Influence of meteorological conditions and composting facilities on active composting performance

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Introduction and objective

The total amount of waste generated per year in Spain experienced an increase of 95.9% during the period between 1990 and 2007. The total amount of waste produced in the last year was 25,584,000 tonnes. With the objective of determining the possible influence of various environmental factors such as air temperature and rainfall on the composting process, qualitatively, a follow-up study was completed utilizing two processes of co-composting of municipal solid wastes organic fraction (OFMSW) and sewage sludge of WWTP (Waste Water Treatment Plant). The trials were conducted during different seasonal periods, during the most active phase of composting, and the development of both indoor and outdoor trials.

Methodology

Two co-composting trials were established. The first trial began in summer while the second took place in winter. The technique used was flipped or dynamic batteries (turning windrows) due to its easy handling, economy and potential for widespread use in the composting plants. They consisted of mixtures of waste in similar proportions: the first consisting of the organic fraction of the municipal solid wastes (OFMSW) in the proportion 70% OFMSW and 30% sewage sludge from WWTP to the weather. The second consisted of a similar mix 70/30 OFMSW/sludge) and located indoors.

Results

During the period of this study, the daily mean environmental temperature was 22.67 +/-2.90ºC for the summer trial, and significantly lower temperatures, 10.49 +/-3.23ºC, for the Winter trial. Because of the seasonal difference during the start-up phase, the period for the winter assays is longer than the summer trials: 26 days for both assays in contrast to 7 for the outdoor batteries and 15 days for the indoor assays. Therefore, the rate of warming was greater in the case of the summer batteries. This was clearly influenced by the weather conditions. According to the rate of warming at the start of the thermopile phase, a similar result was obtained in both batteries in the winter season (1.33ºC +/-0.23 and 1.26 ºC +/-0.17) for the assay exposed to the weather and the assay installed indoors. The summer test was 1.55ºC +/-0.09 and 1.11ºC +/-0.39 respectively which can be interpreted as a greater speed for the battery indoors in winter with respect to its counterpart in the summer. In all cases, Once the fermentative phase ($T^a > 55^o$ C) was initiated, it lasted a number of days sufficient to ensure perfect hygiene and elimination of pathogens. During fermentation, continuous fluctuations in the temperature of the batteries exposed to the weather were observed. Operational factors as well as environmental factors effected moisture content resulted in 40% moisture percentages in the summer and 55% in the winter. On the other hand, the indoor batteries evolved more uniformly and maintained percentages of humidity close to 50% favoring the decomposition and the possible savings contributions of water.

Conclusions

The fermentation in a protected indoor environment guarantees warmth and heat, as demonstrated during the summer trials. There is proper disposal of pathogens and optimal hygiene. It also minimizes the negative effects of the mass composted by the high environmental temperatures during the summer that can inhibit microbial activity. The low rainfall recorded during the research led to initial deficits of moisture, especially in summer, that were subsequently corrected by additional contributions of water, which had repercussions on the reactivation of the microbiota present in the trials.

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Keywords

Composting, recycling, municipal solid wastes, sewage sludge, turning windrows