be absorbed by the material, some of the water drains down to the lower layer during the first day after filling. In combination with the weight of the upper layers, this creates a very dense lower layer. A very high pressure of 4000 to 5000 Pascal is required to aerate this dense mass. As the lowest layer is the most dense and compact, there is a greater risk that no air reaches the material here. So this layer is the most susceptible to anaerobic patches which occur in the first 15 hours following the filing of phase 1. By mixing again after 24 hours the lower layer is mixed with the rest, then aerated and so its condition will recover. At the end of phase 1 (fermentation) the aim is to have a moisture content of approximately 74 to 75%, a nitrogen content of 2%, an NH4 content of 0.65% and a pH of around 8.6.

Fermentation

The combustion of easily decomposable organic compounds during fermentation releases heat and the temperature increases sharply. At this stage the thermophilic microflora take over from mesophilic organisms. The activity of this microflora pushes up the temperature until it reaches the point where there are almost only chemical reactions. The high temperatures (higher than 70 °C) create a lot of ammonia. These two factors together soften and decompose the straw. If a blend does not rise above 70 °C in phase 1, the easily decomposable organic structures will not be broken down sufficiently. The blend will also have a high pH after fermentation, and will produce bad quality mushrooms later on. Normally the temperature rises to above 70 °C in about 18 hours. Then the temperature of the blend must continue to rise to approximately 78 °C. To avoid the wet lower layer becoming anaerobic, I advise removing the compost from the tunnel, mixing it and filling it into another tunnel 24 hours after filling. After 2 to 3 days at around 78 °C, repeat the process and allow the temperature to rise to 78 °C again. After another 4 days the temperature of the blend will start to fall. During the entire process the compost will turn dark brown. This change should already be clearly visible when the compost is moved to another tunnel for the second time.

Oxygen

At a temperature above 80 °C too much structure will be lost in the material and it will become too soft. From experience we know that if the material rises above 80 °C during this period, the usual cause is al lack of oxygen. To ensure combusting the easily decomposable organic compounds proceeds smoothly, an oxygen content of approximately 8% is required in a continually aerated phase 1 system. This equates to a temperature rise of 2 to 3 °C per hour with an on/off ventilation system. If the oxygen content is too low or high, the temperature development will be too fast or slow. If the fan is off, there is a risk of a chimney effect being created in the material. I strongly recommend to avoid this. The chimney effect sucks air through the compost when the fan is off. This is done at low pressure so the air fails to reach all parts of the compost. This less than optimal distribution of air causes differences in the material. The on/off activation times of the fan will be based on measurements that are not representative for the entire bulk. This means that part of the blend will experience erratic temperature development and will deviate widely in uniformity when filled in phase 2. The compost will vary from an anaerobic state, to being overloaded with actinomycetes. This type of compost usually has a lower pH, as well as a lower NH3 and NH4 content when filled in phase 2. If too little fresh air is introduced during fermentation, the temperature will rise very fast and the process will produce a lot of odour. Fermentation will only take place on the surface. The straw in the material will turn into a bluish black or a shiny yellowy green. This process can be compared with charcoal production. If the oxygen content is too high there will be little or no temperature rise, or the temperature may even fall. During the first 5 to 6 hours a lot of fresh air is needed due to the increasing activity of the thermophilic microflora. As the easily decomposable organic compounds fall in number during fermentation, the activity decreases and therefore the volume of air required too. The aeration time should be regularly shortened. Up to 60 °C the fan is constantly active, afterwards the computer must calculate how long the fan should be active/idle up to the required 78 °C. Adjusting these intervals manually is almost impossible.

Diagram of fermentation process

A: The blend contains a lot of easily decomposable organic material and needs plenty of oxygen.

B: In the first 12 hours water seeps out of the material during the periods when the fan is switched off. In the meantime, the lower layer becomes wetter, so anaerobic patches can occur. Removing the blend, mixing it and placing it in another tunnel (after 24 hours) mixes this layer through the rest.

C: After 3 to 4 days move the blend into another tunnel and mix so the outer layer can ferment better.

D: If the temperature continues to fall, switch quickly to phase 2. Waiting too long has a negative effect on good for phase 2.