

C-35: Solar radiation assisted aeration system for making compost from urban solid wastes

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Department of Agricultural Engineering, University of Peradeniya developed the first engineering model, consisting of a chimney assisted aeration system (for making compost from urban wastes) which depended on the daily radiation levels received and other climatic factors. A temperature inversion was

observed between the chimney and ambient value during night time as opposed to day time. In a scaled-up pilot model, it was necessary to consider the influence of the chimney effect on the airflow through the waste pile and to develop a useful mathematical expression.

The temperature variations at several points of the waste pile were monitored continuously at hourly intervals. Also, the temperature variations at the chimney inlet, chimney outlet and the ambient were observed. The air velocity in the chimney was monitored throughout by using an anemometer. In a selected period of time, during daylight hours, air velocity was measured every hour while the inlet door was opened and then the value noted when the unit was totally closed. The wind velocity outside the unit was obtained soon after noting the value inside. The intensity of solar radiation using a pyrometer was noted, coinciding with the air velocity measurements. Two sets of experiments were conducted, the first set without any wastes or decomposed material inside the pilot model and the second with the waste.

The analysis of the data indicates that there is a linear relationship between the amount of solar radiation received and the velocity of air flowing through the chimney. On bright sunshine days when the amount of solar radiation varied from 60 to 800 W/m², the chimney flow velocity linearly increased from 0.1709 to 0.8128 m/s. A linearity was observed only below radiation values of 400 W/m². The increase in chimney flow velocity with solar radiation has a functional relationship of

$$V_c = 0.001557 R + 0.033411$$

where, V_c = Chimney flow velocity (m/s),
 R = Solar intensity, (W/m²).

The temperature inversion observed during the night in the earlier units did not take place. There is no clear relationship from the data obtained between the wind velocity and the chimney flow velocity.

Although there is an increasing trend in the air flow velocity against increasing chimney temperature a clear relationship is not visible.