

Performance Analysis of Aquatic Plants in Treating Dairy Waste Water

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Abstract - This study is about analyzing the dairy waste treatment efficiency of different aquatic plants which are easily available. The plants selected are water hyacinth, Kariba weed, duckweed, Azolla and water lettuce which are easily available. Dairy waste was collected from MILMA dairy plant in Ernakulam district Kerala. Experimental determination of waste characteristics such as Alkalinity, PH, hardness, total dissolved solids, electrical conductivity, BOD and COD done with all five plants in periodic intervals

Key Words Phytoremediation, BOD, Azolla, Duckweed, Water lettuce, water hyacinth, karibaweed

1. INTRODUCTION

Dairy wastes are having high amount of organic and suspended matters. Most of the dairy industries are using conventional waste treatment technologies for removing these organic and suspended matter. It has been seen that phytoremediation technique using plants is a cost effective method in treating this waste water. Phytoremediation is a waste treatment technique which uses some green plants for removing the pollutants. Most of the organic pollutants will be absorbed by the roots of plants and some pollutants will be settled and also may become immobile. In this study the pollutant removal efficiencies of five aquatic plants were tested in laboratory on regular intervals. The aquatic plants chosen are Azolla, Duckweed, Water lettuce, Water Hyacinth and Kareeba weed. The dairy waste was collected from MILMA dairy plant situated in Ernakulam district Kerala. The waste characteristics such as alkalinity, pH, hardness, Electrical conductivity, Total dissolved solids, BOD and COD were tested with these five aquatic plants

2. METHODOLOGY

2.1 Dairy waste and aquatic plants collection

Dairy waste effluent of about 100 liters was collected from MILMA dairy plant and stored in laboratory conditions. The aquatic plants selected for the study such as Water Hyacinth, water lettuce, Kariba Weed, duckweed, Azolla were collected freshly from natural ponds and lakes near Ernakulam. These plants were cleaned properly to remove dirt and stabilized in laboratory conditions for 1 week to normalize their growth in fresh water. The wastewater after necessary dilution in the ratio 1:1 were checked its initial values. Then it was poured into 5 rounded plastic troughs equally. The plants which

maintained in the stock tanks were collected and introduced in the experimental tanks separately. The laboratory conditions were maintained uniformly throughout the experimental period of 1 month. The samples were collected on 7th day, 14th day, 21st day and 28th day respectively. After observing the samples for 28 days, the best absorbing plant sample was selected for dairy samples and the water sample of that plants were collected.



Fig 1 Experimental tanks with aquatic plants

2.2 Laboratory Tests conducted

The laboratory experiments conducted for analyzing waste water characteristics include Alkalinity pH Hardness Electrical Conductivity Total Dissolved Solids Dissolved Oxygen BOD and COD as per the APHA guidelines. and then conducted analysis for 7th, 14th, 21st and 28th day of treatment.

3. RESULTS AND DISCUSSION

In this study the variation of waste water characteristics with the initial values were found. The initial quantities of physico-chemical characteristics obtained for the dairy effluent is shown in Table 1. The variation in these quantities was measured on subsequent four weeks. And the efficiency of five selected aquatic plants in treating dairy effluent is analyzed based on the values obtained.

Table -1: Initial values of dairy effluent before treatment

Sl no	Parameters	Units	Initial values
1	Alkalinity	mg/L	44
2	pH	-	8.9
3	Hardness	mg/L	376

4	Electrical Conductivity	mS/cm	1.5
5	Total Dissolved Solids	mg/L	5010
6	BOD	mg/L	520
7	COD	mg/L	826

Analysis of physico chemical characteristics of duck weed, water hyacinth, Azolla, water lettuce, and Kariba weed were done in each week on laboratory and the following results obtained.

Table 2 Physico chemical characteristics of diary effluent

Parameter	Days	Duckweed	Kariba weed	Water hyacinth	Water lettuce	Azolla
Alkalinity(mg/l)	7	30	30	38	40	28
	14	28	29	35	36	27
	21	12	27.5	30	34	25
	28	7.5	22	27	30	23
Hardness(mg/l)	7	368.4	372	375	375	358
	14	356.3	360	372	370	350
	21	342.6	356.3	366	364	346
	28	322.5	342.8	351	348.6	340
pH	7	8.59	8.56	8.6	8.61	8.4
	14	8.11	8.23	8.41	8.4	8.2
	21	7.64	7.7	7.89	8.1	7.6
	28	7.5	7.56	7.62	7.93	7.3
Electrical conductivity (mS/cm)	7	1.7	1.77	1.8	1.2	1.65
	14	0.8	0.8	0.9	1	0.7
	21	0.6	0.7	0.7	0.8	0.5
	28	0.5	0.6	0.6	0.7	0.4

Dissolved Solids (mg/l)	7	4800	4950	4830	4910	4780
	14	4310	4250	4285	4385	4220
	21	3950	4165	3850	3710	3670
	28	3870	4085	3710	3865	3650
BOD(mg/l)	7	513	432	412	330	318
	14	324	213	324	206	125
	21	120	120	112	92	54
	28	22.5	28	37	24.9	12
COD(mg/l)	7	816	721	713	520	464
	14	432	312	302	215	240
	21	210	204	215	192	189
	28	197	183	185.2	174.6	152

In the present study the variation of alkalinity, hardness, pH, Electrical conductivity, Dissolved solids, BOD and COD by aquatic plants were analyzed periodic intervals. It can see that the initial values of these waste characteristics are decreasing from 7th day toward 28th day. The pollutants are being removed by the root zone of the plants. BOD and solids are very important when we consider diary effluent. It has been noted that Azolla is more efficient in treating BOD. About 96.3% BOD was eliminated by Azolla. Also pH and dissolved solids are also decreased by 23% and 34% by Azolla. The electrical conductivity (EC) shows the amount of soluble salts present in waste water. It can see that EC value decreases after phytoremediation. And the greatest reduction in EC is given by Azolla which is about 76%. Duckweed shows maximum reduction in alkalinity, hardness and COD values.

4. CONCLUSION

From the present study it is observed that Azolla is more efficient in treating majority of waste characteristics of diary effluent. The main waste characteristics such as Electrical conductivity, Dissolved solids, BOD, pH are treated more efficiently with Azolla. Duckweed is efficient in treating alkalinity, hardness and COD according to this study. The pollutants are easily removed using phytoremediation technique. It is cheap compared to the conventional treatment types. Although it could see that Azolla is more efficient in this study, it may be susceptible to conditions like temperature, hydraulic retention time, temperature etc. Azolla also shows a rapid growth in different pH ranges. So it is highly recommendable for waste water treatment.

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