

Electron Microscopic Study of Wheat Straw Degradation During Composting

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ABSTRACT

We have studied the microbial attack on wheat straw that occurs during the process of composting for growth substrate production for the edible mushroom *Agaricus bisporus*. Both transmission (TEM) and scanning (SEM) electron microscopy have been used. Samples were taken at all stages of the composting process. They show an ecological succession of microbial attack initially consisting of a predominantly bacterial flora with only few fungi present. Very few microorganisms are present on the surface of dry straw as the starting material. If stable litter (horse manure/wet straw) is used as a starting material, dense bacterial populations are already present. Bacterial numbers increase very rapidly in the initial stages of composting, and then decline, but with an increase in the proportion of spore forms.

The initial microbial attack takes place on the straw cuticle and in phloem tissue and then spreads to encompass all the tissue types. Actinomycetes become visible in the preparations as hyphae and/or spores after the end of the first stage of the composting process (day 14). Microbial attack on the straw structure was non-uniform. Even at late stages of composting, areas of non-colonized plant cells are present. Various patterns of degradation of the plant wall were found, including tunnelling, the formation of concave depressions, and wholesale erosion causing fraying of the secondary thickening.

Microbial colonies were often seen to be anchored to the plant walls by a polysaccharide layer (glycocalyx). This adhesion may allow greater efficiency of degradation in a localized area, but may also inhibit the rapid spread of the degrading microbial flora. The final material of the composting is heavily degraded, with many of the plant fibers being separated, but it retains a surprising degree of structural integrity.

REFERENCE

1. Atkey, P. T., and Wood, D. A. (1983), *Appl. Bacteriol.* **55**, 293.