INVESTIGATION OF THE EFFECTS OF SPENT WASH UNDER AEROBIC AND ANAEROBIC CONDITIONS: FOR SUITABLE DISPOSAL STRATEGY

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***Ke ywords**: Toddy distillery spent wash, Nutrients, Anaerobic and Aerobic Treatments*

Introduction

Distillery industry contributes to one of the major industrial pollution with generation of large amount of effluent called as spent wash. There are two major distillery units in Jaffna peninsula Thikkam and Navaly and distillate about 2250 L/hour in four batches in a day and 3750 L/day respectively. The generated waste is released in to the land filling areas. The spent wash has the higher nutrient contents such as N, P, K, Ca and sulphates, which need high amount of oxygen to the oxidation process, lead to high biological oxygen demand (Patil *et.al.*, 2010). When apply the waste in to land filling areas, without any treatment process, it leads sever problems such as, reducing alkalinity, eutrophication, green house gas emission, odor, effect the aquatic lives and inhibit the seed germination (Ling *et.al.*, 2009). Hence, the selected objectives are to evaluate the fresh toddy distillery spent wash composition such pH, EC, TDS, total nitrogen, available nitrogen, potassium, phosphorous, carbon and calcium and to investigate the changes in above said parameters in toddy distillery spent wash under storage of aerobic and anaerobic situation for suitable disposal strategy. An anaerobic digestion, particularly, suited to wet organic material and is commonly used for effluent and sewage treatment. It provides an in situ treatment of the spent wash, to enhance the digestion, and promotes the rapid settlement (Reinhart and Tounsend, 1998). Numerous studies, on the effects of effluent, have shown increased biological activity and decomposition along with increased moisture content (Benson *et al.*, 2006).

Methodology

Collection of toddy distillery spent wash and analysis (TDSW)

TDSW was obtained from Navaly toddy distillery unit and it was collected directly from the outlet of Navaly distillery unit without accumulating in aerobic tank. The fresh sample was collected in sterilized screw cap bottle and it was closed immediately by the lid without any contamination for laboratory analysis. Evaluation of the components of TDSW was carried out at laboratory, Department of Bio chemistry, Faculty of Medicine, University of Jaffna for its pH, total dissolved solid (TDS) and electrical conductivity (EC), total nitrogen, carbon, phosphorous, calcium, and potassium with three replicates. The sample was collected at uniform weekly interval; T1, T2, T3 and T4 as 7, 14, 21 and 28 days respectively from both an anaerobic and aerobic digester for the parameter analysis. The experiment was conducted in Complete Randomized Design with three replicates. Also total solid (TS), volatile solid (VS), total suspended solid (TSS) and total volatile solid (TVS) were measured.

Discussion and Conclusion

Components of fresh TDSW stored under an aerobic and anaerobic condition

pH of both an aerobic and anaerobic were increased with the storage time but, the increment was higher in aerobic compared to anaerobic. This acidic nature throughout the period was due to both productions of organic acids by acidogenic bacteria and by the formation of carbonic

acids. Comparison of an anaerobic and aerobic conditions result exposed that releasing of CO_2 is higher in an aerobic process than anaerobic process perhaps pH was controlled by the bicarbonate buffering action of closed system. The TDS (mg/l) and EC (ds/cm) with process time of two different processes, increment in anaerobic was attributed by hydrolysis and acidogenesis. The increment in TDS expresses the high concentration of volatile fatty acids and ethanol concentration (Wijesekara, 2010). It was observed the huge increment in TDS after 21 days, was due to the activity of thermophilic bacteria over mesophilic bacteria. EC follows similar pattern that of TDS. Results reinforces that change of the values of samples obtained from an anaerobic digestion are not significant in between but in case of an aerobic condition, it has an efficient increment of EC with time due to the incorporation of TDS to the system

Total nitrogen (mg/l) and calcium (mg/l) with time of digestion of two different processes, aerobic and anaerobic were decreased. Nitrogen is important for synthesis of ATP and nucleic acids by the process of microorganisms. Regarding these results obtained are similar with other studies where anaerobic digestion reduced the nitrogen content from 500 mg/l to 400 mg/l in feed stock. Aerobic process reduced the total nitrogen than anaerobic which is due to synthetic activity of aerobic micro organisms than anaerobic. Calcium content diminishes for both anaerobic and aerobic processes by 7 days of time. But, it decreases at faster rate for an anaerobic process than aerobic process. It reveals that calcium is either made insoluble or consumed by microbial colonies developing pH inside the bio environment existing in the digester. Results obtained from this analysis, similar to Lata *et al.*, 2002 increasing the phosphorous and potassium was found. Phosphorous and potassium content increase, in anaerobic process, faster than from of aerobic process, notably after 14 days. This is due to the higher activity of phosphorous solubilizing bacteria in such process (Ghosh *et. al.*, 2002). The colony is proliferated faster in an anaerobic process where environment is conducive for them to proliferate. There is an increment was observed in available nitrogen an anaerobic process than an aerobic process. Available nitrogen increases for anaerobic process where as it is not such for aerobic process. These variations are due two entirely different microbial colonies carrying out the processes in isolation.

Comparison of fresh TDSW with anaerobic and aerobic processes

The components of fresh TDSW TS, VS, TSS and VSS were 15.27 g/l, 14.43 g/l, 2.85 g/l and 2.23 g/l. Also other parameters pH, EC, TDS, potassium, calcium, and available nitrogen were shown in table 1under anaerobic and aerobic processes compared with fresh TDSW. Regarding these values, total nitrogen, phosphorous, potassium, TDS and pH shows the significant differences with the P value of 0.5 in both processes. There was not significant different observed for calcium compared with fresh and after processes. In case of EC, there was no more significant in EC of fresh TDSW with anaerobic process, but significant difference was observed in between the fresh and aerobic process. In case of available nitrogen stored under anaerobic showed the significant different than other treatment and control.

Table 1: Average value of fresh TDSW with anaerobic and aerobic processes.

Parameter	Fresh	stored under anaerobic	stored under aerobic
pH	2.98	3.6	5
EC(dS/cm)	43.3	43	80
TDS(mg/l)	3030	3100	4800
Total nitrogen(mg/l)	511	400	250
Phosphorous(mg/l)	320.73	450	425
Potassium(mg/l)	180.54	325	220
Calcium(mg/l)	69.5	64	66
Available nitrogen(mg/l)	9	24	6

Laboratory analysis was revealed that nutrient profile both in anaerobic and aerobic were better than that of direct application to the fields. But, anaerobic process gave good results than aerobic process as far as nutrient profile is concerned especially for available nitrogen.

Anaerobic digestion is a simple process that can greatly reduce the amount of organic matter which might otherwise be land filled or burnt in an incinerator. The anaerobic and aerobic digestion process was evaluated by quality parameters of pH, TDS, EC, total nitrogen, calcium, phosphorous and potassium.

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