BULKING AGENT IMPACT

MIXING RATIOS IN BIOSOLIDS COMPOSTING

Research project in Texas evaluates rice hulls, pine bark fines and yard trimmings to develop a "practical management regime" for producing a quality compost with biosolids.


eight feet by eight feet by 75 feet. Each windrow contained approximately 100 cubic yards of mix.

Calculations determined the amount of water necessary to add to windrows to achieve a minimum 45 percent moisture content. Not all treatments required water initially to achieve this level. Water was uniformly applied by a tanker truck, and the windrows immediately turned to incorporate the moisture. Windrows were retested and irrigated as necessary to achieve the minimum 45 percent moisture at the start of composting.

Windrows were turned as necessary, with a maximum frequency of once per day. The following management conditions were selected and employed: minimum 45 percent moisture, temperatures less than 60°C, oxygen content greater than five percent, and no putrescible odors. These conditions were selected because prior operator experience has shown them to be practical for commercial windrow composting.

As conditions were monitored, mechanical equipment was used to bring the windrows into the target range. When necessary, windrows were turned using a windrow turner. If moisture levels fell below the 45 percent minimum target, water was added and the windrow turned to incorporate the moisture.

If temperatures exceeded 60°C, the windrow was turned to cool it. If odors were present, irrespective of other conditions, the associated windrow was turned to relieve anaerobic spots and gases. If oxygen levels fell below the five percent minimum, the windrow was turned to incorporate oxygen. If a windrow met all target conditions, nothing was done. Ambient air temperatures and rainfall were recorded by a weather station within 2.7 km of the composting site.

When each windrow temperature fell below 40.5°C, the windrows were formed into individual maturing piles. The piles were not turned during this time and no water was added. Upon completion of the maturing time, composite samples were taken from each pile and sent to laboratories for fecal coliform and heavy metal analyses to establish post-composting values.

COMPOSTING RATE

In order for a compost to be economical and commercially viable, the materials must compost as quickly as possible with minimal inputs. All treatments composted at practically the same rate. The field work lasted a total of 106 days with windrow composting taking 76 days and maturation 30 days. By day 76 of windrow composting, the...
temperatures of all windrows were below 40°C and within 10 percent of each other. All windrows were formed into individual maturing piles on day 77.

A principal factor controlling the rate of composting is the resultant carbon:nitrogen ratio (C:N) of the initial mix. When C:N ratios are above 60:1, N is limiting for microbial activity, and composting is slowed. Although there were differences in the bulking agent’s C:N ratios, this fact seemed relatively unimportant, since both biosolids had sufficient nitrogen to allow favorable C:N ratios (below 30:1) of all mixes. Thus, it was assumed that C:N ratio in this experiment was not a factor in limiting composting rate for any treatment.

It should be noted however, that all bulking agents were not fresh and some degree of aging (several months) had already occurred with these materials prior to mixing and composting. This fact probably contributed to lower C:N ratios of the compost mixtures. Use of fresh bulking agents would probably have led to higher C:N ratios and longer composting times.

Another critical factor in controlling composting rate is moisture, since composting is a biological process and all biological activities require sufficient moisture. Several researchers have reported the importance of maintaining a minimum level of 45 percent (by weight) for commercial composting. There were vast differences in initial moisture content between treatments. In order to prevent moisture from becoming a limiting factor for composting, water was added initially and weekly to any windrow falling below the 45 percent minimum.

All treatments containing DB biosolids were considerably drier than belt filtered BFP biosolids. This required very laborious water additions with DB biosolids averaging 1.98 hours of irrigation versus 0.27 hours for BFP biosolids. DB biosolids also tended to lose more water than BFP biosolids. DB biosolids contained a considerable amount of sand from the filtration bed and this contributed to increased moisture loss. Although the higher moisture content of Belt biosolids may have been a labor advantage, it did influence odor generation early in the composting period.

OXYGEN AND ODOR

Most treatments followed similar trends in O2 levels. Early in the composting process, freshly mixed feedstock generates rapid microorganism growth. The rapidly building aerobic microbe population consumes and depletes available O2. This requires turning the windrow(s) to incorporate O2, thus minimizing anaerobic conditions. Composting in the first few weeks is most O2 sensitive and lacking, and from a labor point of view is most intensive because of aeration requirements.

No treatments moved above the minimum target level of five percent until the third week of composting. This required daily turnings of all windrows during this period to temporarily alleviate anaerobic conditions. The incorporation of O2 from windrow turning was immediate but short...
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