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Treatment of Rubber Industry Wastewater Using Anaerobic Digester

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ABSTRACT
Rubber industry is one of the key sectors of the Indian economy. India is the fourth largest producer of natural rubber and the third largest consumer of the polymer. As far as consumption of natural and synthetic rubber together is concerned, the country occupies the fourth position. Although, rubber product manufacture started in India, in the year 1920.In this project work were to examine the efficiency of anaerobic digester process to treat the rubber industry wastewater and to production/generation of methane or bio-gas removal of total solids (TS) and B.O.D (biochemical oxygen demand) from this system. Biogas originates from bacteria in the process of biological breakdown of organic material under anaerobic conditions. Wastewater from rubber industry contains pH 8.5.therefore this wastewater pH must be adjusted 7.0-8.0. Digester was setup (the system consisted of one digester, add cow dung slurry of capacity 5 liters with adding and removing 1000mL of rubber industry wastewater) in a laboratory from first week to fifth week, After feed with wastewater at a pH of 7 to 8 up to fifteenth week. The result of this system removal efficiency of T.S, D.S, F.S, V.S, B.O.D, C.O.D, SO4, NO3 77.98%, 51.75%, 52.00%, 80.76%, 65.98%, 72.96%, 60.79%, 68.79.total bio-gas generation from total solids removal is 8.56mL/gm and total bio-gas production from total B.O.D removal is 81.25mL/gm.

Keywords - Biogas, wastewater, anaerobic digester, BOD, total solids

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I. INTRODUCTION

The rubber industry is one of the key sectors of the Indian economy. Rubber was known to the native people of the Americas long before the arrival of European explorers. In 1525, Padre D'anghieria reported that he had seen Mexican tribes people playing with elastic balls. The first scientific study of rubber was undertaken by Charles de la condamine, when he encountered it during his trip to Peru in 1735. A fresh engineer that Condamine met in Guiana, fresnau studied rubber on its home ground, reaching the conclusion that this was nothing more than a "type of condensed oil". The first use for rubber was an eraser. It was Magellan, a descendent of the famous Portuguese navigator, who suggested this use. In England, Priestley popularized it to the extent it becomes known as India rubber. the word for rubber in Portuguese – Borracha – originated from one of the first applications for this product, When it was used to make jars replacing the leather Borracha that the Portuguese used to ship wine. In 1845, R.W. Thomson invented the pneumatic tire, the inner tube and even the textured tread. In 1850 rubber toys were being made, as well as solid and hollow balls for golf and tennis. The invention of the velocipede by Michaux in 1869 led to the invention of solid rubber, followed by hollow rubber and finally the re-invention of the tire, because Thomson's invention had been forgotten. The physical properties of rubber were studied by payen, as well as Graham, and Wiesner.

The first bicycle tire dates back to 1830, and in 1895 Michelin had the daring idea of adapting the tire to the automobile. Since then, rubber has held an outstanding position on the global market. As rubber is an important raw material that plays a leading role in modern civilization, chemists soon become curious to learn more about its composition in order to synthesize it. Work focused on this objective, soon discovering that rubber is an isoprene polymer.

This paper describes experimental studies that were conducted on rubber industry wastewater in order to evaluate efficiencies in the removal of Chemical Oxygen Demand (COD), Total Solids (TS), Dissolved Solids (DS), fixed solids (FS), volatile solids (VS), Sulphate, Nitrate and Biochemical Oxygen Demand (BOD) at 7 to 8 pH of wastewater.

Advantages Of Waste Water Treatment
- Saving of extra water used for different purpose.
- Recycling and reuse of water for domestic and industrial use.
- Ground water and surface water source is safe from pollution due to treatment of waste water
- Treated water is for vegetation.
- Cost of transportation of polluted water is saved and Air pollution is limited to treatment plant.

Disadvantages Of Waste Waterr Treatmeent
- Space required for treatment plant is more.
- Money is used for construction of waste water treatment is more and Handling of dry sludge

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II. METHODOLOGY

2.1 Experimental Setup

Fig 1 showing the experimental setup i.e. anaerobic digester

2.2 Start up reactor procedure
- For the initial start up, cow dung slurry placed in the digester for acclimatization.
- Reactor was started with cow dung slurry (i.e. made by adding 1kg of cow dung in a tap water) made up to 5 litters total working volume.
- Digester was carried out by adding 100ml/day and 1000ml/week of raw sample for 15 week.
- Take 500ml of digester sample effluent per week.
- And test the initial parameters up to 15 weeks.

III. RESULTS AND DISCUSSION

This chapter describes the results of wastewater characteristics of rubber industry wastewater and also the influent and effluent characteristics of anaerobic digester. Table no 1. is the influent characteristics of rubber industry wastewater as follows,

S.N	PARAMETERS	RESULT
1	PH	8.5
2	Total solids	8300 Mg/L
3	Dissolved solids	800 Mg/L
4	Fixed solids	800 Mg/L
5	Volatile solids	7500 Mg/L
6	B.O.D	970 Mg/L
7	C.O.D	15042.1 Mg/L
8	Sulphate	90.98 Mg/L
9	Nitrate	115.2 Mg/L

Table no 1.Influent characteristics of rubber industry wastewater.

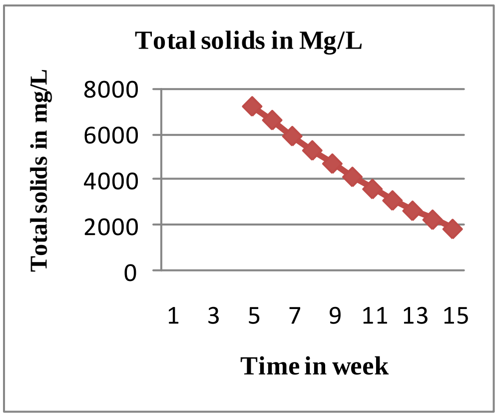

Fig.2 variation of total solids with time

In this experiment the total solids reduction is the maximum 77.98%. The reduction of total solids measured is an important parameter for measuring biodegradation, the above graph sloped downward which indicate that the total solids degradation increased.

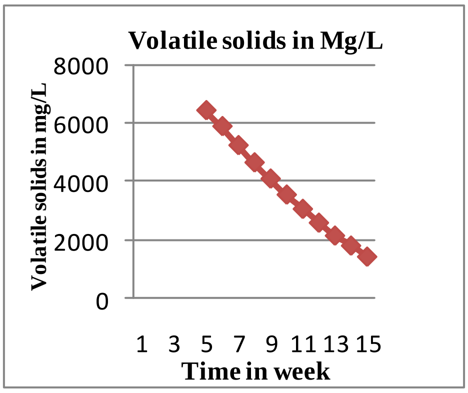

Fig.3 variation of volatile solids with time

In this experiment the volatile solids reduction is the maximum 80.76%. In the anaerobic system the reduction of volatile solids denote the stabilization.

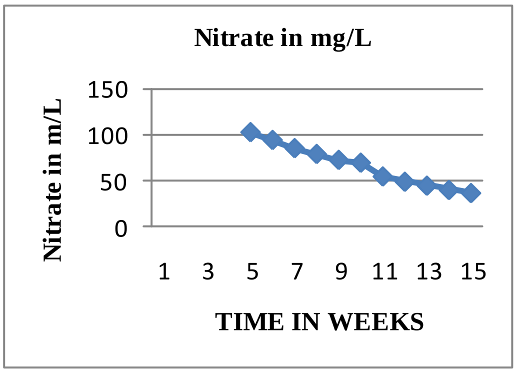

Fig. 4 variation of Nitrate (NO3) with time

The results of nitrate (NO3) concentration of physic-chemically treated wastewater reduction are the maximum 68.79%.

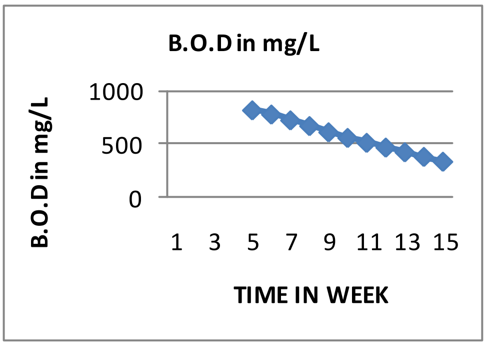

Fig. 5 variation of B.O.D with time

In this experiment the B.O.D reduction is the maximum 65.98%.

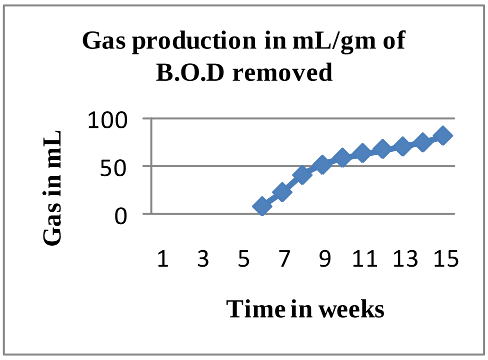

Fig 7 production of bio-gas with respect to time

One of the main objectives of this work is to determine the performance of the anaerobic digestion process. The results in the above graph (4.5) B.O.D contribute to anaerobic degradation and as well as bio-gas production. Total gas production from the digester is,
(Initial BOD – final BOD)*volume of digester/1000, Gas production = mL of gas produced/BOD removed in gm, i.e. (970 – 329.986) = 640.02mg/L, (640.02 mg/L * 5L)/1000 = 3.20gm
Gas production = 260Ml/3.20gm = 81.25 mL/gm.

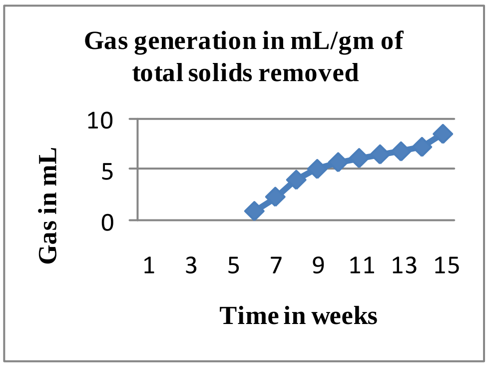

Fig 8 Generation of bio-gas with respect to time

One of the main objectives of this research was to determine the performance of the anaerobic digestion process. The results in the above graph (4.6) total solids contribute to anaerobic degradation and as well as bio-gas generation. Total gas generation from the digester is,
(Initial Total solids– final Total solids)*volume of digester/1000, Gas generation = mL of gas generated/total solids removed in gm, i.e. (8300 - 1827) = 6473 mg/L, (6473 mg/L * 5L)/1000 = 32.00gm
Gas production = 260Ml/32.00gm = 8.56 mL/gm.

IV. CONCLUSION

Anaerobic digester system can be used to treat the rubber industry wastewater to production/generation of methane or bio-gas from this system. But, during about 15 weeks of digester period, wastewater should be pH must be adjusted 7.0-8.0.after that, digester can be fed with wastewater adjusted pH. The result of this system removal efficiency of T.S, D.S, F.S, V.S, B.O.D, C.O.D, SO4, NO3 77.98%, 51.75%, 52.00%, 80.76%, 65.98%, 72.96% 60.79%,68.79.total bio-gas generation from total solids removal is 8.56mL/gm and total bio-gas production from total B.O.D removal is 81.25mL/gm.

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