GOC Technologies

Steps
Cripps Corner, Staplecross
East Sussex,TN32 5RY

Tel: 01580 831223
Fax: 02070678482
sales@goctechnologies.co.uk

BAT 506 in Bio-Aerosol Control

Composting operations are often criticized for their generation of bio-aerosols – fungal spores, airborne bacteria, and organic dusts. This is especially true of windrow composting operations where most activities are based on agitation of the decomposing materials to provide aeration.

The attraction and proliferation of bacteria, fungi, and other microbes is essential to the composting process. It is these creatures, which digest the organic wastes to produce humus, compost, mulch, or other forms of soil conditioners. If there are no microbes, there will be no decomposition and no compost.

The composting process usually begins with the downsizing of the materials by shredding. It is common for large amounts of dust and microbes to be launched into the atmosphere during shredding. A water curtain or cover over the active area of the shredder is the typical method of reducing emissions from shredding. Once materials are sized, moistened, and mixed in a pile or “windrow”, they are turned to force oxygen in, much like fanning a camp fire. The extra oxygen supports increased metabolic activity. The metabolic activity generates heat and the temperatures in the windrow climb. Initially bacteria and other microbial animals attack the readily available carbohydrates in the materials, and utilize the nitrogen to create new cells and reproduce. The fungi and many of the bacteria proliferate by sporing rather than cellular fission, with each spore a potential new creaturel. Most fungi cannot tolerate the thermophyllic heat levels inside the windrow. Consequently they operate chiefly near the surface and in the first 100 centimetres of pile depth. It is important to note that many species do not die at thermophyllic temperatures, they simply become dormant. This is also true of their spores.

As more and more of the organic material is consumed, lignin and other tough cell-wall structures comprise a higher and higher percentage of the remaining organics (carbon). The available food for bacteria decreases, and the bacterial count decreases accordingly. As food suitability changes the microbial population changes accordingly. Actinomycetes and fungi become more prominent as lignin becomes a higher percentage of the remaining carbon. Temperature decreases, the result of less bacterial activity, facilitating increases in fungi, actinomycetes, and more specialised populations. As the upper regions of the pile cool, the fungi attack the lignin near the surface, feeding and reproducing until the upper sections of the pile may be visibly covered with these creatures. Billions of

additional spores remain in the warmer areas of the windrow, still dormant, and waiting patiently for temperatures to cool.

Throughout the process, turning (aeration) throws the spores, the fungi, and other creatures into the atmosphere. At the conclusion of the process, material is often passed through screens to separate it into different sizes of product. This screening provides another method of releasing the spores into the air. The spores are very small (1 to 5 microns in size), allowing them to travel some distance with the air currents, and making them readily ingestible by humans and animals. Excessive exposure may cause flu symptoms in about 20% of the population. On rare occasions and in certain people, ingested spores develop into growing creatures and rapidly into colonies inside the respiratory system. When this occurs, invasive colonization results in tissue damage, respiratory problems, and occasionally in death.

The most common fungus in this situation, and the creature of most concern, is Aspergillus Fumigatus. AF is found wherever starch, wood, grain, and other carbohydrates are found. We are all exposed to it on a regular basis. However, the amount of food (material) at a composting site supports massive populations of AF, sometimes as much as 200,000 times the typical background level. The AF is perfectly suited to survival in the composting process. It feeds when the temperature allows, and goes dormant when the temperature gets too high. All the time it feeds, it spores. Whenever the material is turned, the spores are launched into the atmosphere. Thus, violent mechanical aeration (row turning) becomes a significant generator of bio-aerosols within a few days after windrow formation.

One method of bio-aerosol control is the inoculation of the composting materials with BAT 506. It is formulated to minimize the necessity for aeration and agitation of decomposing materials. BAT 506 is used to decrease labour, equipment maintenance, fuel consumption, odour, and emissions in general. BAT 506 increases nitrogen fixation, decreases sulphate reduction, and stimulates and sustains facultative activity. By increasing nitrogen fixation, less ammonia and ammonium are available for combination into the various nitrogenous compounds responsible for odour, flies, and even ptomaines. By decreasing sulphate reduction, the percentage of sulphides and mercaptans (which also contribute to odours) is greatly limited. The sulphate reduction is replaced with nitrate reduction, producing nitrogen gas rather than sulphides. The sulphates remain in the compost, acting as natural fungicides and limiting sporing accordingly. Most importantly, BAT 506 provides the oxygen and nutrients required to keep microbial activity high and steady throughout the pile. BAT 506 allows the use of smaller shred-sized feedstock, decreasing oversized lignin fibres and encouraging more rapid actinomycete and fungal appearance. Minimal agitation is required after thorough mixing (assuming piles are constructed with reasonable porosity and structure). Agitation may be conducted during the first few days, when bio-aerosol risk is at its lowest. This early agitation assures pathogen kill by heat.

The use of BAT 506 provides the most thorough decomposition with the lowest level of handling and manipulation, and the lowest degree of bio-aerosol and odour risk.

BAT 506 should be added to the pile at a rate of 65 millilitres of concentrate per metric tonne of materials to be composted. The BAT 506 should be added to water and thoroughly mixed throughout the material. This is accomplished during formation of the pile in the first days after formation. The application of BAT 506 is done a single time to all incoming materials. Moisture levels in the piles must be kept above 50% and the initial moisture level should be taken to as high as 67%. Moisture levels should be checked every 14 days, with additional water added as needed.

BAT 506 has been in use in the USA for over 8 years. It is completely bio-degradable, non-toxic, non-hazardous, and non-corrosive. It requires no special handling, storage, or treatment, and has a shelf life of 3 years. BAT 506 should be used as a composting system. Treatment with 506 often lowers total operating costs significantly. When BAT 506 is properly implemented, and control systems are placed around shredding and screening areas, all chemical and biological emissions from composting sites are dramatically decreased.