

Perfect Blend Fertilizers

Pathogen Destruction Program

Process Manufacturing Flow Chart



100% Organic Fertilizers Inspected and Approved By the
Washington State Department of Agriculture for use in the
United States Department of Agriculture National Organic Program.

Inside the Perfect Blend Manufacturing Facility

Perfect Blend has the most advanced pathogen destruction program in the organic industry !

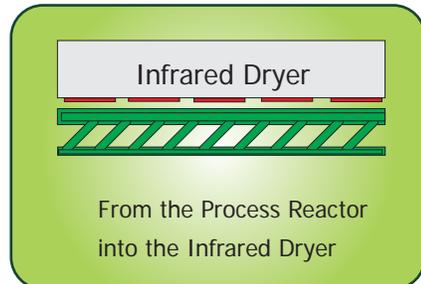
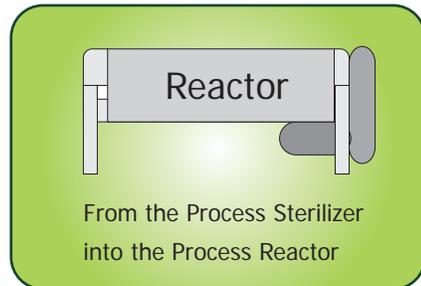
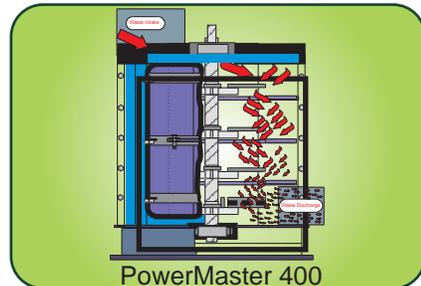
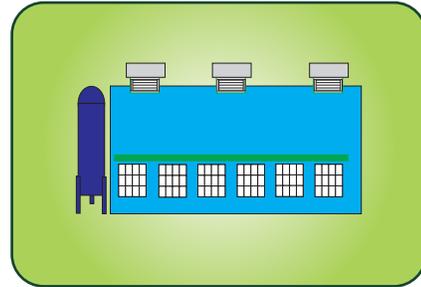
Manure used in the Perfect Blend process is composted prior to receipt at the manufacturing plant in a aerated concrete basement where it is held for up to a year. Composting temperatures vary but are in excess of 160 degrees F. for approximately 2 weeks.

Manure is transported in closed trucks from an enclosed facility into an enclosed facility. No contamination by birds, rats, or other disease vectors occurs during transport.

The PowerMaster Process Sterilizer destroys all bacteria, virus, pathogens, weed seeds, & insect spores. No living organism can withstand a 350 MPH impact against armored steel plate. Thrashing is an accepted form of sterilization. Dwell time approximately 6 - 8 minutes. Raw manure is processed through a 400 HP Vertical process sterilizer

In the process reactor the feedstock is hydrolyzed using acid reactants. These reactants alter the feedstock on a molecular level. During this step temperatures may exceed 145 F. For a dwell time of 7 minutes. The acid reactants during this step are powerful anti-pathogens.

In the Infrared Dryer the finished fertilizer is subjected to 1300 F. Infrared heaters which excite the internal water molecules of the granulated fertilizer. This drying process is extremely lethal to microbes as it vibrates their internal liquid structure at a 2 micron wavelength which will explode the water based structure of any living organism.



Technical Information

Composting Process Technical Information

Poultry manure used in Perfect Blend fertilizers undergoes a year long continuous composting process before it is taken into the Perfect Blend facility for processing. During this process the manure is subjected to a natural decomposition process assisted by large scale aeration of the basement storage facility where it is accumulated. During this time, it undergoes the following process:

- **Phase I Initiation Phase** - Bacteria initiate a heating phase that starts the process of deterioration. Temperature increases due to the metabolic energy from thermophilic bacteria.
- **Phase II Thermophilic Phase** - Cellular structures of cellulose and hemicellulose are broken down during this phase. Pathogens are destroyed.
- **Phase III Stabilization Phase** - During this phase the soluble nitrogen has been changed into organic nitrogen. Temperatures decrease and low temperature microorganisms repopulate the manure.

The Perfect Blend pre-process composting program stabilizes organic nitrogen content of the feedstock manure and is the first step in Perfect Blend's Pathogen Destruction Program.

- **Intake Area** - The feedstock intake area is segregated from the rest of the facility to prevent cross contamination of pathogens from raw feedstock to finished material.
- **Sterilization** - Raw feedstock is process sterilized upon entry to the facility using a 400 HP Vertical Process Sterilizer which accelerates feedstock to a 350 MPH speed before impacting the material against armored steel plate. No pathogen either bacterial or viral can survive an impact of this magnitude. Also eliminated are any weed seeds, spores, or insect eggs which might be present in feedstock materials.
- **Reactor** - In the reactor any remaining living organisms will be subjected to powerful acids which destroy pathogens by reacting with

their cellular fluids to extract the moisture from their cells. Acid is the ultimate destroyer of any pathogen. During the reactor process the pH is dramatically dropped which is a secondary means of destroying pathogens.

- **Drying** - The Perfect Blend fertilizers are dried using a short dwell time under 1300 degree Fahrenheit heaters which emit a 2 micron wavelength. These heaters are designed to excite the internal moisture molecules within the fertilizer to force internal moisture to the surface of the granule where the high direct temperature vaporizes it. The internal molecular excitement of this structure is lethal to any remaining pathogens.
- **Storage** - Finished fertilizers are stored in sealed containers to prevent secondary contamination of finished products.



Perfect Blend Organics Anti-Pathogen Program

The following information is provided to USDA APHIS VS and other governmental regulatory agencies charged with the oversight of the processes used at Perfect Blend to assist in the understanding of the anti-pathogen program used for the elimination of pathogens from the Perfect Blend Organics manure based fertilizers.

Established History of Pathogen Non-Detect Testing

Since its inception, Perfect Blend has repeatedly subjected its products to independent testing laboratories in the past with completely negative results. Bacteriological tests include the following:

Total Coliforms
Fecal Coliform
Listeria Monocytogenes
Shigella
Staphylococcus Aureus –
Coagulase Positive

Repeated tests have indicated that the results of these tests are at a level below which the laboratory reports as "Non-Detectable."

Copies of these tests are available upon request. Perfect Blend welcomes any additional testing required by regulatory agencies either by corporate sampling or by surprise sampling performed on-site by a regulatory agency or their designated representative.

Active On-Going Program of Pathogen Control

In a program that, to our knowledge, exceeds all current industry practice, Perfect Blend Organics maintains a program of pathogen identification, testing, and control at its manufacturing facility.

In addition to pathogenic bacteria, Perfect Blend Organics is tested for Anaerobic Soil Bacteria, Heterotrophic (Aerobic) Bacteria, Fungi, Actinomycetes, Pseudomonads, and Nitrogen Fixing Bacteria. Understanding the role of these bacteria in soil processes and how these bacteria can positively or negatively affect Perfect Blend Organic fertilizers is an important aspect of sound organic agriculture practice.

An innovative aspect of the Perfect Blend Organics program is the fact that Perfect Blend fertilizers are subjected to a number of pathogen destructive mechanisms. Instead of relying on a simple heat process that is never 100% effective, the Perfect Blend Organics fertilizers are subjected to a number of different processes, each of which is in itself a high effective anti-pathogen treatment. We believe that this repetitive use of pathogen destructive mechanisms is superior to any single simple program devised by any regulatory agency currently attempting to regulate manure-based fertilizers.

Primary Pathogen Control Mechanisms in the Manufacture of Perfect Blend Organic Fertilizers

The primary pathogen control mechanisms in the manufacture of Perfect Blend Organics fertilizers are as follows:

- 1. Mass Composting – Sterilization By thermophilic induction*
- 2. Vertical Process Sterilization – Sterilization By High Speed Impact*
- 3. Process Reactor – Sterilization By Acid Hydrolyzation*
- 4. Computer Controlled Infrared Radiation Drying –Organic Structure Internal Sterilization*

Mass Composting – Sterilization By thermophilic induction

Mass composting is the accumulation and natural deterioration of a compostable material in a well ventilated area. This age old method of composting is the mechanism on which any composting toilet, or out-house operates. During this process, thermophilic (heat-loving) microorganisms increase the temperature in the composting pile to internal temperatures that typically exceeds 160 degrees F. During this process organic nitrogen is concentrated and a wide range of more heat sensitive pathogens are destroyed.

The manure used in the Perfect Blend Organics fertilizer process is accumulated over a period of one year and mass composted during this period. It is a given that this process does not completely eliminate all pathogenic bacteria that may be present due to the fact that the composting process is not accelerated by turning, regulation, or by the addition of additional water. However, as part of a total program of pathogen destruction, it is an effective sanitizing mechanism that achieves a high rate of pathogen kill prior to the additional steps undertaken during the manufacturing process.

It is a scientific fact that no composting program known to man achieves a 100% pathogen kill. We know of no such program that even comes close to the quality or level of pathogen destruction which is a part of the overall Perfect Blend Organics program.

Vertical Process Kinetic Sterilization

Incoming raw feedstock manure is initially processed using a high speed sterilizing process that

subjects the organic feedstock to high speed thrashing, an accepted form of sterilization. Raw feedstock is process sterilized upon entry to the facility using a 400 HP Vertical Process Sterilizer which accelerates feedstock to a 350 MPH speed before impacting the material against armored steel plate. No pathogen, either bacterial or viral can survive an impact of this magnitude. Also eliminated are all weed seeds, spores, or insect eggs that might be present in feedstock materials.

The 400 HP – 298 Kw processor has a dwell time for processed materials of approximately 10 –12 minutes during which time the organic feedstock is thoroughly thrashed, resulting in a close to organism free material that is different in texture, nature, and moisture content than the incoming manure feedstock. While this process is effective, it is not 100% effective as there is a minute amount of organisms which survive this process.

Process Reactor – Sterilization By Acid Hydrolyzation

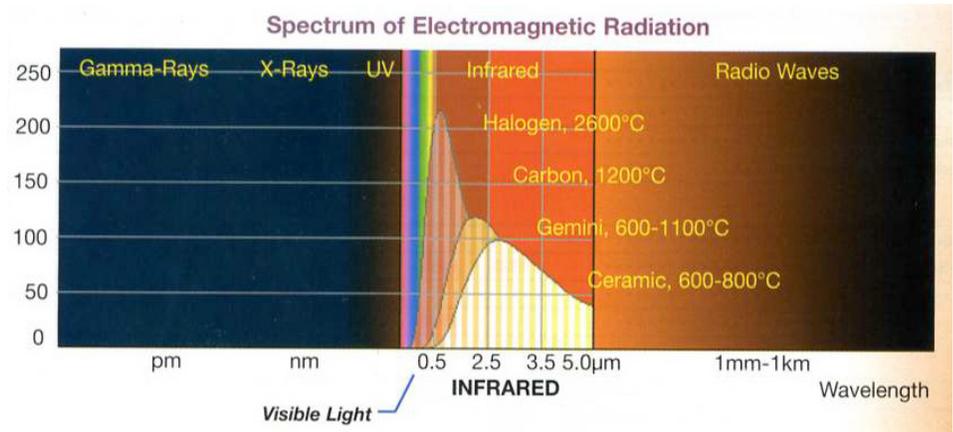
The acid concentrations necessary to hydrolyze organic materials are acutely toxic to all forms of life. Living organisms present during a hydrolyzation reaction have their molecular structures exploded and split open which results in instant death of the microorganisms. Acid sterilization is perhaps the most extreme form of sterilization as it completely destroys any moisture containing microorganisms.

Perfect Blend Organic fertilizers are subject to an acid hydrolyzation process of sufficient length and acid concentration to destroy any living microorganisms which might be contained in the feedstock during the hydrolyzation process.

Computer Controlled Infrared Radiation Drying

Infrared radiant energy is transported through space by electromagnetic waves without the need for a conductive media. Consequently, heat can be delivered into internal moisture containing structures of the organic material being dried in concentrated areas at very fast rates.

for Sterilizing is a Relatively New Technology (Health care Publishing News 2/1/2002 – Noble, Suzanne) Likewise, the use of microwave and radio waves for sterilizing is also a new application (Microwave and Radio Frequency Processing 6/2/200 – USDA). Sterilizing with radiation is basically a factor of strength, frequency, pulse, and dwell time of exposure.



The full spectrum of electromagnetic radiation has been shown to be effective in sterilizing processes. The spectrum of electromagnetic radiation is as follows in the order in which they appear on the spectrum graphic above:

1. Gamma Rays (pm)
2. X-Rays (nm)
3. Ultraviolet (>nm)
4. Infrared (0.5 – 2.5 – 3.5 – 5.0 μm)
5. Microwave (2450 – 915 MHz)
6. Radio Frequency / Induction (13.56 MHz – 160 kHz)

All of these radiation sources have been used as effective sterilizing radiation sources. Each is a potential sterilizing source based on strength and dwell time. Gamma radiation and ultraviolet radiation sources have been used for sterilization for decades in multiple industries from food processing to barbershops. The Use of Infrared Radiation

The radiation used in the manufacture of Perfect Blend fertilizers is an infrared source operating at a wavelength and in a manner that is considered proprietary. The manner of high speed multi-phase precision computer control and application of infrared radiation is also considered to be proprietary information. What can be stated is that this method excites the internal molecular structure of the fertilizer being dried in such a manner to quickly and efficiently dry the material to a 10% - 11% moisture content while destroying any remaining pathogens which might have survived the earlier processes.

The EU regulatory standard does not address moisture levels in the finished product. Perfect Blend Organics fertilizers are dried to a 10% -11% moisture standard. The drying process is, in itself a sterilizing process, due to the effect on microorganisms of rapid dehydration.

Biodegradation Kinetics

Since most of the current regulatory science deals with “sterilization” of manure using composting it is helpful to understand some of the science behind composting.

There are four major factors that influence the rate of the process which compost undergoes.

- *Microorganisms (number & type)*
- *Substrate quantity and bio-availability (composition, lignin content, particle size, etc.)*
- *Nutrients – macro (N,P,K,S) and micro (Mg, Co, etc)*
Applicable to the Nutrients is Liebig’s Law of the Minimum: The nutrient in shortest supply will control the growth rate (decomposition rate in compost). Typically this is C or N in waste streams, and often P.
- *Environmental conditions (moisture, temperature, oxygen, pH)*

We review this information as important to our next statements on energy equivalents as most compost temperatures and “sterilization” rates are highly impacted by these factors. Rarely, if ever, are compost piles, even well turned piles, uniformly subjected to the full level of temperatures and nutrient balances that would assure adherence to set temperature standards at set dwell times. Experience at a composting site usually reveals the fact that internal temperatures of 70° C. at 60 minutes have no external pile temperature equivalents. In other words, only the internal pile temperatures reach the sterilizing temperatures. Regulatory “sterilization” standards are often, after rigid scientific analysis, deemed ineffectual due to the simple requirement for universal and equal distribution of

the biodegradation factors listed above. It is almost impossible for a mixed composite compost to meet uniform heating and dwell time standards.

Treating compost in closed externally heated vessels with a fixed temperature dwell time is the only possible way of achieving a uniform regulatory standard of 70° C. at 60 minutes. This concept actually removes the material from a composting standard, with temperatures reached as a result of the induction of thermophilic microorganisms. Composting has specific goals to maintain the viability of beneficial soil microorganisms that are destroyed at the temperatures called for under a regulation requiring treatment of compost at a 70° C. at 60 minutes standard. A regulatory standard of 70° C. at 60 minutes is actually the level of treatment standard normally reserved for the treatment of municipal solid waste and human bio-solids which are standards requiring the use of external heat application.

Our calculation of the energy required to achieve a treatment standard of the equivalent mass of one US ton of fertilizer at an enclosed rotating insulated vessel operated at an ambient air temperature of 72° for a uniform minimum temperature of 70° C. at a dwell time of 60 minutes is 226.4 Kwh. (See Addendum “A for calculations)

Energy Equivalents

Given the foregoing information on process and biodegradation, we are now prepared to offer energy equivalent comparisons of a 70° C. at 60 minutes regulation compared to the energy expended during processing for Perfect Blend Organics fertilizers.

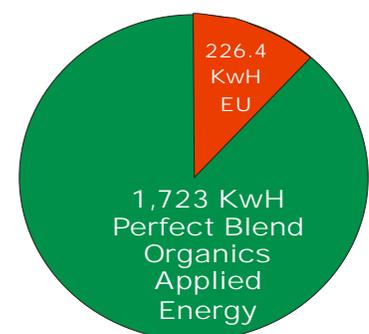
As previously discussed, at least four processes used during the Perfect Blend manufacturing process are sterilizing processes. These include the initial mass composting – sterilization by thermophilic induction, vertical process kinetic sterilization, process reactor sterilization by acid hydrolyzation and the computer controlled infrared radiation drying. The following energy rating is based solely on the energy consumed by the kinetic processor and the infrared drying program during the processing of Perfect Blend Organics fertilizers.

1. *Kinetic Processing – 298 Kwh (measured by drive motor horsepower rating)*
2. *Drying & sterilization – 1,425 Kwh (Addendum “B)*

Total Applied Direct Energy Use in Perfect Blend Organics Processing of 5 US short tons of processed fertilizer (10,000 lbs) is 1,723 Kwh.

Comparison of Energy Equivalents

A comparison of the energy equivalents reveals a 226.4 Kwh for the EU regulatory standard of processing at 70° C. at 60 minutes vs. the 1,723 Kwh required during the Perfect Blend Organics Processing. The Perfect Blend Organic Process uses 7.61 times the amount of energy in the EU regulatory standard to process its fertilizers.



There can be little doubt that the Perfect Blend Organics fertilizer manufacturing process exceeds, by use of applied energy, the heat process referred to the EU Regulatory Standard in accordance with the rules laid down under the procedure referred to in Article 33 (2) of Regulation (EC) NO 1774/2002. Repeated independent laboratory testing has confirmed that Perfect Blend Organics fertilizers are free from salmonella and enterobacteriaceae and reduced in spore-forming bacteria and toxic formation.

Once manufactured, Perfect Blend Organics fertilizers are stored in clean, dry silos or bagged in properly sealed plastic bags or one ton plastic lined totes and are not subject to contamination, secondary infection, or are, at any time subjected to damp conditions.

Addendum "A"

Specific heat, as expressed in Kwh required to meet regulatory standard of 70° C. at 60 minutes regulation for 5 tons (10,000 lbs) of poultry manure.

Assume dry chicken manure = .50 specific gravity
 JOPF manure = 40% water + 60% dry chicken
 Specific Gravity = c
 $c = .40(4186 \text{ J / Kg}^{\circ}\text{C}) + .60 (2000 \text{ J / Kg}^{\circ}\text{C})$
 $c = 2874.4 \text{ J / Kg}^{\circ}\text{C}$
 $(2874.4 \text{ J / Kg}^{\circ}\text{C}) * (9.478 \times 10^{-4} \text{ Btu/J}) *$
 $(.4536 \text{ Kg / lb}) = 1.236 \text{ Btu/lb}^{\circ}\text{C}$

Energy heating manure to 70 C
 $Q = mc\Delta t$
 $= 10000 \text{ lbs} (1.236 \text{ Btu / lb}^{\circ}\text{C}) * 50 \text{ C}$
 $= 618000 \text{ Btu}$

Wattage
 $\text{Watts} = mc\Delta t / 3.412 \text{ Btu/hr} * \text{hr}$
 $\text{Watts} = 618000 \text{ btu} / 3.412 \text{ btu/hr} * \text{hr}$
 $= 181125.43$
 $= 181.12 \text{ Kwh}$

Assume ¼ heat loss to maintain

Total watts = watts heat manure + watts to maintain
 $\text{Total watts} = 181.12 \text{ Kwh} + .25(181.12 \text{ Kwh})$
 $\text{Total watts} = 181.12 \text{ Kwh} + 45.28 \text{ Kwh}$
 $\text{Total watts} = 226.4 \text{ Kwh}$

Addendum "B"

Specific heat, as expressed in Kwh required to meet Perfect Blend Organics standards for a dried and sterilized product.

Each Infrared Tube – 4.5 Kw * 18 per array
 $= 81 \text{ Kw / Array} * 18 \text{ Arrays}$
 $= 1,425 \text{ Kwh Total Applied Energy / hour of operation}$

10,000 lbs / Hour capacity of computer controlled pulsed array infrared heaters Average displayed heater tube temperature – 1,300° F (703° Centigrade)

Perfect Blend Manufacturing Flow Chart

Composting

Perfect Blend is composted in a positive air-flow discharge concrete containment area prior to processing. This step concentrates organic nitrogen.

Feedstock Pre-Prep

Manure feedstock is processed to sterilize the feedstock through thrashing in a high speed vertical processor. It is then stored in an area separate from the manufacturing area until it is needed. Facility rules require that feedstock can only arrive at the facility less than 24 hours before its use.

Reaction

Feedstock is measured into the computer controlled reactor along with supplements of primary, secondary, and trace mineral nutrients prior to homogenization, hydrolyzation, and pH balancing. Organic acid reactants are used during the reactor process to alter the molecular structure of the feedstock.

Granulation

Finished fertilizers are granulated and drum rolled for hardening prior to entering the dryer.

Drying

Finished fertilizers are dried in high speed computer controlled infrared dryers at 1300 degrees Fahrenheit. Organic granules are monitored to assure that granule temperature never exceeds 225 degrees Fahrenheit.



Perfect Blend Organics

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