RESEARCH PAPER:

Flocculant effect of *Aloe vera* L. in removing pollutants from raw and treated dye industry effluent

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SUMMARY

Effluent from dye industry is the most polluting of all industrial effluents. The biological treatment seems to be the most reliable method for the disposal of pollutants. In the present study an attempt has been made to evaluate the pollutant removal efficiency of *Aloe vera* from different concentrations of raw and treated dye industry effluent. *Aloe vera* remarkably reduced the TDS, COD, BOD and chloride in all effluent concentrations of both raw and treated dye industry effluent.

Key words : *Aloe vera*, Dye industry effluent, Flocculant, Biological treatment

Environmental pollution has become a global concern. Increasing pace of industrialization in public and private sectors along with population explosion, urbanization and green revolution are reflected in varying degrees of the purity of water, soil and air. So, the industrial growth has brought along with it new problems too. The current conventional engineering and mechanical methods of industrial waste treatments are quite expensive and thus are uneconomical for industries of low turnover rates. In recent years, there has been an increased interest in alternate and innovative technologies which will prove low-cost, low maintenance and energy efficient. The physical treatment method like flocculation gains significance for the removal of colour which is not amenable to bio-degradation (Calley *et al.*, 1977). *Aloe vera* contains mucilaginous substance rich in albumin. This albumin flocculates on heating and floated on the surface along with the strangled impurities.

Thangamuthu (1991) reported that *Aloe vera* extract can be used as a flocculant in clarifying cane juice. Increased sedimentation and recovery of algal biomass grown on food processing industry effluent using *Aloe vera* as flocculants. Taking these points into account, an investigation was carried out to evaluate the flocculant effect of *Aloe vera* for the treatment of dye industry effluent.

MATERIALS AND METHODS

Fresh *Aloe vera* plants were collected at Palakkattur, Erode and in the laboratory fleshy mucilagenous tissue was scooped out by removing the epidermis. 100g of tissue was added to each dilution (20 %, 40%, 60%, 80%, and 100%) of raw and treated dye industry effluent at boiling temperature. Initially 100ml sample was withdrawn from each dilution and analyzed for its physico-chemical characteristics like colour, pH, EC, TDS, COD, BOD etc. (APHA, 1995). After the retention period (one day), 100ml of biotreated sample was withdrawn from each dilution for analysis of physico – chemical parameters and the data were recorded and statistically analysed.

RESULTS AND DISCUSSION

Results of physico–chemical characteristics of raw and treated dye industry effluent and biotreated effluent (*Aloe vera* treatment) were recorded (Table 1, 2, 3 and 4). The colour of biotreated effluent changed to light brown to pale brown at 40% and 20% concentrations, respectively. Nasr *et al.* (1975) has suggested pH 5 for maximum colour removal. But in the present study colour removal occured at neutral pH.

The flocculation process reduced maximum COD in the raw and treated effluent. The same result was obtained by Slavik *et al.* (1999) who stated that contaminants in water are usually removed by flocculation. *Aloe vera* treatment removed colour and BOD efficiently. The findings are conformity with the results of Milstein *et al.* (1987). The reduced BOD in all

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Table 1 : Physico-chemical characteristics of dye industry raw effluent and its concentrations

Sr. No.	Characteristics	100%	80%	60%	40%	20%
1.	Colour	Black	Black	Black	Dark brown	Brown
2.	pH	9.3 ± 0.11	9.1 ± 0.09	8.8 ± 0.07	7.8 ± 0.07	7.8 ± 0.11
3.	Electrical conductivity	8640 ± 7.14	7250 ± 7.14	6606 ± 4.12	4653..3 ± 10.91	2613 ± 4.12
4.	Total dissolved solids	6389 ± 9.37	5656 ± 4.68	4630.3 ± 4.12	3265.7 ± 4.12	1823.7± 4.12
5.	Dissolved oxygen	-	2.5 ± 0.15	4.6 ± 0.05	4.6 ± 0.09	4.9 ± 0.05
6.	Chemical oxygen demand	415.7 ± 1.4	313.7 ± 0.83	235 ± 2.23	95 ± 0.71	76.47 ± 1.25
7.	Bio-chemical oxygen demand	150 ±. 7.14	113.7 ± 1.09	89 ± 0.71	38 ± 1.42	29± 0.71
8.	Total alkalinity	609 ± 0.71	556.7 ± 4.12	476.7± 4.12	466.3 ± 2.3	392 ± 1.4
9.	Total hardness	1376.7 ± 4.12	1155± 3.57	991.7 ± 3.06	780 ± 3.57	565 ± 3.57
10.	Calcium	360 ± 3.57	352 ± 1.42	316 ± 1.42	246.7 ± 1.65	174 ± 1.42
11.	Magnesium	1016.7 ± 3.06	803 ± 4.29	675.7 ± 0.36	533.3 ± 5.07	391 ± 3.11
12.	Chloride	2609.7 ± 0.41	2233.3 ± 4.12	2043.3 ± 18.4	1535 ± 3.57	930 ± 3.57

Table 2 : Physico-chemical characteristics of dye industry treated effluent and its concentrations

Sr. No.	Characteristics	100%	80%	60%	40%	20%
1.	Colour	Dark brown	Dark brown	Dark brown	Yellow	Pale yellow
2.	pH	7.81 ± 0.01	7.72 ± 0.01	7.69 ± 0.001	7.66 ± 0.001	7.63 ± 0.001
3.	Electrical conductivity	8550 ± 10	7150 ± 6.1	6435 ± 8.9	4570 ± 6.5	2430 ± 5.7
4.	Total dissolved solids	6272± 8.1	5537 ± 7.2	4532 ± 8.9	3136 ± 4..30	1760 ± 4.8
5.	Dissolved oxygen	2.3 ± 0.1	3.6 ± 0.12	5.5 ± 0.1	6.1 ± 0.11	7 ± 0.2
6.	Chemical oxygen demand	280 ± 0.21	210 ±0.89	170 ± 1.9	90 ± 2.3	74.± 0.11
7.	Bio-chemical oxygen demand	70 ± 0.11	68 ± 0.14	44 ± 1.8	32 ± 1.4	24 ± 0.35
8.	Total alkalinity	550 ± 0.12	490 ± 3.11	410 ± 3.7	364 ± 1.2	300 ± 4.5
9.	Total hardness	1400 ± 0.13	1160±2.14	995 ± 5.7	790 ±1.8	580 ± 5.7
10.	Calcium	384 ± 0.11	376 ± 1.51	348 ± 1.4	288 ± 2.8	196 ± 5.1
11.	Magnesium	1016 ± 1.1	784 ± 3.41	647 ± 2.6	502 ± 1.13	384 ± 0.11
12.	Chloride	2510 ± 5.6	2130 ± 5.1	1870 ± 4.7	1420 ± 5.6	800 ± 0.5

Table 3 : Efficiency of *Aloe vera* L. in treating raw effluent and its concentrations

Sr. No.	Characteristics	100%	80%	60%	40%	20%
1.	Colour	Black	Black	Black	Light brown	Pale brown
2.	pH	6.6 ± 0 .1	6.3 ± 0.01	6.3±0.001	6.0 ± 0.001	5.7 ± 0.01
3.	Electrical conductivity	7708 ± 5.7	6935± 5.7	6124 ± 6.5	4631.7±5.7	1824 ± 4.1
4.	Total dissolved solids	5342 ± 4.7	4852± 3.3	4285 ± 4.7	3225 ± 2.3	1793 ± 1.1
5.	Dissolved oxygen	2.5± 0.001	2.5 ± 0.01	4.6 ± 0.01	4.7 ± 0 .01	4.9 ± 0.01
6.	Chemical oxygen demand	124 ± 0.2	80 ± 0.3	71.5 ± 0.5	28.6 ± 0.9	23.9± 0.02
7.	Bio-chemical oxygen demand	128 ± 1.1	72 ± 1.9	73 ± 1.7	24.5 ± 0.9	20 ± 0.8
8.	Total alkalinity	195 ± 1.1	163 ± 0.9	142.7± 0.8	97.3 ± 0.7	95 ± 0.7
9.	Total hardness	1376 ± 1.5	1160± 2.7	991 ± 0.8	780 ± 1.7	570 ± 1.9
10.	Calcium	358.3± 1.1	359 ± 0.9	315 ± 0.08	250 ± 0.91	180 ± 0.87
11.	Magnesium	1018 ± 1.1	810 ± 0.9	800 ± 0.8	630 ± 0.7	390 ± 0.7
12.	Chloride	2420 ± 5.7	1930± 5.7	1815 ± 5.9	1410 ± 4.7	820 ± 7.1

Table 4 : Efficiency of *Aloe vera* L. in treating treated dye industry effluent and its concentrations

Sr. No.	Characteristics	100%	80%	60%	40%	20%
1.	Colour	Dark brown	Dark brown	Dark brown	Yellow	Pale yellow
2.	pH	7.69 ± 0.1	7.62 ± 0.2	7.49 ± 0.1	7.2 ± 0.3	7.1 ± 0.01
3.	Electrical conductivity	7352 ± 3.7	6185 ± 10.1	5356 ± 9.5	4358 ± 8.7	2425 ± 6.7
4.	Total dissolved solids	5146 ± 5.9	4329 ± 9.7	3749 ± 9.6	3051 ± 9.8	1750 ± 7.8
5.	Dissolved oxygen	2.3 ± 0.01	3.6 ± 0.1	5.5 ± 0.01	6.1 ± 0.02	7.3 ± 0.02
6.	Chemical oxygen demand	48.5 ± 1.2	45.5 ± 1.1	44.1 ± 1.2	42.3 ± 0.9	36.9 ± 0.8
7.	Bio-chemical oxygen demand	65.5 ± 0.9	60 ± 0.11	34.0 ± 0.8	28 ± 0.9	20 ± 1.6
8.	Total alkalinity	144 ± 1.1	126 ± 1.2	104 ± 1.3	91.5 ± 1.7	84 ± 1.3
9.	Total hardness	1300 ± 1.2	1160 ± 14.7	965 ± 10.5	630 ± 1.7	480 ± 0.91
10.	Calcium	255 ± 1.3	248 ± 1.31	243 ± 1.2	213 ± 1.4	186 ± 1.31
11.	Magnesium	1045 ± 2.7	912 ± 2.1	722 ± 1.2	417 ± 2.1	284 ± 1.8
12.	Chloride	2500 ± 3.4	2110 ± 1.5	1570 ± 1.6	1110 ± 1.7	710 ± 2.1

concentrations might be due to inhibition of microbial growth at the acidic pH of the effluent. Total alkalinity calcium, magnecium and chloride content were also reduced by *Aloe vera*. But *Aloe vera* was not efficient in removing total hardness. Here, the results indicate that *Aloe vera* mucilage reduced pollution load of dye industry effluent.

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