Concentration of dissolved solid for the plant of Canna Indica For Horizontal Flow	Concentration of dissolved solid for the plant of Colocasia esculenta For Vertical Flow	Concentration of dissolved solid for the plant of Canna Indica For Vertical Flow
1	0	7340	7340	7340	7340
2	1	7191	6685	6628	6600
3	2	6982	5970	5858	5800
4	3	6773	5255	5088	5000
5	4	6564	4540	4318	4200
6	5	6355	3825	3548	3400
7	6	6146	3110	2778	2600
8	7	5940	2400	2000	1800

Table 3.6 Observation table for Concentration of color (mg/L)
Initial value of untreated sample = 3800 (mg/L)

Sr. No	Retention time in days	Concentration of color for the plant of Colocasia esculenta For Horizontal Flow	Concentration of color for the plant of Canna Indica For Horizontal Flow	Concentration of color for the plant of Colocasia esculenta For Vertical Flow	Concentration of color for the plant of Canna Indica For Vertical Flow
1	0	3800	3800	3800	3800
2	1	3400	3357	3507	3457
3	2	3000	2914	3214	3114
4	3	2600	2477	2921	2771
5	4	2200	2028	2628	2428
6	5	1800	1585	2335	2085
7	6	1400	1142	2042	1742
8	7	1000	700	1750	1400

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Table 3.7 Observation table
Reading on spectrophotometer (Biochrom Libra S11)

Sr. No.	Sample No.	Transmission in %
1	1	1.10
2	2	76.10
3	3	86.50
4	4	55.90
5	5	64.20
6	Water	100

1) Sample No. 1:- Original Untreated waste water
2) Sample No. 2:- Treated waste water for Conocasia esculenta for horizontal flow.
3) Sample No. 3:- Treated waste water for Canna Indica for horizontal flow.
4) Sample No. 4:- Treated waste water for Conocasia esculenta for vertical flow.
5) Sample No. 5:- Treated waste water for Canna Indica for vertical flow.

Table 3.8 Observation table for % variation of p^H of treated waste water for various retention time.
Initial Value of untreated sample=9

Sr. No	Retention time in days	Horizontal flow for the plant of Colocasia esculenta		Horizontal flow for the plant of Canna Indica		Vertical flow for the plant of Colocasia esculenta		Vertical flow for the plant of Canna Indica	
		Value of P^H	% Removed	Value of P^H	% Removed	Value of P^H	% Removed	Value of P^H	% Removed
1	1	8.75	2.77	8.75	2.77	8.75	2.77	8.75	2.77
2	2	8.50	5.55	8.50	5.55	8.50	5.55	8.50	5.55
3	3	8.25	8.33	8.25	8.33	8.30	7.44	8.00	11.23
4	4	8.00	11.23	7.75	13.88	7.50	16.66	7.50	16.66
5	5	7.75	13.88	7.50	16.66	7.25	19.74	7.25	19.44
6	6	7.50	16.66	7.25	19.44	7.20	20.00	7.20	20.00
7	7	7.25	19.44	7.50	16.66	7.50	16.66	7.25	19.44

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Table 3.9 Observation table for % removal of Turbidity (JTU) of treated waste water for various retention time.
Initial Value of untreated sample=800 (JTU)

Sr. No	Retention time in days	Horizontal flow for the plant of Colocasia esculenta		Horizontal flow for the plant of Canna Indica		Vertical flow for the plant of Colocasia esculenta		Vertical flow for the plant of Canna Indica	
		Value of Turbidity	% Removed	Value of Turbidity	% Removed	Value of Turbidity	% Removed	Value of Turbidity	% Removed
1	1	685	14.37	0 (BDL)	100	600	25.00	0 (BDL)	100
2	2	500	37.50	0 (BDL)	100	500	37.50	0 (BDL)	100
3	3	400	50.00	0 (BDL)	100	400	50.00	0 (BDL)	100
4	4	350	56.25	0 (BDL)	100	300	62.50	0 (BDL)	100
5	5	200	75.00	0 (BDL)	100	150	81.25	0 (BDL)	100
6	6	100	87.50	0 (BDL)	100	100	87.50	0 (BDL)	100
7	7	0 (BDL)	100	0 (BDL)	100	0 (BDL)	100 (BDL)	0 (BDL)	100

Table 3.10 Observation table for % removal of COD (mg/L) of treated waste water for various retention time.
Initial Value of untreated sample=304 (mg/L)

Sr. No	Retention time in days	Horizontal flow for the plant of Colocasia esculenta		Horizontal flow for the plant of Canna Indica		Vertical flow for the plant of Colocasia esculenta		Vertical flow for the plant of Canna Indica	
		Value of COD	% Removed	Value of COD	% Removed	Value of COD	% Removed	Value of COD	% Removed
1	1	293	3.61	284	6.57	282	7.23	280	7.89
2	2	283	6.90	270	11.18	263	13.48	254	16.44
3	3	872	10.19	256	10.52	224	26.31	228	25.00
4	4	262	13.48	242	20.39	224	25.98	202	33.55
5	5	252	16.77	228	25.00	206	32.23	176	42.10
6	6	242	20.06	214	29.60	178	38.48	150	50.65
7	7	232	23.35	200	34.21	168	44.73	124	59.21

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Table 3.11 Observation table for % removal of Total solids (mg/L) of treated waste water for various retention time.
Initial Value of untreated sample=7400 (mg/L)

Sr. No	Retention time in days	Horizontal flow for the plant of Colocasia esculenta		Horizontal flow for the plant of Canna Indica		Vertical flow for the plant of Colocasia esculenta		Vertical flow for the plant of Canna Indica	
		Value of Total solids	% Removed	Value of Total solids	% Removed	Value of Total solids	% Removed	Value of Total solids	% Removed
1	1	7230	2.29	6817	7.87	6942	6.18	6900	6.75
2	2	7064	4.54	6234	15.76	6484	12.37	6400	13.50
3	3	6890	6.89	5651	23.63	6026	18.56	5900	20.25
4	4	6730	9.05	5068	31.51	5568	24.75	5400	27.00
5	5	6560	12.00	4485	39.40	5110	30.94	4900	33.75
6	6	6400	13.51	3902	47.27	4652	37.13	4400	40.50
7	7	6240	5.67	3320	55.13	4220	43.00	3900	47.50

Table 3.12 Observation table for % removal of Dissolved solids (mg/L) of treated waste water for various retention time.
Initial Value of untreated sample=7340 (mg/L)

Sr. No	Retention time in days	Horizontal flow for the plant of Colocasia esculenta		Horizontal flow for the plant of Canna Indica		Vertical flow for the plant of Colocasia esculenta		Vertical flow for the plant of Canna Indica	
		Value of Dissolved	% Removed	Value of Dissolved	% Removed	Value of Dissolved	% Removed	Value of Dissolved	% Removed
1	1	7191	2.82	6685	9.66	6628	10.43	6600	10.81
2	2	6982	5.64	5970	19.45	5858	20.83	5800	21.62
3	3	6773	8.47	5255	28.98	5058	31.24	5000	32.43
4	4	6564	11.29	4540	38.64	4318	41.64	4200	43.24
5	5	6355	14.12	3825	48.31	3548	52.05	3400	54.05
6	6	6146	16.94	3110	57.97	2778	62.45	2600	64.86
7	7	5940	19.72	2400	67.56	2000	72.97	1800	75.67

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Table 3.13 Observation table for % removal of Color (mg/L) of treated waste water for various retention time.
Initial Value of untreated sample=3800 (mg/L)

Sr. No	Retention time in days	Horizontal flow for the plant of Colocasia esculenta		Horizontal flow for the plant of Canna Indica		Vertical flow for the plant of Colocasia esculenta		Vertical flow for the plant of Canna Indica	
		Value of Color	% Removed	Value of Color	% Removed	Value of Color	% Removed	Value of Color	% Removed
1	1	3400	10.52	3357	11.65	3507	7.71	3457	9.00
2	2	3000	21.04	2914	23.31	3214	15.42	3114	18.05
3	3	2600	31.56	2477	36.84	2921	23.13	2771	27.07
4	4	2200	42.08	2028	46.63	2628	30.84	2428	36.10
5	5	1800	52.60	1585	58.28	2335	38.55	2085	45.13
6	6	1400	63.12	1142	69.94	2042	46.26	1742	54.15
7	7	1000	73.64	700	81.57	1750	53.94	1400	63.15

IV. RESULTS AND DISCUSSIONS

A. *Results of Experiment*

1) *Ph:* After 7 days of retention time pH of treated waste water by the plant of Colocaria esculenta for horizontal flow remains at 7.25 and after 7 days of retention time, pH of same plant for vertical flow remains at 7.50. Also after 7 days of retention time pH of treated waste water by the plant of Canna Indica remains at 7.50. And after 7 days of retention time pH of treated water by same plant comes to 7.25. Thus the maximum % variation removal is 20% for vertical flow of Colocasia esculenta and vertical flow of Canna Indica at the end of 6^{th} day.
2) *Turbidity:* After 7 days turbidity of water treated by Colocasia esculenta by horizontal flow comes down to BDL (Below Detectable limit). At the end of 7^{th} day turbidity remains below detectable level for both plants and for both type of flow.
3) *Chemical Oxygen Demand:* After 7 days the COD of water treated by Colocasia esculenta for horizontal flow comes to 232 mg/L and for same time and flow the COD of water treated by plants of Canna Indica comes to 200 mg/L. Also after 7 days of retention time for horizontal flow, COD was 168 mg/L and for Canna Indica for same time and flow COD remain at 124 mg/L. Thus maximum % removal of COD finds to be 59.21% in the case vertical flow of Canna Indica.
4) *Total Solid:* Total solid of waste water treated by Colocasia esculenta by horizontal flow after 7 days was detected to 6240 mg/L and total solid after 7 days for Canna Indica for horizontal flow was found to be 3320 mg/L. Also total solids for Colocasia esculenta for vertical flow remains at 4220 mg/L for horizontal flow and 3900 mg/L by the plants of Canna Indica for vertical flow. And maximum % removal is found to be 55.30% after 7 days for the Canna Indica for horizontal flow.
5) *Dissolved solid:* For 7^{th} day of horizontal flow from Colocasia esculenta dissolved solid was detect to 5940 mg/L and for 7^{th} day of horizontal flow from Canna Indica dissolved solid was measured to 2400 mg/L. Also for same period for vertical flow from Colocasia esculenta, results was 2000 mg/L and for Canna Indica dissolved solid after 7 days of vertical flow was 1800 mg/L. Thus higher % of removal of dissolved solid is found to be 75.67 % in the case of vertical flow of Canna Indica.
6) *Color:* After retention time of 7 days for horizontal flow from Colocasia esculenta color Concentration was 1000 mg/L and for horizontal flow after 7 days treated water from Canna Indica remains at the level of 700 mg/L for horizontal flow after 7 days. Also after 7 days period after passing waste from Colocasia esculenta in vertical flow intensity of color was 1750 mg/L and after 7 days the Concentration of treated water from Canna Indica for vertical flow comes to 1400 mg/L. Thus maximum % removal of color is found to be 81.57% in the case of horizontal flow of the Canna Indica.

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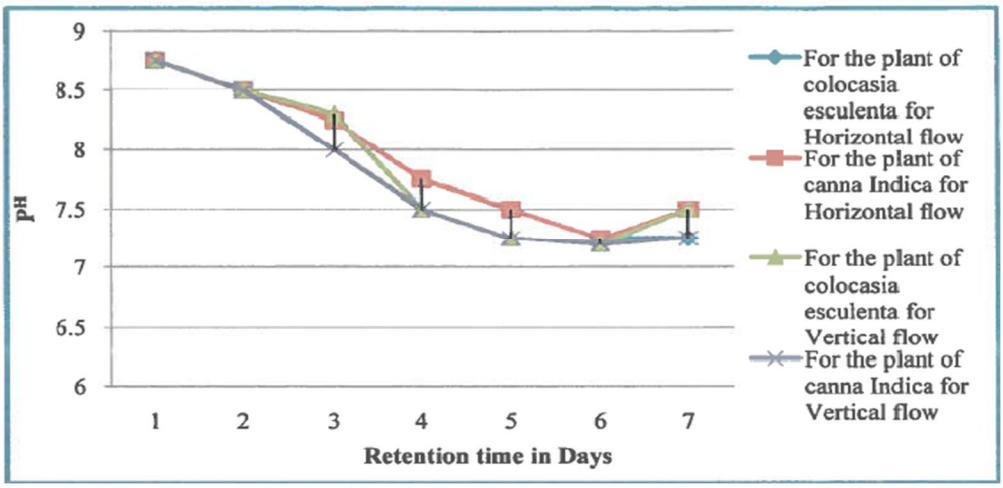

Fig 1: Showing pH variation with respect to retention time in days

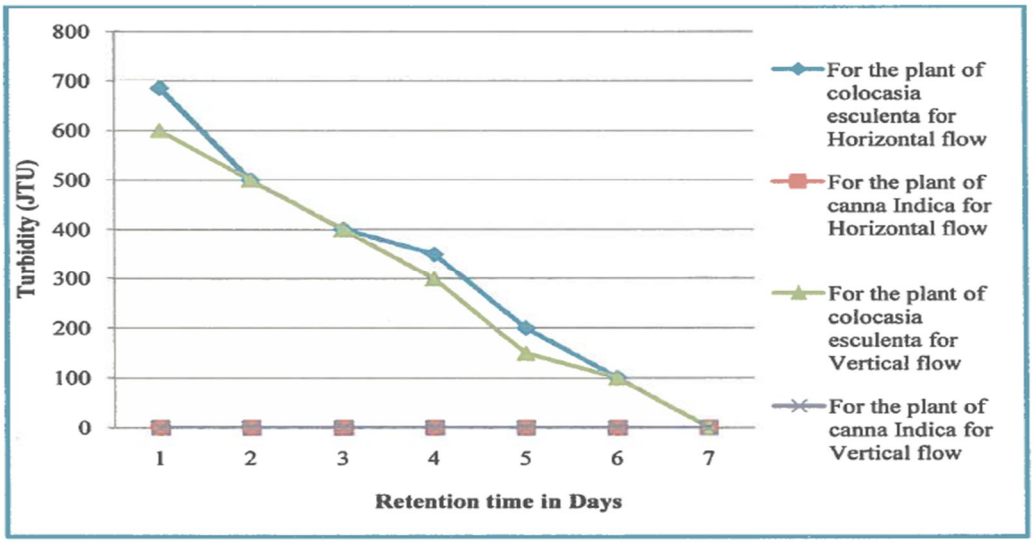

Fig 2: Showing concentration of turbidity with respect to retention time in days

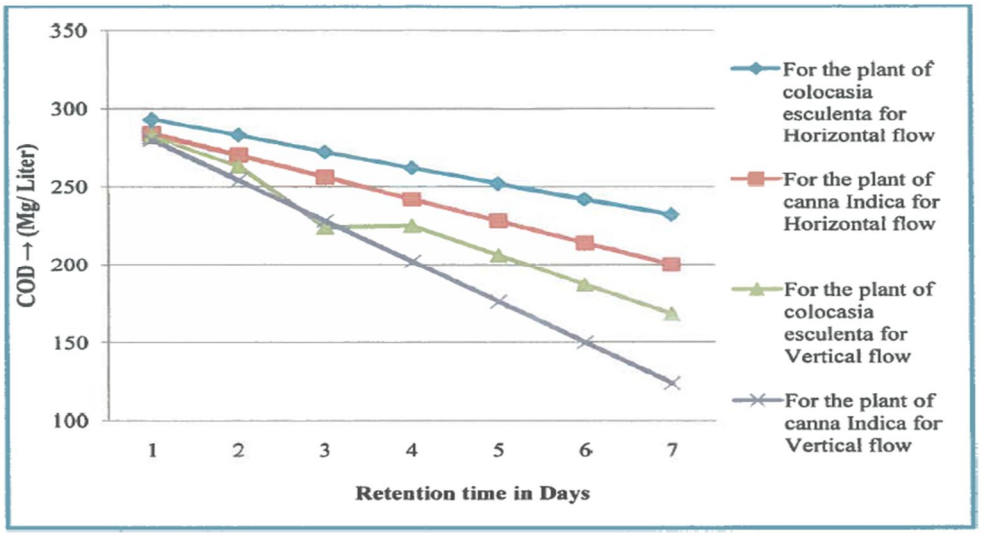

Fig 3: Showing COD with respect to retention time in days

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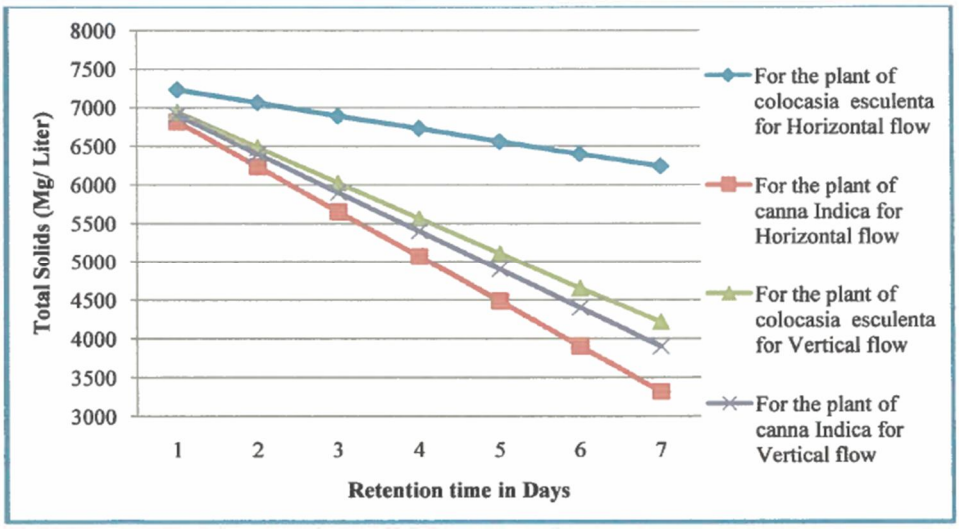

Fig 4: Showing concentration of total solid with respect to retention time in days

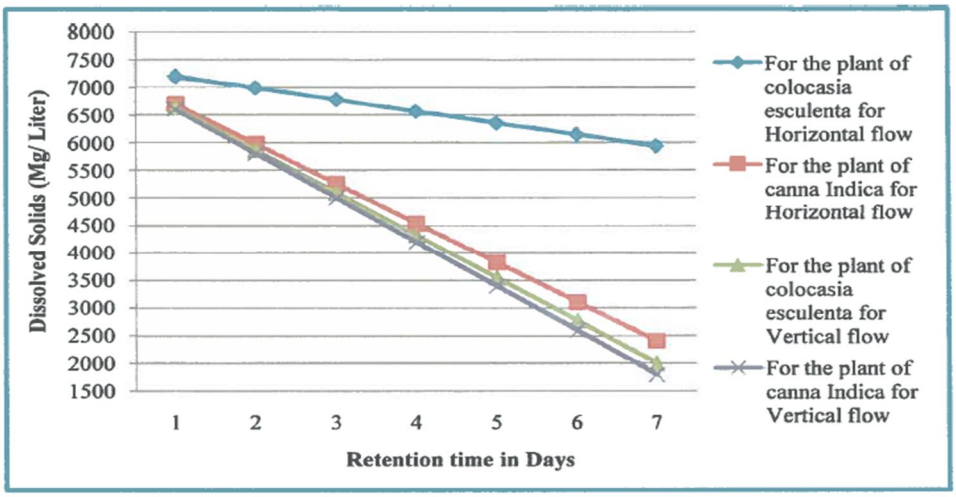

Fig 5: Showing concentration of dissolved solid with respect to retention time in days

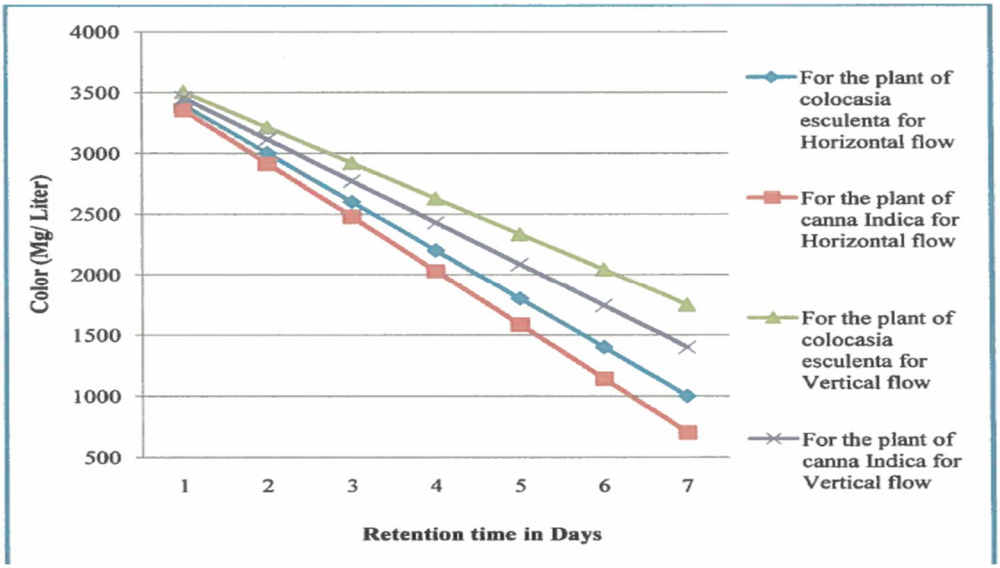

Fig 6: Showing concentration of colour with respect to retention time in days

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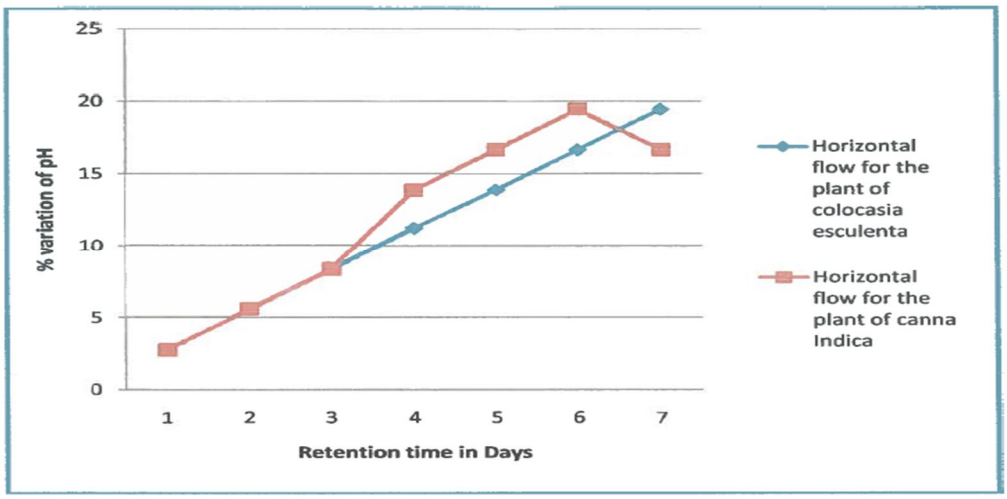

Fig 6 a) Shows the graph of variation of pH of treated waste water by horizontal flow for various retention time

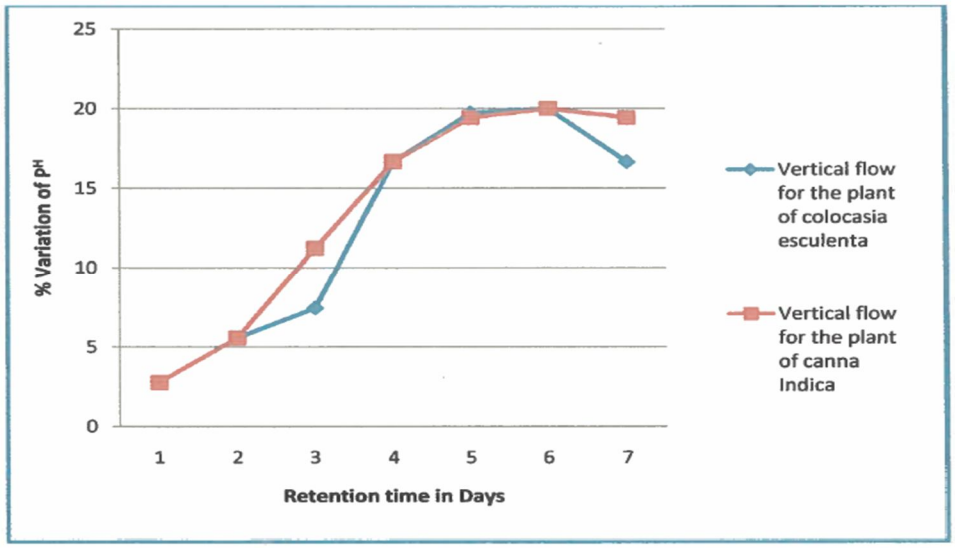

Fig 6 b) Shows the graph of variation of pH of treated waste water by vertical flow for various retention time

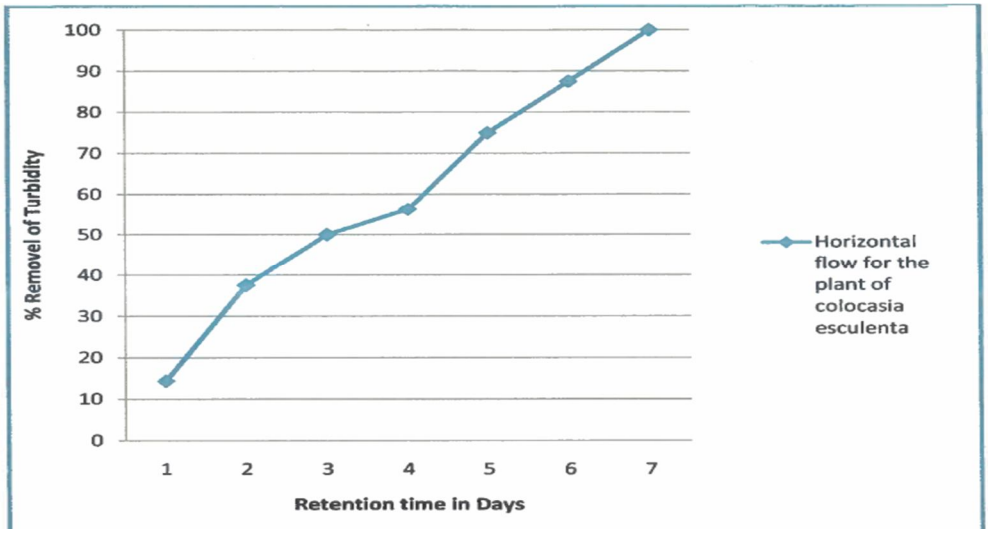

Fig 7 a) Shows the % removal of turbidity by horizontal flow for various retention time

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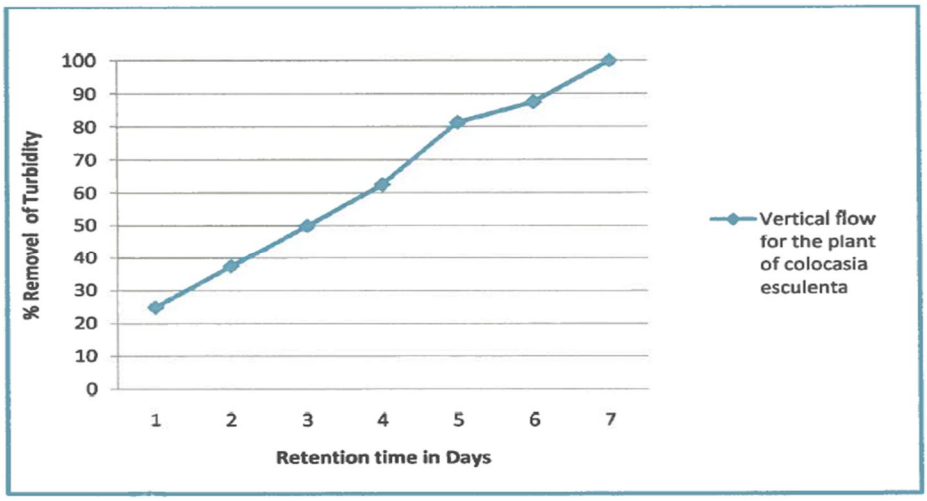

Fig 7 b) Shows the % removal of turbidity by vertical flow for various retention time

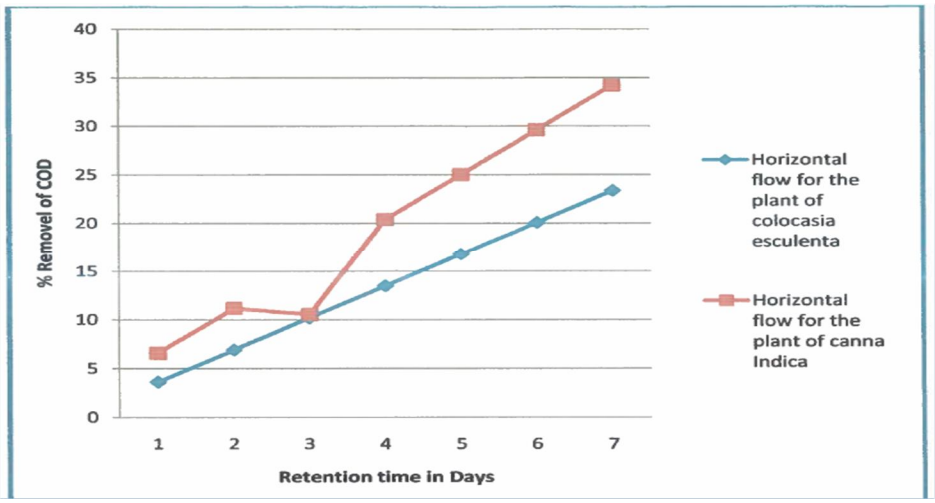

Fig 8 a) Shows the % removal of COD by horizontal flow for various retention time

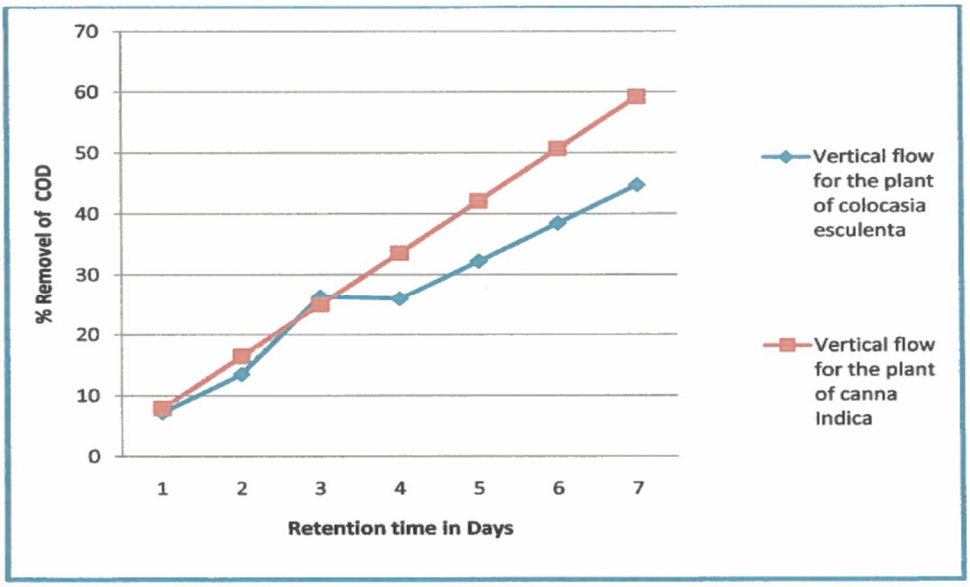

Fig 8 b) Shows the % removal of COD by vertical flow for various retention time

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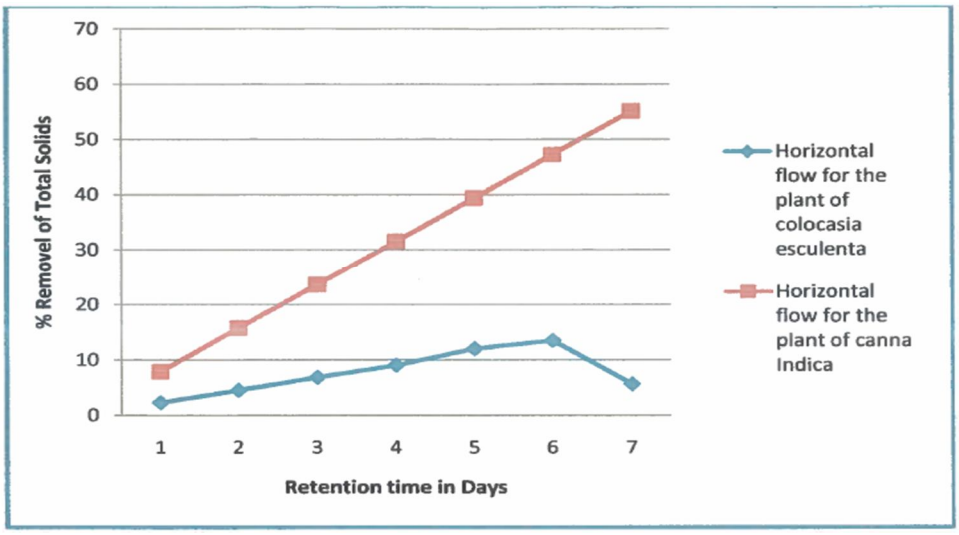

Fig 9 a) Shows the % removal of total solid by horizontal flow for various retention time

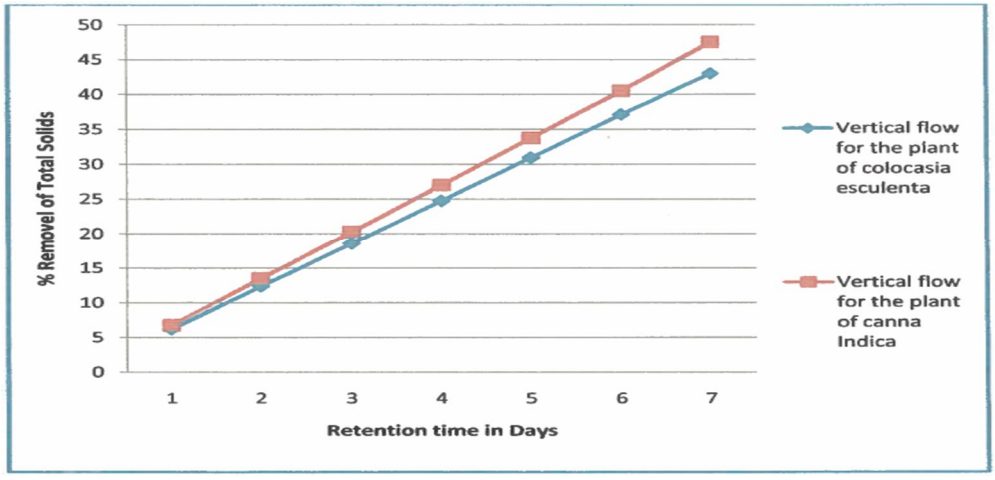

Fig 9 b) Shows the % removal of total solid by vertical flow for various retention time

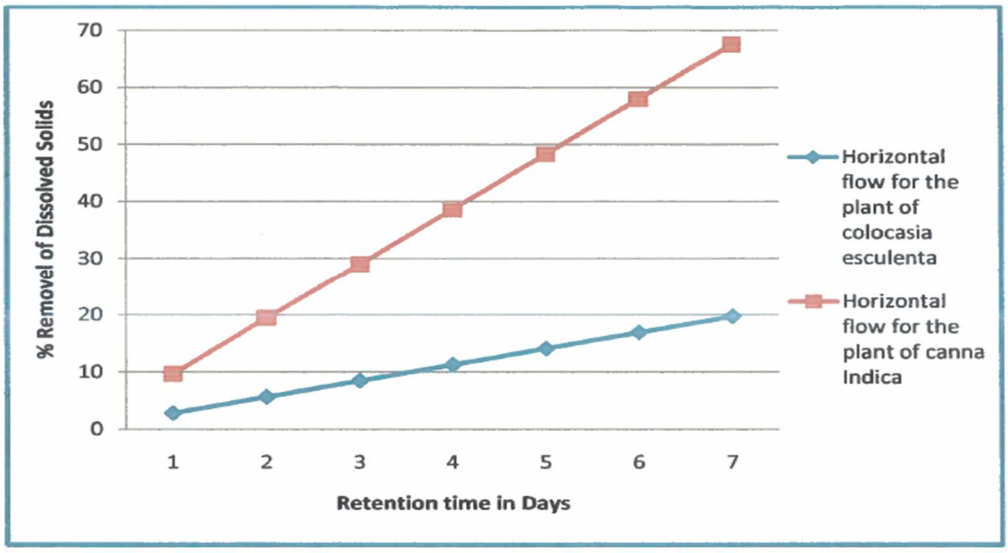

Fig 10 a) Shows the % removal of dissolved solid by horizontal flow for various retention time

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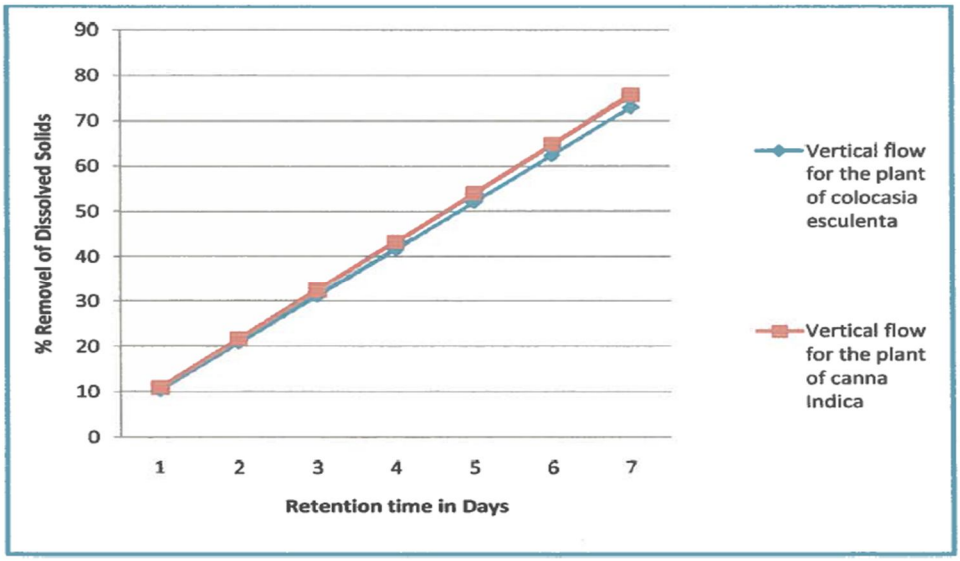

Fig 10 b) Shows the % removal of dissolved solid by vertical flow for various retention time

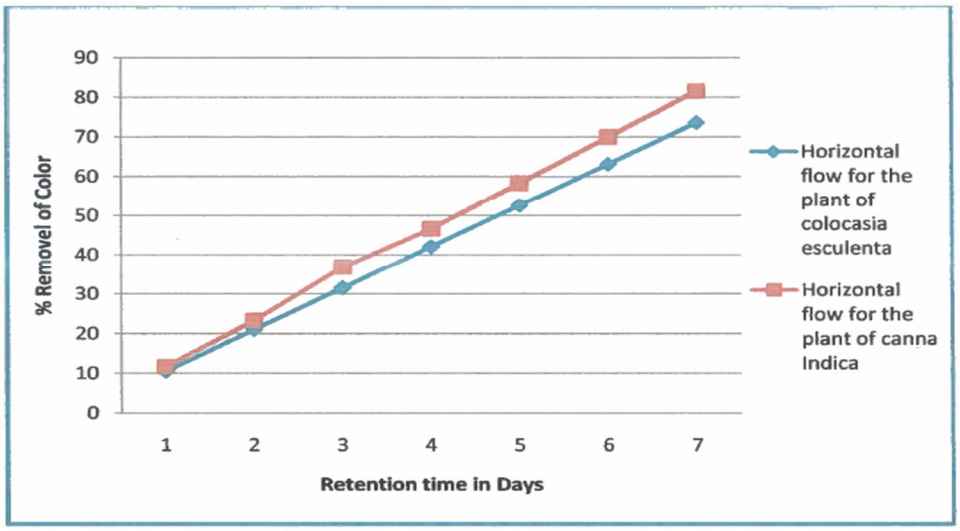

Fig 11 a) Shows the % removal of color by horizontal flow for various retention time

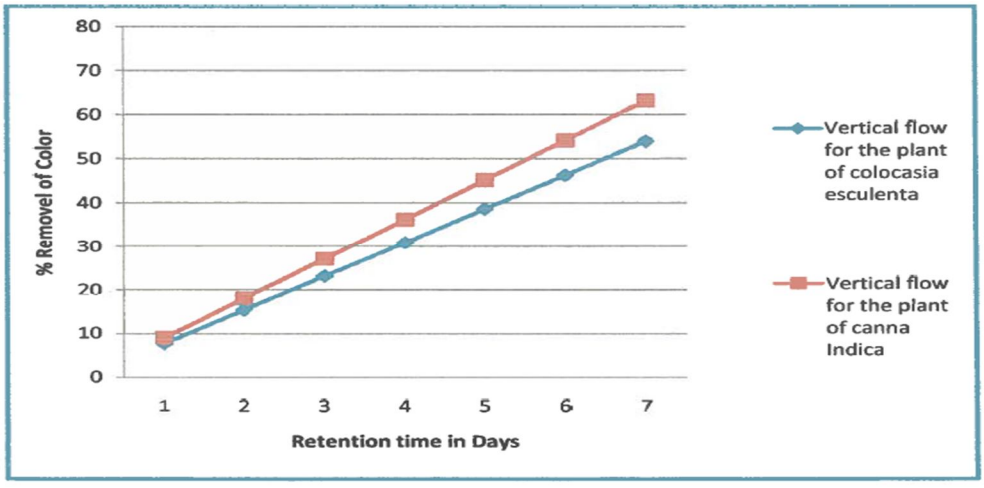

Fig 11 b) Shows the % removal of color by vertical flow for various retention time

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V. CONCLUSIONS

A. From the result it is conclude that the best pH of treated waste water is after 7 days in the case of plants of Canna Indica for horizontal flow is 7.5 that is neutral. Also pH for after 7 days in case of Colocasia esculenta for horizontal flow is 7.50 and pH for treated water after 7 days for vertical flow passed from Canna Indica gives the value is 7.25 and this pH is according to the standard of MPCB limit of effluent for Textile mill.

B. Turbidity for the treated water for both plants and for both type of flow after 7 days remains Below Detectable level (BDL). Thus both of the plants shown good results and this value is according to limit of MPCB for the discharge effluent for Textile mill, that is Below Detectable level (BDL).

C. From observation table, we can conclude that the COD is found to be 124 mg/lit. For Canna Indica for vertical flow. Thus this plant show good result the other type of plant. Thus in vertical flow Canna Indica lower the COD at the levelof 124 mg/L and this value is within the limit of MPCB for discharge of textile effluent.

D. The plants of Canna Indica for horizontal flow plays very important role to decrease the total solids up to 3320 mg/L after 7 days.

E. After 7 days of retention time total dissolved solid is 1800 mg/L when water is treated by vertical flow from the plants of Canna Indica which is lowest value along all the observations and this value of 1800 mg/L is under the limit of effluent MPCB for discharge of Textile effluent.

F. From observation table, this can be concluding that the property of plant Canna Indica for horizontal flow is best for colour removal. Here quantity of colour in treated plant is detected to 700 mg/L. The sample of this concentration looks clear near to domestic clean water. This plant removes the color with great extent.

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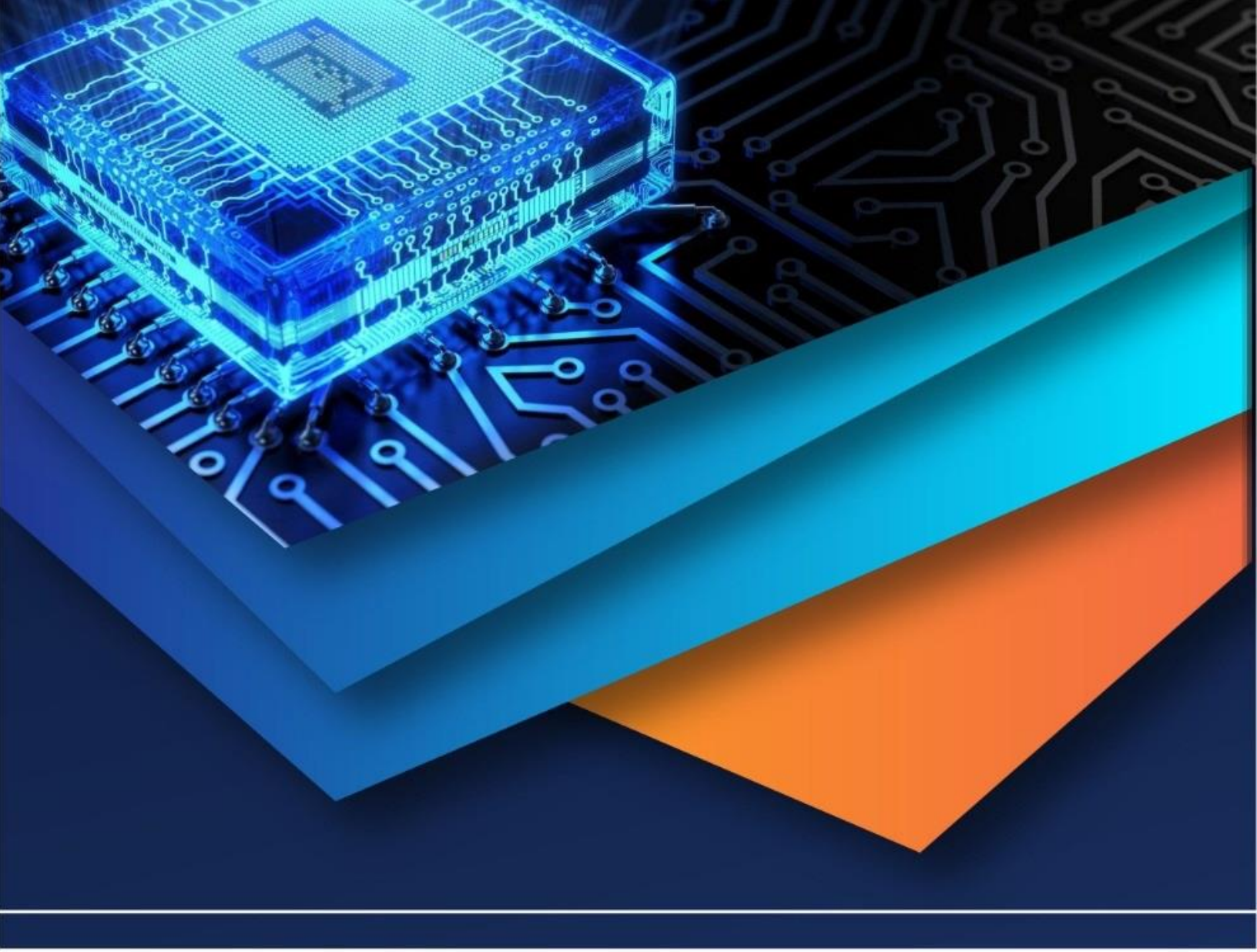

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