How does
ODOR-GO™
work
to establish microbial consortia
that oxidize organic wastes and do not emit
reduced N- and S-gaseous compounds?

Organic matter may be decomposed by the chemical reactions of enzymes released by indigenous microbes, which is the basis of the natural composting process. ODOR-GO™ accelerates the aerobic bacterial decomposition of organic wastes.

Within the organic waste, water capillary conduits maintain the hydration of the aerobic bacteria in their refuge pores and transport digestive enzymes and nutrients between the bacteria and their nutrient sources (e.g., the surface of the organic waste). Oils and insoluble organic compounds usually coat the surfaces of the capillaries and pores, causing them to resist the penetration of water. That is due to the large surface tension of water and water's inability to wet and spread on oils. In nature, some bacteria respond to this oily condition in the waste by producing bio-emulsifying enzymes. These enzymes reduce the surface tension of water and emulsify the oils and insoluble organics, making them available as a food source. However, nature's time-scale for bio-emulsifying is too long for practical treatment of municipal and industrial wastes. The addition of ODOR-GO™ greatly accelerates the decomposition processes by providing carefully selected surfactants and emulsifiers, increasing the composting rate and the oxidation rate of toxic organic compounds. The oxidation of toxic organics (e.g., PAHs) is more effective in hot than cold composts.

If water and nutrients do not penetrate into the bacteria's refuge pores, a droughty condition is established. Anaerobic bacteria are more water-stress tolerant than aerobic bacteria, become dominate, and cause the waste to emit mal-odorous reduced nitrogen and sulfur gases.

The handling of decaying organic waste usually has the objective to suppress the emissions of mal-odorous gases. The objective can often be realized by satisfying the requirements of the indigenous, aerobic nitrifying bacteria.

Requirements of Aerobic, nitrifying bacteria:

- **Nutrients:** oxygen, water, carbohydrates or proteins, fixed nitrogen, phosphate, potassium and trace elements.

- **Material structure:** Aeration is essential for nitrification; it is controlled by water content and sludge clump structure. Most anaerobes are poisoned by 0_2 and its toxic derivatives, especially superoxide (0_2^-) and hydrogen peroxide. Aerobes release the enzymes superoxide dismutase and catalase to protect themselves from superoxide and hydrogen peroxide. Anaerobes usually do not have these protective enzymes. However, for anaerobe poisoning to occur, there must be present 0_2 and an electron donor (food supply) to drive the electrochemistry. Denitrification and sulfate reduction occur under anaerobic conditions and produce mal-odorous nitrogen and sulfur gases.

- **Particle Size:** Water-saturated crumbs smaller than 3-mm radius may be aerated to the core, if connected to an air conduit. Larger sizes have no dissolved 0_2 in the center.

- **Acidity:** Nitrification (the oxidation of ammonia to nitrite or nitrate) is optimal in the pH range of 6.6 to 8.0. It is negligible for pH below 6.0. High pH values (above 8) inhibit the transformation of nitrite to nitrate.

- **Moisture:** Waterlogging limits 0_2 diffusion, which suppresses nitrifying bacteria. Insufficient water prevents bacterial proliferation. The nitrifiers are less tolerate of stress than the ammonifiers. The optimal water potential is the level attained upon soaking and draining away the gravitational water.

- **Temperature:** Nitrification is slow below 5° C and slow above 40° C; the optimum range is 30-35 C.

- **Safe Pores:** The most favorable pores for bacteria occupancy are those 0.8-3 µm in diameter with pore neck sizes of 0.2-1.2 µm, corresponding to the diameters of bacteria. (View the "pore" as an "ink well") Pore neck sizes larger than 6 µm do not provide refuge protection from predators, such as protozoa. (Clay usually has a favorable neck and pore size distribution for bacteria habitation.) A full soaking followed by gravitational draining will fill all pores with diameter less than 3 µm; the larger pores (that can be attacked by predators) are dry and unsafe for bacteria.

- **Mineral surfaces (e.g., clay):** Those with high external and internal surface area adsorb enzymes such as urease and protease, protecting them from hydrolysis by other enzymes. That leads to preferential consumption of urea over protein. Urea diffuses to a urease site on the clay particle and undergoes decomposition, and the ammonia is oxidized by nitrifiers. However, proteins diffuse at a much slower rate and consequently are decomposed at much slower rates. The proteins not consumed by the bacteria may be absorbed subsequently by indigenous fungi (or cultivated mushrooms).

HOT COMPOSTING -- Problems and Solutions

1. Problem: Bad Odor but pile is moist throughout
   Cause: Insufficient air
   Solution: Turn and fluff while adding ODOR-GO™

2. Problem: Bad odor and pile is dry in center
   Cause: Insufficient water
   Solution: Turn and fluff while adding ODOR-GO™

3. Problem: Pile is damp but warm in middle only
   Cause: Pile is too small
   Solution: Add fresh compost material and ODOR-GO™

4. Problem: Pile is aerated and damp but will not heat up
   Cause: Nitrogen content is too low; needs ammonium
   Solution: Turn and add ODOR-GO™.

Amount of ODOR-GO™ (1-6%) to add: After turning and fluffing the pile, add ODOR-GO™ only until the solution drains out of the pile.

DETAILED COMPOST PROBLEMS AND SOLUTIONS

Odor	Water	Temp	CAUSE/ACTION
bad	soaked or damp	cold or low	**Insufficient air:** Turn and fluff with cellulose, clay, sand adjunct to remove excess water and to clump to provide air conduits. If this action fails, then, **Weak bacteria:** Pile is toxic to bacteria. Adapt bacteria to sludge diluted with non-toxic cow manure. If this action fails, then **Protozoan Predation:** Verify by microbial count; if protozoan predation is not occurring, inoculate with proven strain.
bad	damp	warm in center only	**Pile cross-section is too small; heat is lost:** Expand the cross-section by 25% by adding fresh compost material; spray with ODOR-GO™.
bad	dry in center	low	**Insufficient water:** Turn and fluff while adding ODOR-GO™.
OK	damp	low	**Nitrogen content is too low:** Turn and add urea or ammonium phosphate in ODOR-GO™.