Cellular Preservation Technology Freeze Drying

It is this process that distinguishes our herbs from all others.

1. Dry powder does not require any preservatives or heat treatment to prevent degradation. If this were a crème or liquid it would require preservatives since moisture is the medium for the enzymes and microorganisms to degrade the product.
2. The enzymes, vitamins, minerals and other vital ingredients are preserved with their full potency intact. The value of the herbs and botanicals are kept at their highest level.
3. It is exactly this high level of preservation of the vital ingredients that create the results that we would otherwise not achieve in traditional drying methods, even if we had used exactly the same ingredients in exactly the same proportions.
4. If we use heat to remove the moisture (de-hydration), the heat will denaturize the enzymes (making them ineffective), reduce the protein levels considerably and oxidize thermo-sensitive vitamins such as Vit C and beta-carotene.
5. The freeze dry process eliminates water without exposure to heat thereby preserving all of the enzymes, vitamins, minerals, and bioactive compounds.
6. The very small particle size (micronization - no need for grinding) and porous particle structure achieved by the Bio-Dynamic Freeze Dry Process allow our herbs to be more easily absorbed and metabolized. Vitamins such as Vit C are fat soluble and are easily and quickly absorbed into our body.
7. The effectiveness and capabilities of all our herbs are greatly enhanced due to the particulate size and structure produced by our transitional and evolutionary Freeze Dry process.

“Where Nature Meets Science”

CELLULAR PRESERVATION TECHNOLOGY

Cellular Preservation Technology (CPT) is a key element in the creation of our functional super foods and nutraceuticals. This process allows us to **preserve whole foods in their fresh form, maintaining the medicinal bioactivity of a live plant while providing the safety of a stable (preserved) commodity.** This is essentially Freeze drying but with a dynamic twist. This evolutionary and transitional process provides a highly bioactive, stable, bioavailable and concentrated product that is not as subject to microbial or enzymatic spoilage.

CPT is unique in that the plant tissue fractures between/along the layers of the cell walls **preserving cellular integrity and improving the retention of the bioactive intracellular contents**. **Exposure of the entire surface area to be dried results in “even” drying which preserves the cell wall structure and preserves the biochemical makeup of the plant as it exists in nature**. In addition to higher bioactivity, this process results in particles having a more bio-available particle structure**. Higher bioactivity combined with higher bio-availability make all of our CPT bio-activate botanicals significantly more effective.**

CONVENTIONAL FREEZE DRYING:

Freeze drying uses a natural process called “sublimation” that has been used for centuries. High in the Peruvian Andes, the Incas preserved their potatoes and vegetables by burying them in the snow. The freezing temperatures and high altitude (low atmospheric pressure) effectively preserved their food through sublimation.

During the process of sublimation water in liquid form passes into water in gas form (water vapor) which naturally moves toward a colder temperature where it solidifies (ice). The water never passes back into its liquid state.

In a modern freeze dry machine the product is flash frozen in a vacuum inside the “product chamber.” The product chamber is connected to a second much colder condensing chamber called the “ice

chamber". Water (in vapor form) moves by sublimation from the product chamber into the colder condensing chamber where it solidifies as ice. The moisture being moved from the product chamber into the ice chamber includes the moisture contained in the products, and in this way the products become dried while they remain frozen.

Most herbs and botanicals are designed by nature to degrade once they are harvested. The enzymes and microorganisms that naturally degrade our herbs and botanicals require water. If we remove the water, the herbs and botanicals are preserved. However, if we use heat to remove the moisture (de-hydration), the heat will denaturize the enzymes (making them ineffective), oxidize thermo-sensitive ingredients including vitamins such as C and beta-carotene, result in CIS to TRANS conversion of vital oils and fatty acids. Elimination of the water without exposure to heat preserves the enzymes, vitamins, minerals, vital oils, fatty acids and other important bioactive compounds.

During the freeze dry process the moisture inside the product takes a path from the liquid phase to the gas phase (water vapor) and is then removed as water vapour which goes directly into the solid phase (ice) without crossing back to water. When water is removed in its liquid state by exposure to heat the liquid is removed at a finite rate while the quantity or volume of liquid steadily decreases. When this occurs, the surface tension in the liquid body pulls against any solid structures the liquid might be in contact with; delicate structures such as cell walls tend to be broken apart by this surface tension between liquid water and the cell walls.

Freeze drying avoids this surface tension by removing the water in its gas state rather than in its liquid state and thereby preserves cellular integrity.

The scientific community has long recognized that the freeze dry process is the best method for the preservation of bio-active materials. Freeze drying became well known near the end of WWII when it was used to transport blood plasma to soldiers on the front lines. When snake venom is collected to make anti-venom it is freeze-dried. Most scientific laboratories have a small freeze dry machine to preserve samples without disturbing their chemical composition. Science recognizes the freeze dry process as the most effective method of preservation of bio-active substances including herbs and botanicals.

Please keep in mind that conventional freeze drying where the product to be dried is not exposed to oxidation by heat and in which the water is removed as a gas (water vapor) rather than a liquid is far superior to any drying methods that use heat and remove water in its liquid state. Our intention is not to "de-value" the original method of freeze drying, but to take the valid principles and advantages of the freeze dry process to a new and higher level using science and technology. CPT has been referred to in the vernacular as "super freeze drying," "freeze drying on steroids" or as we prefer to say "Premium Freeze Drying." While CPT is, in fact, a freeze dry process, it is evolutionary, transitional and for those heavily invested in the status quo it may be viewed as a "disruptive."

CELLULAR PRESERVATION TECHNOLOGY:

We have developed an evolutionary and transitional technology that provides the highest quality nutraceuticals, supplements, food ingredients, and cosmetic compounds containing the full spectrum of nature's bio-active constituents. It expands our capabilities to provide products of superior quality and exceptional efficacy.

Cellular Preservation Technology (CPT) is a dynamic process. The product is dried by sublimation, not while sitting motionless on trays, but while flying around vigorously inside the product chamber. The flash-frozen (using liquid CO_2), course, brittle particles decrease in size due the movement of the super-frozen particles and, even more substantially, as a result of the sublimation of the connecting ice structure that holds the frozen particles together. The material breaks down into increasingly smaller particles along natural cellular fracture-lines. The plant tissue fractures between/along the layers of the cell walls preserving cellular integrity and significantly improving retention of the bioactivity of the intracellular contents.

In conventional "tray" freeze drying the product sits motionless on trays, one piece of material covering the other. This exposes only a small part of the total surface area to sublimation at any one point in time. The moisture will exit along the path of least resistance which is through that part of the cell wall exposed to sublimation. This "uneven" drying scenario, where only part of the surface area to be dried is exposed, causes all the water in the cell to be funneled through the relatively small exposed surface area subject to sublimation. This can results in damage to the cell walls. The molecular structure loses its shape and the biochemical makeup of the plant you are trying to preserve is changed.

In contrast, Cellular Preservation Technology, wherein the particles to be dried are flying vigorously in what might be described as a "whirling vortex," the entire surface area to be dried is exposed at the same time. Water (in vapor form) is eliminated evenly thereby preserving cell wall structure.

The shape and structure of the cells of many of the most healthy herbs and botanicals is complex. If you were to see a diagram of the molecular structure as the plant exists in nature and compare this natural structure to the molecular structure of the dried powder you would want them to be as close to one another as possible. Our goal achieved by CPT Technology is to minimize damage or destruction of the cellular structure, preserve cellular and intracellular contents and achieve preservation of the biochemical makeup of the plant as it exists in nature.

ADVANTAGES OF CELLULAR PRESERVATION TECHNOLOGY

In addition to the substantial benefits of tray freeze drying, our cutting-edge CPT Technology provides:

1. Preservation of cellular integrity
2. Improved retention of bioactive intracellular contents
3. Increased bioavailability
    a. Natural Micronization-smaller particle size
    b. Porous particle structure- increased surface area per unit of weight
4. Faster and more consistent drying at lower temperatures
5. Sublimation and micronization accomplished in a one-step process (higher purity)
6. Finished powder with exceptionally low moisture content (better preserved)

1. CELLULAR INTEGRITY:

CPT preserves the cellular, intracellular and molecular structure as closely as possible to the plant as it grows in nature. The factors that achieve this amazing result include:

a. An evolutionary and transitional premium freeze dry process where the product is never exposed to the destructive oxidative forces of heat. Here is a trade secret regarding conventional freeze drying: near the end of the process the moisture content may still be in the range of 10% plus. At this point the temperature is increased substantially to reduce this residual water content. This is not the case in Cellular Fraction Line Technology.

b. In the case of dehydration or conventional freeze drying the dried product must be mechanically ground to achieve a fine powder. The reduction of particle diameter by mechanical processes such as crushing, cutting, milling or grinding, creates high temperatures, hemorrhages the cellular structure and creates solid particles with flat surfaces and sharp corners. In CPT plant tissue fractures between/along the cell walls preserving cellular integrity and improving the retention of bioactive intracellular contents.

c. Water removed as a liquid at a constant temperature evaporates at a constant rate while the quantity of water steadily decreases. This creates surface tension. Any solid structure in contact with the water will experience surface tension strong enough to damage fragile cell walls. CPT, using sublimation, removes water in its gas state (water vapor) and avoids this destructive surface tension.

d. Exposure of the entire surface area to sublimation results in "even" drying which preserves cellular integrity.

The extracellular matrix (ECM) consisting of molecules secreted by plant cells provides biochemical and structural support to surrounding cells. Plant ECM includes cellulose as well as signaling molecules among other cell wall components. Dynamic biological functions including but not limited to intercellular communications, growth factors, healing processes, gene expression, cell death (apoptosis), cell migration and differentiation are effected by the extracellular matrix as are mechanical properties such as elasticity.

Damage, diminish or destroy intercellular and intracellular contents and you have dramatically limited the function and efficacy of your plant material regardless of to what degree you may capture specific targeted ingredients used as markers to indicate effectiveness. Maintain the complex synergy of the Master Formulator – Mother Nature.

2. BIOACTIVITY:

CPT preserves the cellular integrity and preserves the biochemical makeup of the plant material as described above and thus maintains the bioactivity of the plant material.

g. BIOAVAILABILITY:

In terms of nutritional science, bioavailability is a measure of the extent to which ingested substances are absorbed by our body and available for use or storage.

The value of our food, supplements, and medicine is part of a complex, vital, intelligent structure, and it is the energetic breakdown and uptake of this structure that delivers the benefits.

It is not only important to measure antioxidant capacity, vitamin content, nutritional values etc. in the laboratory but to trace their breakdown and uptake inside the human body. The true function and value of our foods comes as a result of their breakdown, release, absorption, and metabolism. A simple example of this would be tablets with super high synthetic vitamin C content. Your urine turns bright yellow/orange with a strong caustic odor. The vitamin C goes in one end and out the other. What good has that high vitamin C content provided you? Little to none.

The easier and more fully our food, supplements and medicine can be absorbed and metabolized, the greater their benefit will be to you. It is in this arena of bioavailability that the particle size and porous particle structure of CPT bio-active botanical powders makes them dramatically more effective. The physical principle is easy to understand. Smaller particle size and/or a porous particle structure provide more exposed surface area per unit of weight. The larger exposed surface area allows the powder to be absorbed more easily.

a. MICRONIZATION:

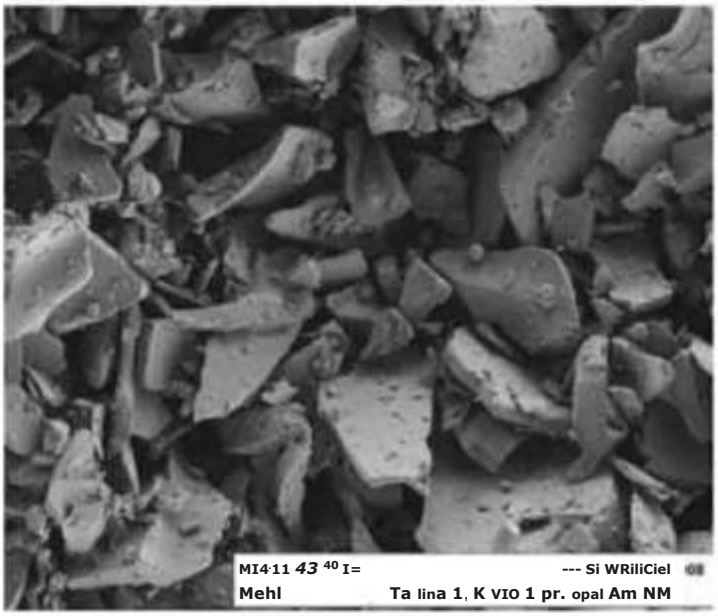
The brittle super- frozen granules break naturally along cellular fracture-lines into very small particles due to the vigorous motion of the frozen particles combined with sublimation of the ice structure that holds the particles together. In this way CPT results in micronization (dramatically smaller particle sizes) without hemorrhaging or demolishing the product by intense mechanical grinding.

b. POROUS PARTICLE STRUCTURE:

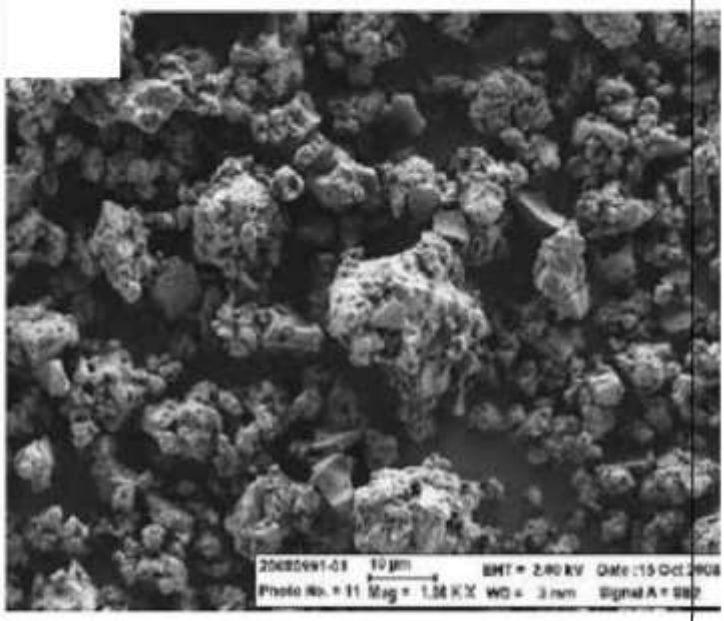
In addition to reduced particle size, the structures of the particles have an impact on how easily they are absorbed and metabolized. CPT produces particles that are easily absorbed due to their porous structure. The physical principle is easy to understand. Porous particles provide more exposed surface area per unit of weight than solid particles. The larger exposed surface area allows the powder to be absorbed more easily.

The pictures below show clearly the difference in the particle structure produced by CPT which results in easier absorption and higher bio-availability.

10 gm scale



Conventional Freeze Dried Particle Structure



Cellular Preservation (CPT) Particle Structure

Good porous structure - CPT

Solid Structure - Conventional

4. FASTER AND MORE CONSISTENT DRYING AT LOWER TEMPERATURES:

In the conventional tray freeze dry machines pictured here the product sits on trays, one piece on top of another. The quantity of product that can be processed in one production cycle is limited. The top and bottom (exposed) layers dry faster than the product underneath the surfaces, and in some cases the exposed layers dry to create a moisture barrier that prevents the product within from drying. In this case, the product can't be effectively freeze dried. You can't pile a large quantity on the trays. In contrast, CPT works well with a "slurry" and can freeze dry products that can't be otherwise freeze dried, in larger quantizes over less time.

The conventional freeze dry process is slower and more expensive. The results are inconsistent and you can expect the average moisture levels of the finished powder to be in the range around 6%.

CPT dramatically increases the exposed surface area during the drying process. This increases the rate of heat exchange which results in faster and more consistent drying. A better heat transfer rate results from the continuous mixing of the product as it naturally breaks down into smaller particles during the drying process. Faster and more consistent drying of larger quantities at lower temperatures assists in greater efficiency and increased quality:

- better conservation of the phytochemical constituents
- moisture content normally under 2% which indicates better preservation
- larger quantizes over less time lowers costs making freeze drying a more commercially viable option

The CPT machine is product-specific. It can't produce shape specific products such as dried chips. It does not work well in the case of products with high levels of oil. The water is removed but the oil remains and you don't get a fine dry powder. It does not work well in the case of high sugar content. Freeze drying high levels of amorphous sugars results in hygroscopic powder highly susceptible to caking.

Cellular Preservation Technology is engineered to produce only dry powder, but it produces dry powder with a higher quality, more efficiently and more economically than any other process.

5. ONE-STEP PROCESS = PURITY:

The entire process of drying and micronization takes place in one step and in one single unit. This is a "one port system." Raw product goes in and comes out a finished powder. Eliminating multiple handling, multiple locations, and multiple processes decreases the risk of contamination, exposure to heat and exposure to moisture.

6. LOWER MOISTURE CONTENT=BETTER PRESERVATION: Finished powder with lower moisture levels is better preserved. The idea behind drying is to eliminate the moisture which provides the medium for microorganisms and enzymes to degrade the product. CPT, because it is faster, more consistent and exposes much more surface results in drier, better preserved powder.

FREEZE-DRY FACTORY

TFD Factory Premises

30,000 Kilos of food-grade liquid C02

Loading The CPT Freeze-Dry Machine

Super Freeze-Drying with Liquid C02as freezing agent

Condensing (“Ice”) Chamber

Bulk Powder

Central Control Cabinet