The QuikSoil® BACS Process

Scientific Principals

Part 2

The Science of QuikSoil® BACS

Consider the following point:

After you turn your compost, the process recovers and goes happily on for days or weeks until you turn it again –

Even though all credible studies we have seen show the increased oxygen from the turn only lasts a few hours.

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What is the actual definition of an aerobic bacteria?

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"An organism that is *CAPABLE* of using oxygen as a terminal electron acceptor,

and can *TOLERATE* a level of oxygen equivalent to or higher than that present in an air atmosphere....."

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Definition from

Bergey's Manual of Determinative Bacteriology; 9th Edition, 2000, page 23 Lippincott Williams & Wilkins

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Bacteria have no mouths, noses, or lungs.

The method by which they utilize oxygen is not equivalent to our own.

Oxygen is largely utilized in reactions that occur EXTERNAL to the cell, in moisture.

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The concept that aerobic bacteria must have high levels of oxygen to grow and reproduce is not only unsubstantiated, it is physically impossible.

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It is physically impossible due to the nature of the world in which bacteria grow, and the way bacteria secure their food, a way dependent on moisture and temperature.

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We all know subconsciously that bacteria only grow in moisture.

That is why we only use deodorant on those areas of our bodies that are likely to become damp.

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Bacteria are on our arms, our tabletops, our clothes, our computers, telephones, and just about everywhere else.

BUT THEY DO NOT AND CANNOT GROW UNTIL AND UNLESS THEY ARE EXPOSED TO MOISTURE !

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This is why the moisture level is so important in composting.

Moisture acts as the medium by which nutrients and essential compounds are transferred through the outer cell membrane and into the bacterium.

Temperature acts as the controlling agent, determining the permeability of the bacterial cell outer membrane.

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Decomposition occurs more rapidly at thermophylic temperatures (above 105°F) because the bacterial cell walls are more permeable, allowing more rapid access to nutrients and essential compounds, and thus, more rapid growth and reproduction.

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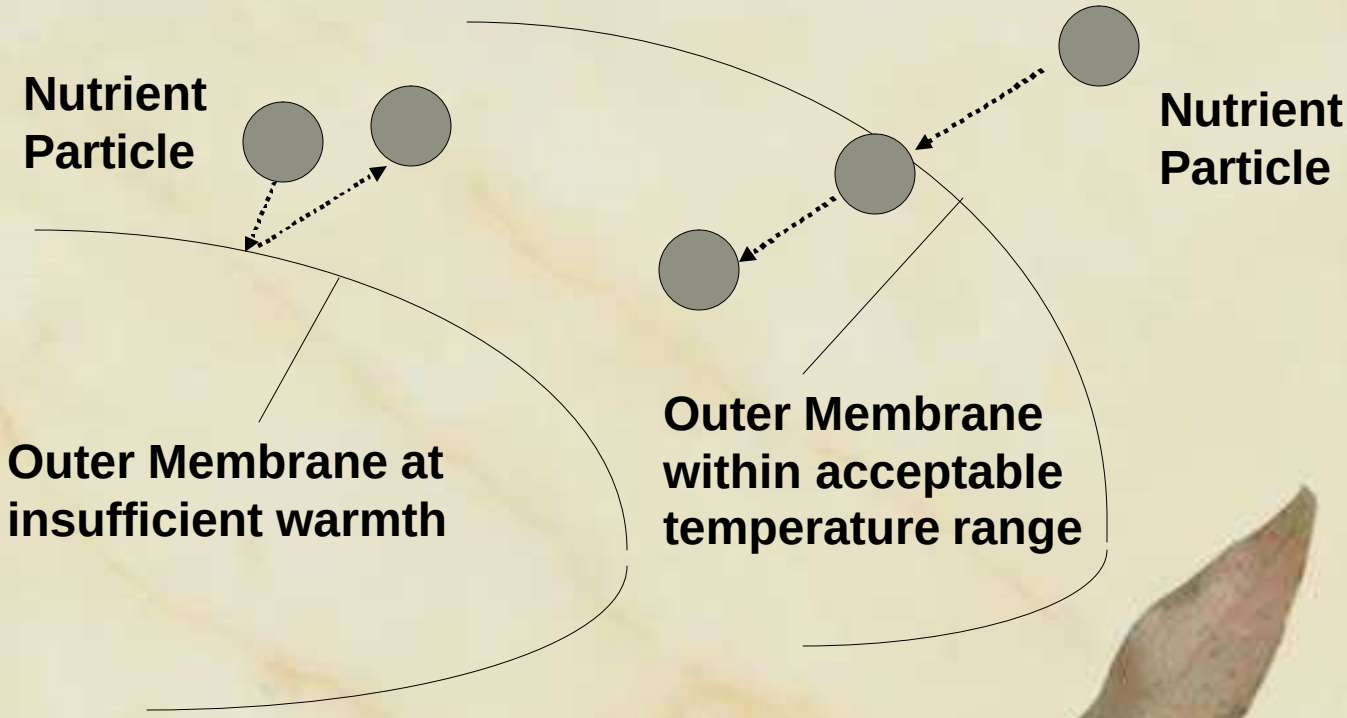
At cooler temperatures the membrane becomes less permeable. Thus the digestion rate and therefore the growth and reproduction rates both decrease.

At temperatures that are too hot, the membrane becomes too permeable, and the cell fills with liquid until the membrane bursts. This is the basis for pathogen kill by temperature.

Membrane Permeability



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The “digestion” occurs externally, and the required nutrient is then transported through the membrane . This method is the reason bacteria require temperature and moisture to grow and reproduce.

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Therefore,
the only oxygen
available
to the bacteria
must be
in the moisture.

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Water is limited as to the amount of dissolved oxygen it can hold. This limitation varies with temperature. At thermophylic temperatures, the maximum dissolved oxygen level in the moisture, and the only available oxygen to the bacteria,

is 3 to 5 parts per million !

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This is a maximum of
one two-thousandth of 1%
dissolved oxygen
available at any given moment !!

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This *must* be sufficient oxygen for the aerobes involved in thermophylic composting,
as it would have been impossible for the creatures to develop needing more oxygen than would ever be available for their use.

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Remember the point we began with:

After you turn your compost, the process recovers and goes happily on for days or weeks until you turn it again –

Even though all credible studies we have seen show the increased oxygen from the turn only lasts a few hours.

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It is the flow of oxygen,
- the rate at which
re-saturation of the
moisture with oxygen
occurs –
that maintains aerobic
requirements.

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A steady convective flow of even 1% oxygen through the mass will keep the moisture continuously saturated.

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So long as porosity is maintained,

heat and oxygen will move through the pile.

When decomposition causes densification, and porosity declines, then it is time to turn –
to reallocate assets
within the mass.

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Porosity and convective flow are encouraged by proper construction of the row or pile.

Diversity in size and shape of particles is critical.

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Turning without a justifiable reason destroys colonies and forces the restart of bacterial cycles.

It also encourages homogenous particle sizes that can pack tightly and discourage porosity!

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For turning to be a reasonable source of aeration,

Turning would be required every few hours, and the bacteria would never have sufficient time to recover, and effectively grow and reproduce.

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Aerobic soil maintains thousands of strains of bacteria – yet it is "turned" annually - if at all.

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In addition to creating porosity by using diverse particle shapes and sizes, aeration can be assisted by duplicating the physical chemistry of aerobic soils in the compost row or pile.

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In good aerobic soil there is a specific volume relationship between cationic (positively charged) minerals. Because they have like charges, these cellular units repel each other. When the volumes are correctly balanced, this repelling action helps create and maintain porosity.

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Imagine dropping a handful of magnetized iron filings into a tray of loose soil. The iron particles would repel each other, and in the process move the soil particles.

Various sets of minerals found in aerobic soils accomplish this same task, and these relationships are correctly duplicated in QuikSoil® to achieve the same result in compost.

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As decomposition causes materials to become more dense, ionic mineral balances are essential in maintaining aerobic conditions. The rapid loss of porosity and convection often found in conventional processes does not occur in the BACS process.

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The aeration qualities of QuikSoil® are fundamental to BACS. By allowing a significant decrease in agitations and disruptions, less CO_2, VOC's, and odor escape the decomposing mass. And more time is spent in bacterial growth and reproduction - in actual decomposition - yielding more finished, stable, and carbon-rich compost.

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By increasing actual decomposition hours without increasing processing time, a more thorough level of decomposition is achieved - with a substantial decrease in emissions.

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The second function of BACS and QuikSoil® is to maintain sufficient aeration to allow a significant decrease in mechanical aeration events, events which disrupt bacterial growth and reproduction.


End Part 2