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Phytoremediation Process of Textile Industry Effluent by Eichhornia Crassipes and Pistia Stratiotes

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Abstract:
In the world, a large part of the wastewater is not previously treated, resulting in the contamination of water resources. Textile wastewater contains large volume of pollution load. In the present study, the removal of pH, COD, TS, TDS, TSS, Sulphate and Chloride has been studied by using *Eichhornia crassipes* and *Pistia stratiotes*. A lab scale study was conducted to test the feasibility of *Eichhornia crassipes* and *Pistia stratiotes* for treating textile wastewater. pH was reduced from alkaline to nearly neutral in all dilution. The maximum percentage reduction was observed after treatment with *Eichhornia crassipes* and it was 25.62% for pH, 69% for COD, 25.71% for TS, 34.61% for TDS, 68% and 45% for Sulphate and Chloride respectively. Aftrer treatment with *Pistia stratiotes* percentage removal efficiency was pH 23%, COD 45%, TS 20%, TDS 17.53%, Sulphate 64% and Chloride 39.51%. Hence, the efficiency for removal of pollutants of textile wastewater by *Eichhornia Crassipes* is more than *Pistia stratiotes.*

Keywords: Phytoremediation, textile waste water, *Eichhornia Crassipes, Pistia stratiotes.*

1. Introduction:

In the world, more than 80% of wastewater is discharged directly into the river or the sea without giving it a previous treatment producing pollution of water resources (WWAP, 2017). This pollution is mainly caused by chemical substances that are dumped by mining industries, and is a debatable issue due to the effects it causes on human health, ecology and the environment (Yadav S. 2011, Latorre and Tovar, 2017; Canaza Choque, 2018).

Phytoremidiation is an emerging technology and rapidly gaining interest and promises effectively and inexpensively cleanup of hazardous waste sites contaminated with metals, hydrocarbons, pesticides and chlorinated solvents (Macek et al 2000, Susarla et al 2002, zia et al 2003). The use of plant to degrade, assimilate, metabolize or detoxify contaminants is cost effective and ecologically sound (Schnoor *et al*,. 1995). Phytoremidiation used for removing heavy metals and pollutants by MATS (aquatic macrophytes treatment system) is a well established environmental protective techniques (Mahmood *et al.*,2005) Four mechanisms are involved in phytoremidiation of organic compound. a) Direct uptake and accumulation of contaminants by plant tissues. b) Transpiration of volatile organic hydrocarbons through the leaves. c) Release of exudates that stimulate microbial activity and biochemical transformation around root system

(Schnoor *et al*,.1995). The uptake and accumulation of pollutants vary from plant to plant and also from specie to specie within a genus (Singh et al., 2003). The economic success of phytoremediation largely depends on photosynthetic activity and growth rate of plants (Xia and Ma, 2006) and with low to moderate amount of pollution (Jamuna and Noorjahan, 2009). Many researchers have used different plant species like water hyacinth (Eichhornia crassipes (Mart.) Solms) (Muramoto and Oki, 1983; Trivedy and Pattanshetty, 2002; Mahmood et al., 2005; Dhote and Dixit, 2007; Jamuna and Noorjahan, 2009; Lissy et al., 2010; Valipour et al., 2010; Valipour et al., 2011; Dar et al., 2011;)

2. Material and Methods:

2.1 Collection of plant sp.:

The plants used for project were collected from a natural pond near Kolhapur. Two types of plants used for study are *Echhornia crassipes* and *Pistia stratiotes.* The plants are very common in Maharashtra state inhibiting vast marshy areas, propagating by stolen and multiplying very rapidly.

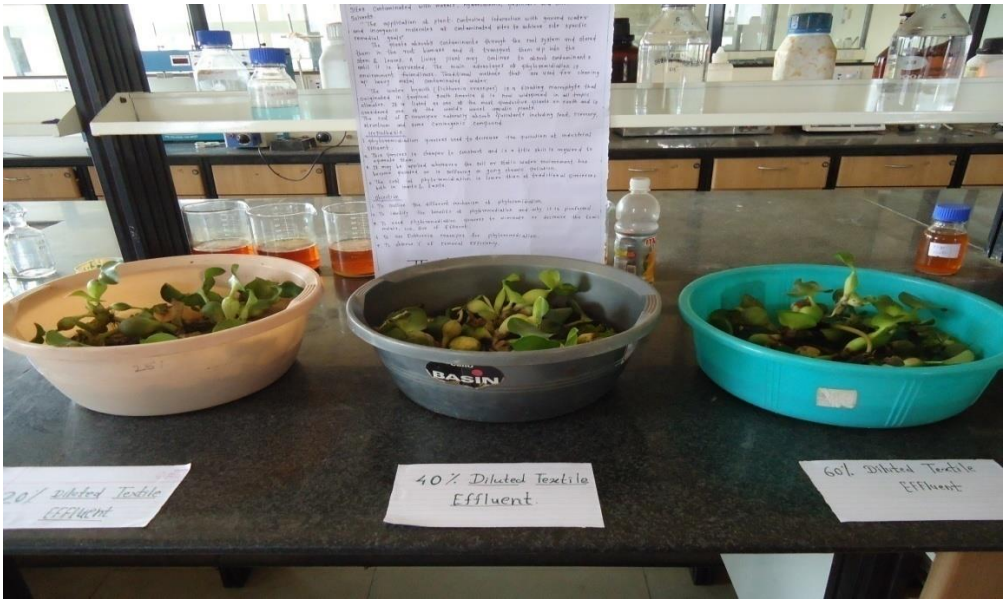
2.2 Preparation of live plants:

Plants of *Eichhornia crassipes* and *Pistia Stratiotes* were collected from local pond of Kolhapur city, Maharashtra. The plants were grown under laboratory condition.

2.3 Collection of textile effluent and treatment with water hyacinth and Pistia :

Effluent was collected from Common Effluent Treatment Plant (CETP) of Cluster Private Limited, Ichalkaranji, District, Kolhapur. Sample was collected in plastic can from the inlet of common effluent treatment plant. before treatment with phytoremediation treatment the waste water was analysed for physicochemical parameters. pH, COD, TS, TDS, TSS, Sulphate and Chloride parameters of waste water were tested before and after the treatment with *Eichhornia crassipes* and *Pistia Stratiotes* spp.

Figure no. 1 Set of Eichhornia crassipes



3. Result and Discussion:

The physicochemical parameters of waste water were analyzed before and after treatment and following results were obtained.

Table No 1: Table of percentage removal efficiency of pH after treatment

Plant species used	% Removal Efficiency											
	2nd day			4th day			6th day			8th day		
Dilution percentage	20%	40%	60%	20%	40%	60%	20%	40%	60%	20%	40%	60%
Treatment with *Eichhornia crassipes*	11	0.75	1.51	23.24	5.94	6.59	23.56	17.4	21.62	25.62	19.45	23.24
Treatment with p*istia Sratiotes*	11	5.94	0.84	22.27	6.48	2.27	23.02	20.64	9.4	23.56	21.4	20.86

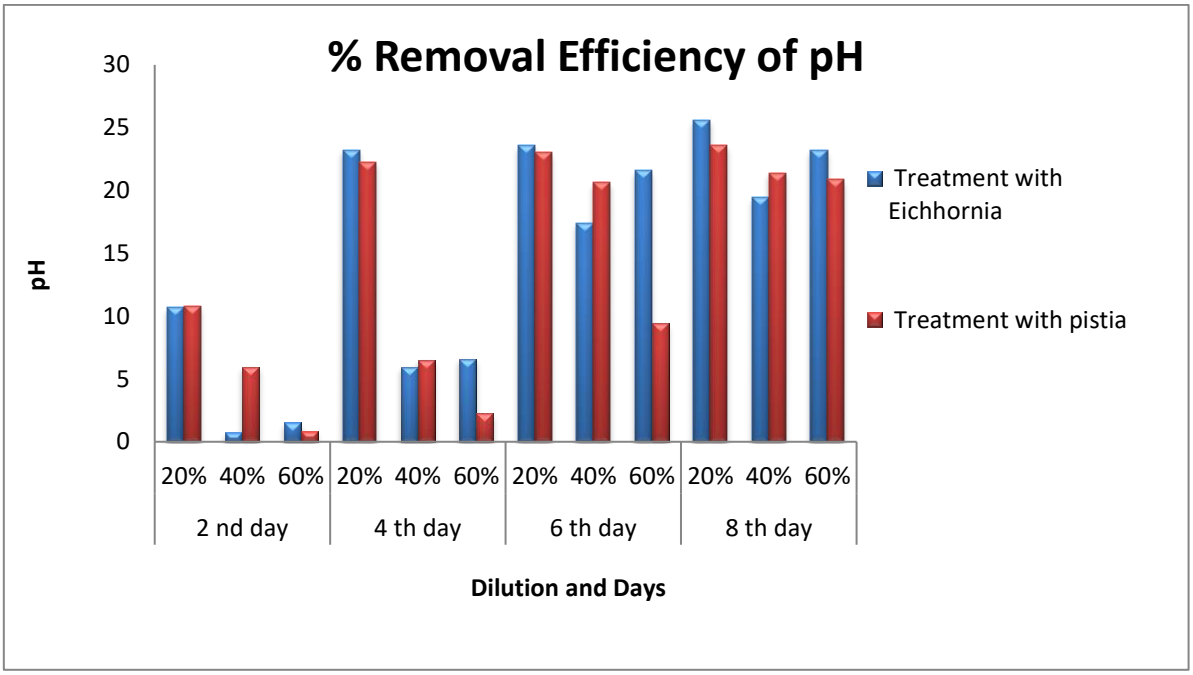


Fig No 1: Graph of Percentage removal efficiency of pH

Table No 2: Table of percentage removal efficiency of COD after treatment

Plant species used	**% Removal Efficiency**											
	2nd day			**4th day**			**6th day**			**8th day**		
Dilution percentage	20 %	40 %	60 %	20 %	40%	60%	20 %	40 %	60%	20 %	40 %	60 %
Treatment with *eichhornia crassipes*	27	36.5	5	31.5	41.5	24	38	51	39	69	64.5	53.5
Treatment with *pistia stratiotes*	32	23.5	2	36	26	3	41.5	29.5	6	45	35	19

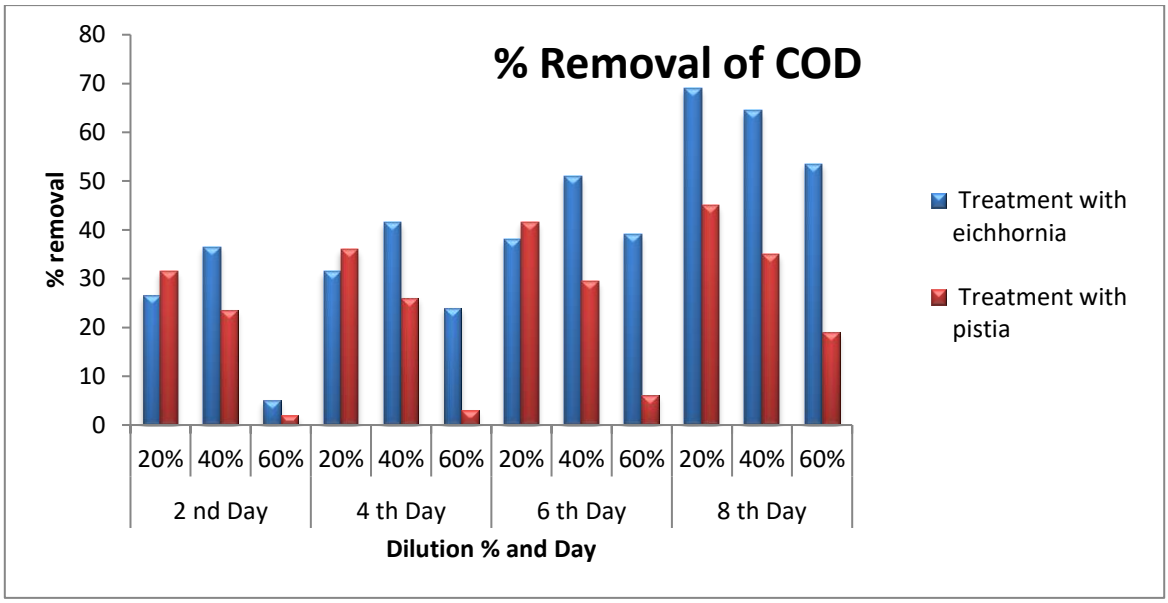


Fig No 2: Graph of percentage removal efficiency of COD

Table No 3: Table of percentage removal efficiency of TDS after treatment

Plant species used	% Removal Efficiency											
	2nd day			**4th day**			**6th day**			**8th day**		
Dlution percentage	20 %	40 %	60 %	20%	40%	60%	20%	40%	60%	20%	40%	60%
Treatment with *Eichhornia Crassipes*	5.7	5.71	5.71	14.28	14.28	14.28	22.85	20	20	24.28	25.71	24.28
Treatment with *Pistia stratiotes*	2.9	2.85	2.85	8.57	8.57	8.57	10.85	11.42	10.85	20	17.14	17.14

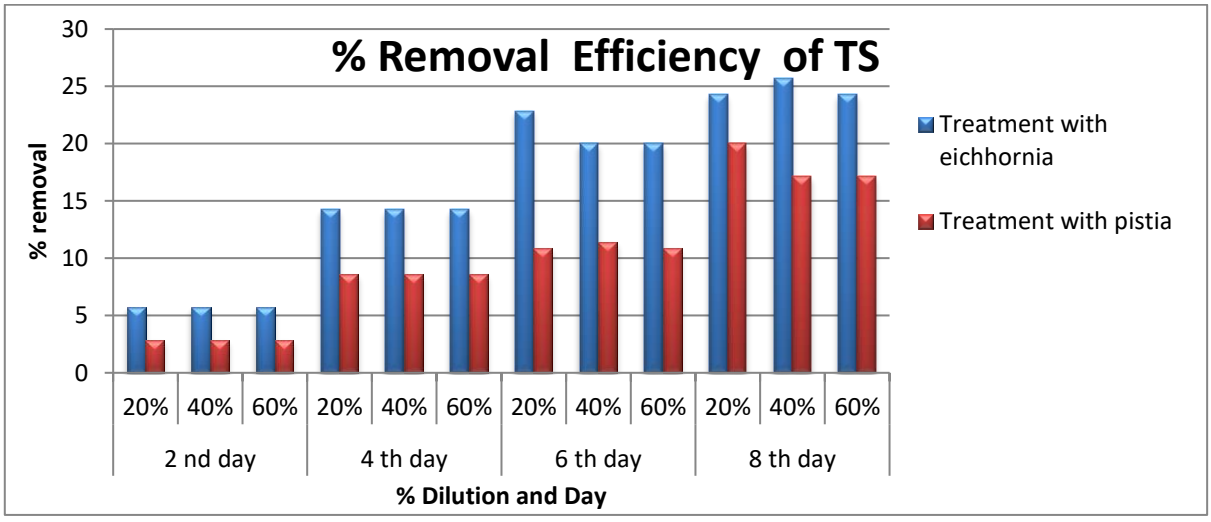


Fig No 3: Graph of Percentage removal efficiency of TS

Table No 4: Table of percentage removal efficiency of TSS after treatment

Plant species used	% Removal Efficiency											
	2nd day			**4th day**			**6th day**			**8th day**		
Dlution percentage	20 %	40 %	60 %	20%	40%	60%	20 %	40 %	60 %	20 %	40 %	60 %
Treatment with *Eichhornia crassipes*	0	0	0	21.11	21.11	21.11	33.3	33.3	33.3	5.55	5.55	5.55
pistia stratiotes	0	0	0	5.55	5.55	5.55	16.6	16.6	16.6	33.3	33.3	33.3

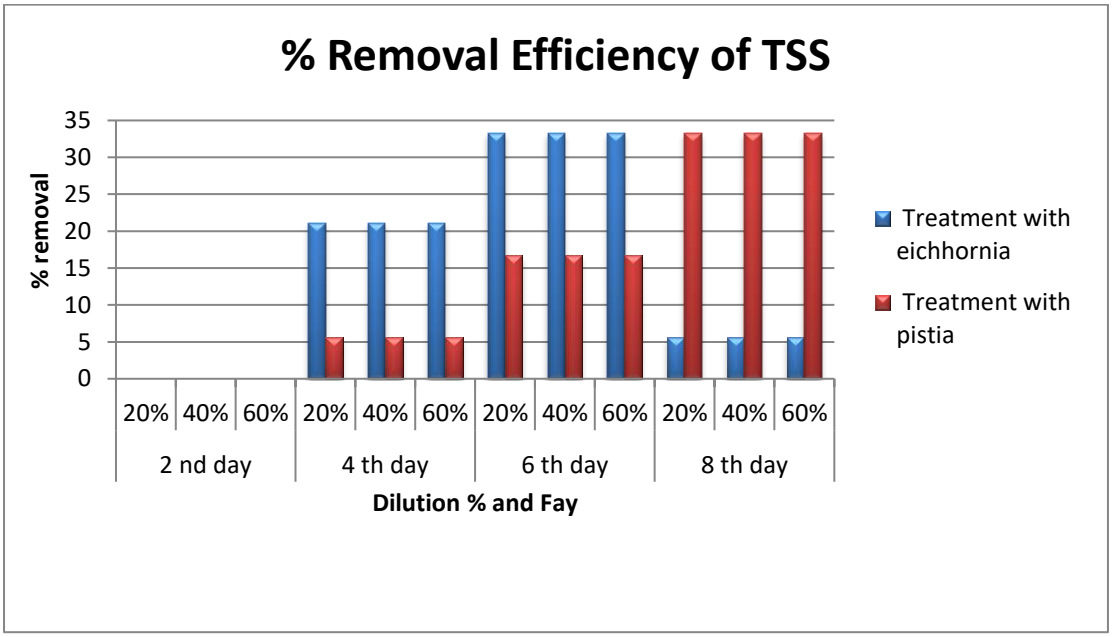


Fig No 4: Graph of percentage removal efficiency of TSS

Table No5: Table of percentage removal efficiency of TDS After treatment

Plant species used	% Removal Efficiency											
	2nd Day			**4th Day**			**6th Day**			**8th Day**		
Dlution percentage	20%	40 %	60 %	20%	40%	60%	20%	40%	60%	20%	40%	60%
Treatment with *Eichhornia crassipes*	3.8	3.84	3.84	11.92	11.92	11.92	11.23	15.38	23.07	34.61	30.76	30.76
Treatment with *pistia stratiotes*	3.8	3.84	3.84	5.76	5.76	5.76	8.46	9.61	8.84	17.53	11.53	11.53

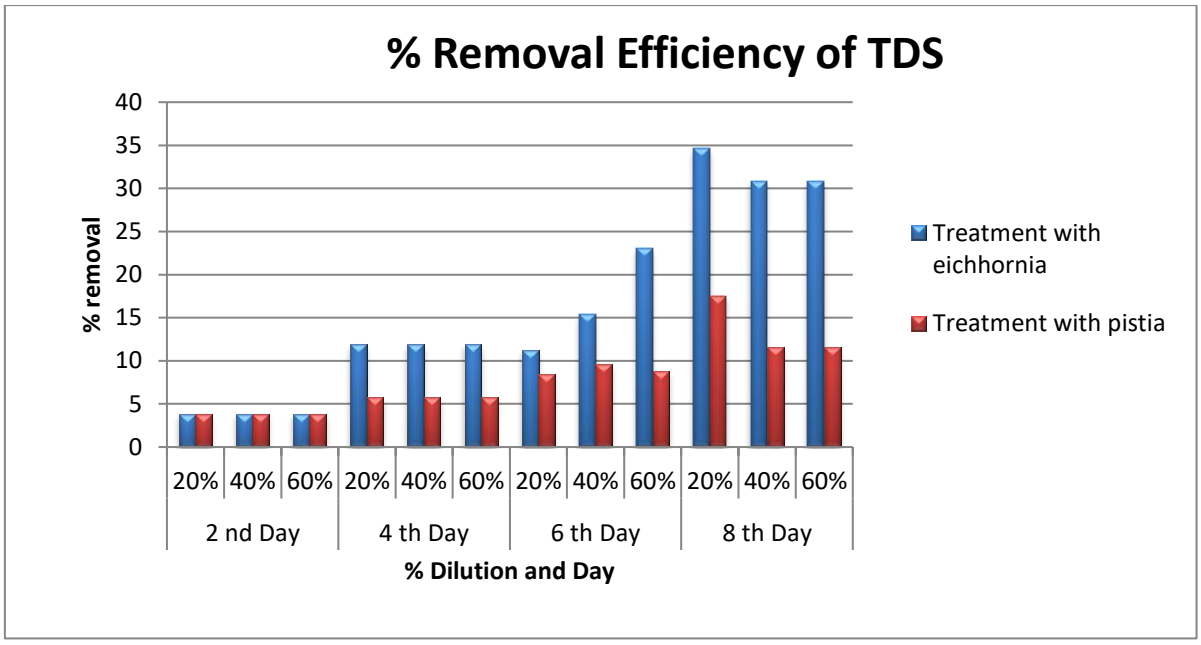


Fig No 5: Graph of Percentage removal efficiency of TDS

Table No.6: Graph Of Percentage Removal Efficiency Of Sulphate After Treatment

Plant species used	% removal efficiency											
	2nd Day			**4th Day**			**6th Day**			**8th Day**		
Dlution percentage	20 %	40 %	60 %	20 %	40 %	60 %	20 %	40 %	60 %	20 %	40 %	60 %
Treatment with *Eichhornia crassipes*	61	43.33	7.57	63.01	47.86	10	64.65	48.81	14.48	68.07	57.12	19.45
Treatment with *pistia stratiotes*	54	43.02	1.45	60.9	45.12	9.21	62.82	45.78	10.78	64.6	52.21	14.42

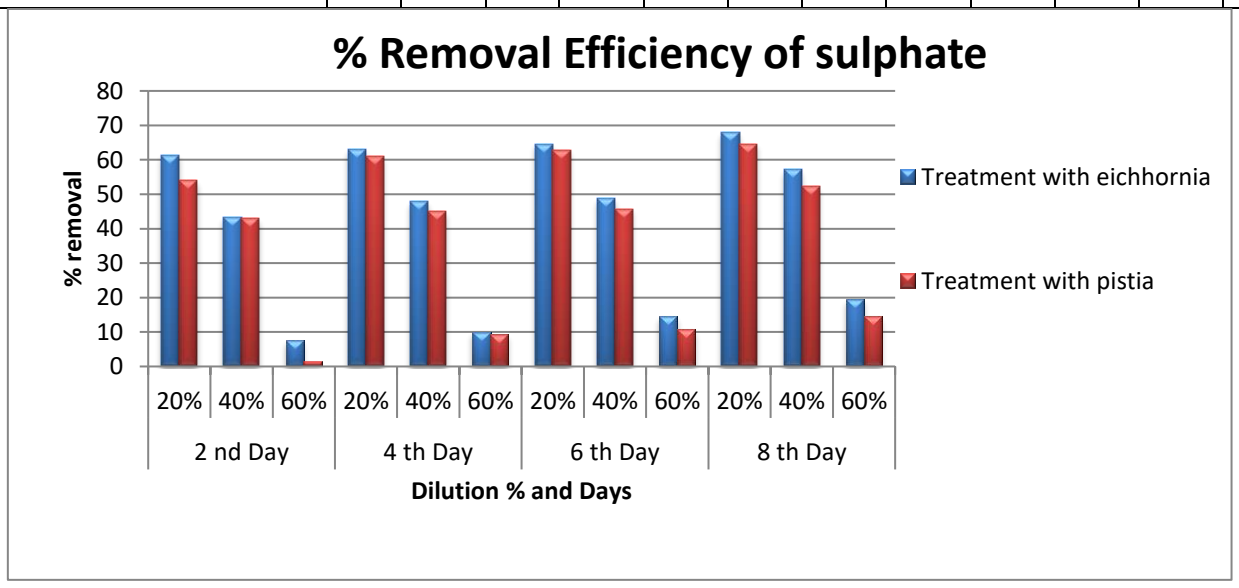


Fig No 6: Graph of percentage removal efficiency of Sulphate Observation

Table No.7 Table No.7: Table of percentage removal efficiency of Chloride after treatment

Plant species used	% Removal Efficiency											
	2nd day			**4th day**			**6th day**			**8th day**		
Dlution percentage	20 %	40 %	60 %	20 %	40 %	60 %	20 %	40 %	60 %	20 %	40 %	60 %
Treatment with Eichhornia crassipes	28	6.37	2.04	31.8	13.8	11.73	39.51	12.97	22.95	45.69	20.75	28.31
Treatment with pistia	27	2.76	0.53	28.53	6.37	2.04	30.55	7.83	4.91	39.51	9.05	5.95

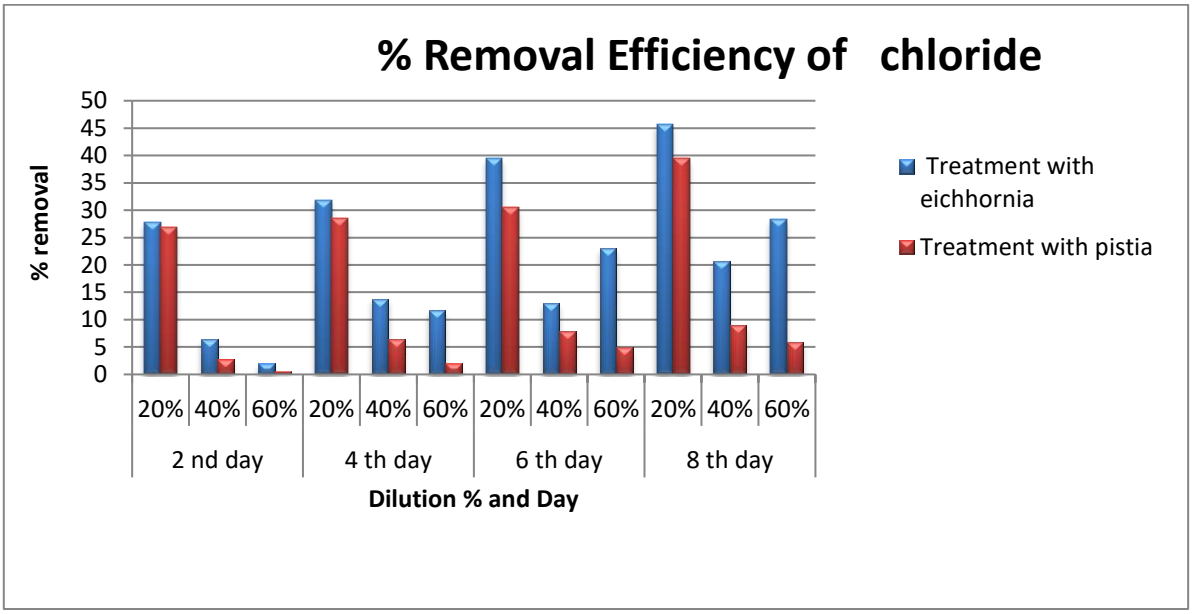


Fig No 7: Graph of Percentage removal efficiency of Chloride

Table No 8: Table of parameter before and after treatment with *Eichhornia crassipes*

Parameter	Before treatment	AFTER TREATMENT											
		2nd day			**4th day**			**6th day**			**8th day**		
		20%	40%	60%	20%	40%	60%	20%	40%	60%	20%	40%	60%
pH	9.25	8.26	9.18	9.11	7.1	8.7	8.64	7.07	7.64	7.25	6.88	7.45	7.1
COD	2000	1470	1270	1900	1370	1170	1520	1240	980	1220	620	710	930
TS	3500	3300	3300	3300	3000	3000	3000	3000	2700	2800	2650	2600	2650
TSS	900	800	800	800	710	710	710	600	600	600	450	450	450
TDS	2600	2500	2500	2290	2290	2290	2100	2200	2000	2000	220	2150	2200
Sluphate	678.95	261.9	384.75	627.5	251.1	354	611.9	240	347.5	580.6	216.7	291.1	546.85
Chlorid	1025	740.7	959.7	100	699	882.	904.	620.	892.	789.7	556.	812.	734.7

e		4		4		2	7	6	2	5	6	2	5

Table No 9 :Table of parameter before and after treatment with *Pistia stratiotes*

Parameter	Before	AFTER TREATMENT											
		2ND DAY			4TH DAY			6TH DAY				8TH DAY	
		20%	40%	60%	20%	40%	60 %	20%	40%	60%	20%	40%	60 %
pH	9.25	8.25	8.7	9.71	7.19	8.65	9.04	7.14	7.34	8.38	7.07	7.3	7.32
COD	2000	1370	1530	1960	1280	1480	1940	1170	1410	1880	1100	1300	1720
TS	3500	3400	3400	3400	3200	3200	3200	3120	3100	3120	2800	2900	2900
TSS	900	900	900	900	850	850	750	750	750	750	600	600	600
TDS	2600	2500	2500	2500	2450	2450	2450	2380	2350	2370	2300	2300	2300
Sluphate	678.95	312.08	386.8	669.05	265.45	372.55	616.4	252.41	368.07	605.7	240.3	224.45	581
Chloride	1025	748.56	996.67	1019.5	732.56	559.7	1004	711.77	944.7	974.65	760.59	932.17	964.7

Conclusion

The main objective behind this research was to treat the textile wastewater by phytoremediation treatment with *Eichhornia crassipes* and *Pistia Stratiotes* spp. From the above experiment it can be concluded that efficiency of absorbent of toxicants increases from 2 to 8 days of phytoremediation treatment. The waste water parameters like pH, COD, Sulphate, Chloride, TS, TDS was found to be more reduced while treatment with *Eichhornia crassipes* than *Pistia stratiotes*. The maximum percentage reduction was observed after treatment with *Eichhornia crassipes* and it was 25.62% for pH, 69% for COD, 25.71% for TS, 34.61% for TDS, 68% and 45% for Sulphate and Chloride respectively. Aftrer treatment with *Pistia stratiotes* percentage removal efficiency was pH 23%, COD 45%, TS 20%, TDS 17.53%, Sulphate 64% and Chloride 39.51%. Hence, the efficiency for removal of pollutants of textile wastewater by *Eichhornia Crassipes* is more than *Pistia stratiotes.* Hence, ability of *Eichhornia crassipes* to absorb pollutants was more than *Pistia stratiotes* and this is found to be effective plant for phytoremediation tretamrnt of textile waste water.

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