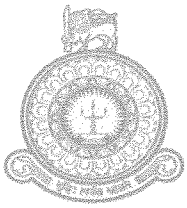

Analysis of Composting Process to Determine the Maturity of Compost

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R.A.G.K. Ranawaka

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Abstract

The study aimed to monitor the composting process and its parameters to evaluate the nitrification process in composting as an indicator to define the maturity of compost of municipal solid waste (MSW). Two composting sites were selected for the study, where one site is composting materials predominantly with garden waste while the other site is predominantly with vegetables and fruit waste. Nitrification during the composting process and the appearance and variation in water soluble Nitrate concentration during the composting process lasting 11 weeks was monitored. The piles were turned for aeration and the variation of other parameters such as pile temperature, moisture content, volatile solids content and the volume reduction in piles during the composting process was monitored. The statistical significance of the differences in all the measured parameters were analyzed and compared between two sites to determine the maturity level of the compost as well as the impact of the different feedstock on the composting process. The significances in correlations have been analyzed between the measured parameters to define interrelationships during the process of compost maturity.

Daily pile temperature was measured with a thermocouple thermometer. Moisture content and volatile solids content of composite compost samples were measured according to standard procedures on gravimetric method and the water soluble nitrate concentration was measured with a Nitrate ion selective electrode (ISE) in water extraction of nitrates. The samples were collected weekly and the sample size is 132 (66 from each site). The highest mean temperature has been recorded in both sites between 60°C-65°C during the early stage of the composting process. In piles with fruit and vegetable waste, a low average volume reduction of 60% has been recorded and the temperature remained around 40°C at the end of the process showing a heat accumulation within the mass, which is an indication of the degradation process is yet incomplete. Although the trend in volume reduction is the same for both feedstock, the highest volume reduction of average 90% has been achieved in composting of garden waste while ending up the process at ambient temperature. During the early stage of the process the water soluble nitrate concentration was at a low level of 100ppm and it has been increased significantly during the composting process over the curing stage. The maximum values recorded at the end are 449ppm at the site where the composting predominantly with garden waste and 384ppm at the site where the composting predominantly with fruit and vegetable waste, which has not been shown a significant difference due to difference in feedstock. Due to differences in process handling methods between two sites the moisture content was recorded with a significant difference. Regular turning and watering is needed to maintain the optimum moisture content and for proper aeration to minimize the nitrate loss during the process as well as to ensure rapid aerobic composting. Due to high heterogeneity in compost substrate the volatile solids content has been varied in an unrealistic manner and it is not a good indicator to define the degradability of composting material.

All the parameters are interdependent and it is evident with the significant correlations. All of these factors are interrelated, and must be monitored and controlled throughout the composting process. The nitrate concentration increases with the decrease in temperature and the status of degradation can be decided by analyzing the nitrification process. The maturity of compost can be achieved with maximum nitrate concentration during the curing stage with the decline in pile temperature which is closer to ambient temperature.

Key words: Municipal solid waste, Composting process, Nitrification, Water soluble nitrates, Compost maturity