Generation of Compost Fertilizers from Banana Stem using Poultry Droppings and Industrial Sewage Sludge as Activators

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A THESIS SUBMITTED TO THE INSTITUTE OF ECOLOGY AND ENVIRONMENTAL STUDIES, OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR AN AWARD OF THE DEGREE OF MASTER OF SCIENCE (M.Sc.) IN ENVIRONMENTAL CONTROL AND MANAGEMENT

M A Y 2008

ABSTRACT

Banana pseudostem was composted using poultry droppings and industrial sewage sludge as activators. The specific objectives were to isolate and identify some of the microorganisms involved in the composting, assess the bacterial and fungal dynamics during composting process, determine the population of coliforms in the matured compost, determine the effect of activators on the quality of compost generated, and determine the quality of end-product (compost). This was with a view of assessing if a sanitarily-safe quality organic fertilizer can be produced from banana pseudostem.

Equal weights (5 kg) of poultry droppings and chopped banana stem were mixed (l:l) in a basket lined with polyethylene sheet. In a second, basket 7 kg of chopped banana pseudostem was mixed with 3.5 kg of poultry droppings (2:1). These 2 mixing ratios were repeated also for the industrial sewage sludge. For the control, 10 kg of the pseudostem alone was piled in a basket. The total heterotrophic bacterial, total coliforms and total heterotrophic fungal counts were determined using the standard pour plate technique. The population of *Escherichia coli* was used as the indicator of pathogenicity in the end-product (compost). The contents of carbon, nitrogen, phosphorus, potassium, calcium, magnesium, iron, manganese, zinc, copper and heavy metals such as lead, cadmium and nickel were determined to ascertain their fertilizer value and probable heavy metals toxicity. The moisture content, temperature, weight and pH of each treatment were also monitored using established procedures.

The results showed that the bacterial populations in the matured composts were between 2.4×10^5 and 1.4×10^6 cfu/g (wet weight), while the fungal counts ranged between 6.0×10^3 and 3.0×10^4 cfu/g (wet weight). All the matured compost samples were

free of E. *coli*, an indicator of pathogenicity. Similar bacteria genera with different population patterns were isolated from the five different composting samples. Some of the bacteria recovered were of the genera *Pseudomonas, Arthrobacter, Proteus, Serratia, Norcadia, Corynebacterium, Enterobacter, Bacillus, Kurthia, Micrococcus, Escherichia, Klebsiella, Staphylococcus, Geotrichum, Edwardsiella* and *Actinomyces* while the fungi included *Aureobasidium, Aspergillus, Alternaria, Mucor, Cladosporium, Rhizopus, Botrytis* and yeast. The moisture content ranged between 48% and 54%. The composting process occurred within the mesophilic range of 25°C and 39°C and a pH range of 5.60 and 8.70 in all the treatments. The reduction in weight of all the treatments ranged between 60.8% and 74.0%. With the exception of the control pile, all the composts produced fell within the specified carbon/nitrogen (C/N) ratio of less than 25. The fertilizer value in terms of nitrogen-phosphorus-potassium (NPK), other macro and micronutrients analysed in the matured composts indicated that the finished products are suitable as organic fertilizer except the control, which had nutrients a little below the recommended Food and Agriculture Organization (FAO) minimum standard and a C/N ratio higher than 25 which can cause nutrient immobilization. The NPK concentrations were significantly different in all the mature composts ($F = 262.4$, $P<0.05$). Compost produced with poultry droppings (1:1) as activator had the highest NPK concentration, while it was least in the control compost.

In conclusion, the banana stem could be a very good organic fertilizer source if amended with poultry droppings or sewage sludge as activators. However, poultry droppings could serve as a better activator as compared to industrial sewage sludge, in producing compost from banana stem.