

and secondarily to utilize the resulting compost. While there were many composting processes, two types of plants predominated: the rasping system-windrow composting plants developed by the Dutch N. V. Vuilafvoer Maatschappij (VAM) and the Dano biostabilizer plants developed by the Dano Works in Denmark.

In the United States, Waksman and his associates conducted research during 1926-1941 on aerobic decomposition of plant residues and manures. The first basic studies on aerobic composting of community solid wastes were conducted by the University of California, Sanitary Engineering Research Project (1), during 1950-1952. One conclusion of this work was that composting should be considered as a means of disposal and reclamation for municipal refuse. Gotaats (2) later prepared a comprehensive text on this subject for the World Health Organization.

From 1953 to 1962 Wiley and others (3) (4) of the Public Health Service, Communicable Disease Center, conducted laboratory studies at Savannah, Georgia, and pilot plant studies at Chandler, Arizona. These studies indicated that composting of municipal refuse, with or without sewage sludge, is a feasible and sanitary method of treatment. However, at that time funds were not available for large-scale municipal demonstrations.

At about the same time, Gartrell first proposed a full-scale composting project to be jointly sponsored by the Tennessee Valley Authority, the Public Health Service, and a municipality in the Tennessee Valley area. Both TVA and PHS are interested in sanitary methods of disposal of municipal solid wastes without creating problems of health hazards, nuisance, and water, land, or air pollution. Composting appeared to present a satisfactory method of waste disposal and at the same time to produce a marketable material useful in soil improvement. Marketability of the compost produced greatly affects the economy of a composting operation and may determine whether the process is competitive with other sanitary methods of solid waste disposal.

TVA operates the National Fertilizer Development Center at Muscle Shoals, Alabama, one of the world's largest fertilizer research and development institutions. As a part of its agricultural research and development program, TVA has resources to test and demonstrate the value of compost as a soil amendment and to study marketing opportunities. While the nutrient contents (N, P_2O_5 , K_2O) of compost are relatively low, tests may reveal benefits from fortifying compost with nutrients to produce an organic-base fertilizer.

Most American composting plants built in recent years have relied on the sale of compost and salvaged materials for their primary income, while there was only a nominal payment by the municipality for disposal. Wiley and Kochtitzky (5) concluded that the inability to dispose of large quantities of compost at a favorable price was probably a major factor in the closing of six of nine plants during the period 1962-1964. Nevertheless, interest in composting is increasing, and half a dozen plants have recently been completed or are under construction. There will be nine distinct composting processes represented in the fifteen American plants, each undergoing modification and improvement. Reliable cost data are not available, but the industry has found it necessary at the newer plants to increase charges for disposal and to place less reliance on income from sales of compost to meet processing costs.

Processing raw sewage sludge with solid wastes at a composting plant rather than at the sewage treatment plant should greatly improve the economics of composting. Normal sludge digestion and air drying account for an appreciable portion of the cost of wastewater treatment and produce only a low-value product that may contain pathogens and undesirable viable seeds. Since moisture must be added to mixed refuse for optimum composting, sludge can be used to provide moisture along with other benefits. The nutrients in raw sludge will enhance the decomposition of refuse and augment both structure and nutrient content of the compost. However, sludge thickening is required when all sludge and refuse from the same contributory population are combined. There are several relatively inexpensive means of concentrating or dewatering sewage sludge.

In normal composting, the aerobic thermophilic decomposition produces temperatures of 140 degrees F or higher for several hours or even days. Such time-temperature is believed to be adequate to destroy most, if not all, pathogens. Reports by Knoll (6), Wiley (7), and Krige (8) on European and South African studies have consistently indicated the safety of composts produced by a number of processes. Several reports have indicated that anti-microbial substances are produced during composting and that their action may be as important as time-temperature in destroying pathogens. It appears obvious that compost