

THE MICROBIOLOGY OF COMPOSTING MSW WASTE

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ABSTRACT

Composting Municipal Solid Waste (MSW) is a simple process that can save significant amounts of space in landfills across the United States. Due to shortcomings in product consistency and in marketing, many municipalities continue to place organic wastes in landfills. To consistently achieve a quality composting product, the compost facility operator can control the waste mixtures being composted, the moisture content of the mix, the particle size of the solids, and the level of aeration the mix receives. By controlling these factors, the operator optimizes the conditions for microorganisms to metabolize and significantly degrade the organic compounds in the waste. With an effective composting program in effect, as much as 40% of a typical municipal waste streams in the United States could be diverted from landfills.

KEYWORDS: Composting, Municipal Solid Waste (MSW), Organic Compounds, Windrowing, Microbiology

INTRODUCTION

Composting has been an available technology for stabilizing solid waste for several decades. In fact, whether they realized or not, human beings have been practicing some sort of composting for several centuries. When placed outside on dirt, a pile of organic material will degrade without any special chemical or physical controls. There are a lot of success stories of large facilities that are effective and dependable. However, most of the solid waste that residents toss into the garbage is organic waste that ends up in a landfill. Placing organics in landfills takes up space and creates additional leachates and biogases as organics are digested by microorganisms.

Many of the references of this paper estimate that organic materials make up about 40-45% of MSW in the United States. Figure 1 shows a breakdown of municipal wastes similar to what is mostly found in the United States. Figure 2 shows the proportion of organics in MSW in the State of Iowa. Think of the amount of landfill space that could be saved if this amount were reduced in half. Yet many municipalities continue to place organics in the landfills rather than to work with a better, smarter solution.

Composting is a process in which microorganisms degrade organic materials into stable compounds ready to be safely assimilated into any landscape. Microorganisms such as bacteria, fungi, and some protists are able to degrade the complex organic materials into more simple and useful molecules for life such as sugars, carbon dioxide gas, water, and ammonia. Examples of complex organic molecules in organic wastes that are broken down are cellulose, hemicellulose, starch, chitin, and peptidoglycan. Other organics like lignin or humus take so long to break down that they remain in the substrate after the composting cycle has been completed.

Effective composting disinfects the waste solids of weed seeds and pathogens. This is accomplished when the microorganisms generate enough heat from their metabolic processes to reach temperatures exceeding 40 °C. The organisms present in a healthy compost pile may include those seen in Figure 3. This paper will focus on the organisms that are generating the heat and breaking down the organic materials – the bacteria, fungi, and protists of the first level.