C-34: The design and development of a vertical composting bioreactor for urban solid waste management

B F A Basnayake, D S Fernando
(Dept of Agric Engineering, Faculty of Agriculture, University of Peradeniya)

A basic process for composting Urban Solid Wastes was developed at the Faculty of Agriculture, University of Peradeniya. It consists of a chimney assisted aeration vessel. The composted material handling was difficult since there was no provision for a through flow of decomposing matter.

With the view of commercializing the process, a modified engineering model was designed incorporating a pre-treatment unit and developed to improve the existing unit. It was also necessary to determine the variables influencing the rate of degradation and to test the hypothesis that backend-sorting system could be a viable proposition in view of the difficulties encountered in sorting non-degradable materials from degradable.

The pre-treatment unit consisted of a step-grate furnace. The waste was heated to about 400°C for a short duration of less than 1 min.

A step-grate was incorporated to permit through flow of material while allowing air to circulate through this step-grate. The height of the chimney was maintained at the initial height of 3.58 m. The total volume of this engineering model, bioreactor is 0.64 m^3. The height could be adjusted to determine the optimum for commercializing the unit.

Results show that pre-treatment is an advantage and the time of heating should be less than 0.5 min. However the temperature should be maintained at 400°C. Recycling of waste is needed when pre-heating is practiced. This permits the required balance of organisms to be maintained in the reactor specially some types of larvae.

At peak sunshine hours a maximum flow of 0.5 m/h was observed. The temperature of the pile of waste from top to bottom varied from 32.6°C to 50.8°C and density varied from 430 kg/m^3 to 800 kg/m^3. The lower temperatures were experienced when the decomposition rates reached a very low value. The composted materials were entangled with the non biodegradable material.