ASSESSING AND COMPARING THE QUALITY OF ENRICHED COMPOST WITH DISTILLERY SPENT WASH

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Keywords: *Spentwash, Anaerobic Process, Aerobic Process, Compost*

Introduction

South Asian countries like Sri Lanka are facing severe problems of managing the solid waste with ever increasing populations, urbanization and lack of land for final disposal of wastes and this problem is further aggravated due to absence of proper solid waste management systems. About 50,000 MT of hazardous waste is annually generated in Sri Lanka. Most of the wastes generated are dumped and very little is treated and recycled in Sri Lanka (Basanayake and Menikpura, 2009). At present daily per capita waste generation is 0.65-0.85 kg/day in Sri Lanka (Wijesekara, 2010). Municipal solid waste is the waste generated in a community with the exception of industrial and comprises of about 85% is organic matter (Prabhaharan *et al.*, 2010). In Jaffna Municipal Council, annual generation of solid waste was 9702 tons (Statistical report, 2007). The produced compost from municipal solid was poor quality in the stand of nutritional status specifically low nitrate content.

The ethanol produced in the northern parts of Sri Lanka, especially in the Jaffna peninsula, is from the naturally fermented *palmyrah* and coconut toddy respectively. There are 10 million *palmyrah* palms in Sri Lanka, spreading over 60,000 acres. The Jaffna peninsula has 7×10^6 *palmyrah* palms growing widely (Mohanathas, 1983). Palmyra trees are abundant and huge amount of sap is produced seasonally in Jaffna Peninsula. Excess amount of sap is distilled through distillation process. Liquid waste from distillery unit (toddy distillery spent wash, TDSW) creates pollutants causing environmental degradation and social unrest. So, it is vital to avoid environmental impact on the people living there by developing an appropriate management method to suit the system concerned and improve the organic waste. Application of TDSW increases the soil nutritional properties of available nitrogen, Phosphate and potassium (Alvapillai *et al.*, 2010). But direct application of distillery spent wash in to the soil, causes significant effects to soil as pollution by decrease alkalinity and reducing availability of nutrients, even though it has good nutritional properties for the plant growth. Hence the effluent has to be disposed in environment in a proper manner. Hence this study was focused on the suitability of application of TDSW to municipal solid waste to get enriched compost by anaerobic and aerobic digestion.

Methodology

The waste load was separated manually and composition of waste material was determined by collecting random samples from the collecting points. TDSW was collected directly from the outlet of Navaly distillery unit in 50 l buckets, without accumulating in aerobic tank. It was kept air tight to apply the waste fraction in large scale. The TDSW was transferred to an experimental area in the shield containers. Compost digester was designed as aerobic and anaerobic to control aeration and to promote composting from the organic waste by using 50 l plastic bucket.

In an Anaerobic treatment, **e**qual amount of waste of 5 Kg was filled and 30 l of TDSW were applied into each compost digester. Mean time, control treatment was scheduled with 5 kg of waste with 30 l of water. The samples of digester/compost were collected at uniform weekly interval starting from 14^{th} day to 42 day from both an anaerobic and control for the parameter analysis. In an Aerobic treatment**,** equal amount of waste of 5 Kg was filled in to an aerobic digester. All materials were assigned for ensuring better aeration to the system. The application of total amount of TDSW was equal as 30 l, but the time of application time set changeable. Such as 30 l of TDSW was applied in 15 times at two days interval for 30 days. Collection of sample for parametric evaluation was considered similarly in that of an anaerobic treatment. The control treatment was designed as split application of water instead of TDSW.

Composite samples were collected from each digester. It was spread under at an air dried condition. Finally the collected samples were ground by grinder to break down the materials. The final samples were stored in an air tight plastic bottle for analysis. The experiment was conducted in the CRD with three replicates. Temperature, pH, total nitrogen, available nitrogen, phosphate and potassium were analyzed.

Discussion and Conclusion

Digestate is the solid fraction, coming out from the digester at the completion of the digestion process. Digestate has nutrient value as such it can be applied as manure. The digestate, from anaerobic digesters, usually contains about the same amount of nutrient as in the feed materials for the digesters. However, nutrients, in the digestate, are in more readily available form for plants. The relationship between the temperature with time of two different processes, aerobic and anaerobic during the period of digestion, were from 32^0C to 42^0C at mesophilic temperature.

An anaerobic process the methanogenetic bacteria are pH sensitive and generally having an optimum range of pH 6.5 - 7.5 (Clark and Speece, 1971). It is especially important for the methanogenic bacteria to maintain at least pH 6.5 in the system. It was initially observed that the pH was slightly decreased with time due to the acidogenic phase. Significant change was not observed thereafter of methanogenesis buffering process. Anaerobic process ends up with pH near 7 starting from the ph 8.3. It clearly indicates that the anaerobic process is activated, by a bacterial colony which has an ability to produce acids through the process methanogenesis. In control of an anaerobic process, pH slightly decreased as treatment. But, in control of aerobic and treatment it shows the ranges between 8-8.3 and was not observed a significant fluctuation.

Figure 1 shows the relationship between available nitrogen (mg/100g) and time of digestion of aerobic and anaerobic with control. This was attributed to release of available nitrogen as ammonia during hydrolysis of protein or utilization of nitrogen for bio mass synthesis. In this study, the total nitrogen concentration was reduced from 610 mg/100g to 580 mg/100g due to the activity of *nitrosomonas* sp and *nitrobactor* sp. Similar trend was observed in control, in aerobic process. The values of available nitrogen for both anaerobic and aerobic process are 180, 50 mg/100g respectively.

Table 1 shows composition of digestate of available nitrogen, phosphate and potassium after 42 days. 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. The colony is proliferated faster in an anaerobic process where environment is conducive for them to proliferate. All essential nutrition such as available nitrogen, phosphate and potassium were higher in treated than control. Hence these technologies, aerobic or anaerobic could be used to produce enriched compost while conserving the environment.

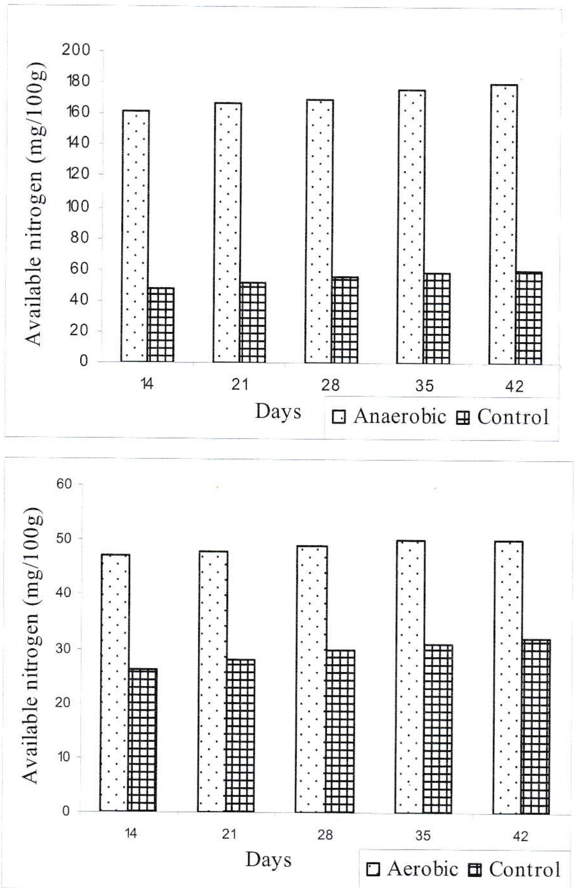

Figure 1: Changes of available nitrogen in anaerobic and aerobic situation with control

Table 1: Final composition of digestate after 42 days

Parameters	Anaerobic		Aerobic	
	Treatment	Control	Treatment	Control
Total Nitrogen (mg/100 g)	560	500	520	500
Available nitrogen (mg/100 g)	180	60	50	32
Phosphate (mg/100 g)	260	190	180	90
Potassium (mg/100 g)	140	80	120	50

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