Role Of Cattle Dung On Effluent Treatment

Piyush Agarwal[1], Akshay Aher[2], Aditya Dahiphale[3], Samitinjay S Bansode[4]
[1, 2, 3, 4] JSPM's Narhe Technical Campus, Narhe, Pune, Maharashtra, India

Abstract- *In this experiment Raw distillery effluent and cattle dung were used as Substrate in MFC (Microbial Fuel cell). Enhancement of electricity generation by is using cattle dung and reduction in the COD of effluent was the main focus of the study. In this study, dual chamber fuel cells with graphite rods electrodes are used.*

The distillery effluent is having very high COD as about 87997 mg/lit. The effluent used 12 days hydraulic retention time, the peak voltage of 54mV was observed with COD reduction as 71277 mg/lit i.e. reduced by 19.01 %. After adding 12.5 % cattle dung the peak voltage boost to 102mV.
This study shows that treatment of raw distillery effluent with microbial fuel cell is an effective and the current generation can also be increased by adding cattle dung but reduction in COD is not possible further treatment is suggested for it.

Keywords- Microbial fuel cell, spent wash, Scanning electron microscope, COD.

I. INTRODUCTION

Due to increase in population over the years, demand for resources and energy has increased which has given rise to increased industrialization .The need of energy has also raised in the modern world, therefore need of alternative energy sources has become very important .Scientists have researched one such source which comes through Microbial fuel cell with the help of Distillery spent wash.

Distillery spent wash is the unwanted residual liquid waste generated during alcohol production and pollution caused by it is one of the most critical environmental issue. Despite standards imposed on effluent quality, untreated or partially treated effluent very often finds access to watercourses .Different methods used for distillery effluent treatment are Continuous stirred tank reactor, Upflow anaerobic sludge reactor ,anaerobic sequencing batch reactor, upflow sludge blanket filter (USBF), Ozonation , Oxidation, Coagulation etc .Effluent to be treated had Total suspended solids-20 mg/lit ,Total dissolved solid-111160 mg/lit, Total solids-111180 mg/lit, P-acidity-11764, M-acidity- 11860 ,COD-87997 mg/lit.

Different environmental regulatory bodies worldwide have already set norms for the waste discharge from industries. In India for instance, according to CPCB in December 2005 all the distillery industries were suggested to maintain zero discharge of spent wash.

II. METHODOLOGY

1. Microbial fuel cell

A Microbial fuel cell was used for the treatment of effluent .A microbial fuel cell (MFC), or biological fuel cell, is a bio-electrochemical system that drives an electric current by using bacteria and mimicking bacterial interactions found in nature. MFCs are of different types; however, the basic designs used in the laboratories for its applications include double-chamber MFC, single-chamber MFC, up flow MFC and stacked MFC. In this experiment double-chamber MFC was used. In the following experiment different proportion i.e. 25%, 12.5%, 5% of the pot capacity of cattle dung was added in the fuel cell and corresponding voltage and current readings and characteristics of effluent after addition of cattle dung were recorded. Voltage and current readings were recorded till peak is attained.

2. Setup of microbial fuel cell

The complete setup consisted of two pots with capacity of as 1.3L & 9L respectively, in which smaller pot is placed inside the bigger one as seen in the picture, two carbon rods of diameter-12 mm, Height-150 mm were used, Length dip in effluent-75 mm, before using the rods they were dip in distilled water for 24 hrs to avoid losses, small holes of 1mm diameter and 1mm depth were made on the rod to increase the surface area of contact and hence increase the conduction, two standard copper wire, digital multimeter to record readings.

Fig. 1 Wires And Multimeter

Fig. 3 Setup of microbial fuel cell

III. RESULT AND DISCUSSION

1. The voltage and current readings differ depending on the percentage of cattle dung added and also the number of days after setting it up. The observation was carried out till peak voltage and current readings were obtained. The voltage and current readings of the fuel cell were recorded as shown in the table below.

Fig.2Raw distillery spent wash

Table no.1 Current and voltage generation

Cattle dung percentage	Days→	1	2	3	4	5	6	7	8	9	10	11	12
25%	Voltage(mV)	81	88	94	**97**	59	69	66	56	46	44	-	-
	Current(mA)	18	26	37	**58**	40	42	30	24	15	10	-	-
12.5%	Voltage(mV)	87	91	93	97	**102**	100	82	78	75	71	-	-
	Current(mA)	21	33	47	53	**62**	60	51	43	38	31	-	-
5%	Voltage(mV)	11	23	35	39	42	58	**63**	57	49	35	29	-
	Current(mA)	7	13	22	34	41	49	**57**	51	47	31	23	-
Blank	Voltage(mV)	9	20	38	39	40	41	51	**54**	48	40	33	30
	Current(mA)	3	12	19	24	26	30	43	**47**	48	31	10	9

In the above results it can observe that peak voltage of 102mV and current 62mV is obtained on 5th day after adding 12.5 % cattle dung. The results also suggest that the voltage and current increase with increase in cattle dung percentage but only at certain limit after which it starts decreasing. In this case voltage and current for 25% is less than 12.5% which indicates that 12.5% cattle dung is optimum for achieving most efficient results.

2. The physical and chemical analysis of the spent wash was carried out to check its characteristics. These analyses of the spent wash were done at each stage i.e. before and after using test run. This helped in understanding the behaviour of spent wash in MFC in terms of current generation and the effect MFC on COD of spent wash whether it is increased or decreased. The test results obtained are as follows:

Table no.2 Characteristics of effluent

Sr. No.	Test Parameters	Addition of cattle dung							
		0% Cattle dung		5% Cattle dung		12.5% Cattle dung		25% Cattle dung	
		Before	After	Before	After	Before	After	Before	After
1.	pH	4.4	5	4.6	5.1	4.7	5.9	5.4	6.09
2.	Temperature	27	30	28	30	32	30	29	33
3.	Total Solids	111180	134015	107820	114310	103900	115740	107600	116100
4.	Total Dissolved Solids	111160	134000	107800	114280	28700	106640	107300	100350
5.	Total Suspended Solids	20	15	20	30	75200	9100	15750	300
6.	COD	87997	71277	68215	72418	56224	65319	72054	85340

When 0% cattle dung was used pH increased by 13.6 %, temperature increased by 11.11%, total solids was increased by 20.53%, Total dissolved solids was increased by 20.5%, Total suspended solids decreased by 25% & COD was reduced by19%.

When 5% cattle dung was used pH increased by 10.86 %, temperature increased by 7.14%, total solids was increased by 6.01%, Total dissolved solids was increased by 6.011%, Total suspended solids increased by 50% & COD was increased by 6.16%.

When 12.5% cattle dung was used pH increased by 25.53 %, temperature decreased by 6.2%, total solids was

increased by 11.39%, Total dissolved solids was increased by 271%, Total
suspended solids decreased by 87.8% & COD was increased by 16.17%.

When 25% cattle dung was used pH increased by 12.77 %, temperature increased by 13.79%, total solids was increased by 7.89%, Total dissolved solids was decreased by 6.47%, Total suspended solids decreased by 98.09% & COD was reduced by 18.43%.

3. SEM test was carried out on various material used in MFC treatment such as graphite rod and pots. This test helped to identify the effect of effluent treatment on theses material and how they affect test result. The results obtained in SEM test are as follows:

Table no.3 SEM test results for Earthen Pot

Mass(%) of Element	Blank Earthen pot	After Treatment on Spent wash without Cattle dung earthen pot	After Treatment on Spent wash with Cattle dung earthen pot
Mass(%) of C	3.33	5.50	3.88
Mass(%) of O	35.21	35.85	25.26
Mass(%) of Al	4.62	4.18	3.49
Mass(%) of Si	21.59	18.68	15.64
Mass(%) of Ca	4.22	3.91	-
Mass(%) of Tellurium	6.13	3.86	-
Mass(%) of Dysprosium	1.98	-	-
Mass(%) of ytterbium	5.05	4.47	4.64
Mass(%) of Na	-	0.84	-
Mass(%) of Mg	-	1.70	1.61
Mass(%) of Zirconium	-	3.96	3.71

From the above result we can observe that Na, Mg, and Zirconium were absent in new earthen pot but are present in other two earthen pots. This indicates that these three elements present in the spent wash were absorbed by the earthen pot which leads to elimination of the elements and making the spent wash pure. There was increase in percentage of Carbon and Oxygen in raw spent wash earthen pot which indicates that there was some amount of C &O present in the raw spent wash which was absorbed by the earthen pot. Also there is percentage reduction in ytterbium and tellurium (completely eliminated in cattle dung earthen pot). Also dysprosium was completely eliminated from the other two earthen pots.

Table no. 4 SEM test results for Carbon rod

Mass(%) of Element	Blank Rod	After Treatment on Spent wash without Cattle dung Carbon rod	After Treatment on Spent wash with Cattle dung Carbon rod
Mass(%) of C	91.64	96.15	95.09
Mass(%) of O	4.09	3.85	4.91
Mass(%) of S	4.27	-	-

From the above result we can observe that the carbon and oxygen percentage in both the raw spent wash rod and cattle dung rod have increased which indicates that amount of carbon and oxygen present in the spent wash has been absorbed by the rod. Oxygen was reduced in raw spent wash rod but increased in cattle dung rod which indicates that Oxygen was present in cattle dung which lead to its increase in percentage. Sulphur was eliminated from both the rods which indicates that sulphur was consumed/mixed with the spent wash.

IV. CONCLUSION

Peak Voltage of 102 mV and Current 62 mA was achieved on day 5 after adding 12.5% cattle dung. So cattle dung is optimum for electricity generation but COD is increased from 56224 mg/lit to 65319 mg/lit with percentage increase of 13.90% .Therefore alternative processes need to be carried out to reduce COD.

SEM test indicated that there was complete elimination of elements like Na, Mg, Zirconium and C from the spent wash. There was also reduce in percentage of Oxygen in spent wash.

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