

## Why Combine Bacteria and Enzymes?

In the past, biological products only came in a few formulations: bacteria only, enzyme producing bacteria, and enzyme only formulations.

Enzymes break down a food source into a form that the bacteria can eat. By using a "bacteria only" or "enzyme producing bacteria" (as all bacteria produce enzymes), you are counting on the bacteria to produce their own enzymes to do the job that they were bought to do. Unfortunately, since the majority of products are not stabilized, you are asking the ineffective strains to perform a task that they simply can't handle. By using an enzyme only product, you are not "finishing" the job. Enzyme-only products convert food sources into simpler forms without digesting them completely. Enzyme-only products will only pass the problem down the line to cause substantially larger problems later.

By combining the proper bacteria strains with the appropriate enzymes, the EcoSolutions formulas have an immediate action. This immediate digestion enables our bacteria strains to "adhere" to food sources, where they continue to eat until the food source is gone. It is important to remember that the "food source" is usually the problem that you bought the product to solve.

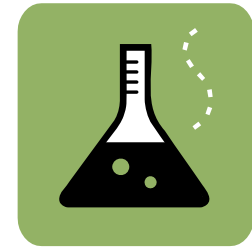
Science shows that the EcoSolutions line of products is far superior to any "competitor" products. Our customers nationwide call our products "the last product they will ever buy."

## Why a Powder?

In the past, biological products have come in 2 forms, liquids & powders. The important thing to remember about biological products is that you are dealing with live organisms. When bacteria eat & reproduce in non-laboratory conditions (specific pH, temperature, & food source), each generation becomes less and less effective. Most of the time, manufacturers add a food source to both liquid and dry products. The food source is most often a cereal grain of some sort. As the bacteria eat and reproduce in these non-laboratory conditions, the product's effectiveness decreases rapidly. By the time the product is purchased for use, the buyer has no guarantee of any effectiveness. In addition, liquid and powder forms of this type have a very short shelf life.

EcoSolutions utilizes the above-described patented microencapsulated process in all of our product lines. The bacteria are neither dead nor alive but rather in a state of suspended animation or "dormancy".

When the product is mixed with water, the protective barrier is dissolved and the user is insured that the highest count possible of first generation bacteria is ready to go to work on the application.



*Introduction*

*To*

*Microbiology*



**EcoSolutions, LLC**

**PO Box 2049**

**Council Bluffs, IA 51502**

**Phone: (402) 657-4540 Fax: (712) 545-3029**

**EcoSolutions, LLC**  
*Solutions for a Cleaner Environment*

[www.pondsolutions.biz](http://www.pondsolutions.biz)

## EXPLAINING BACTERIA

### How Does The Bacteria Stabilization Process Work?

Bacteria reproduce by a process called binary fission – one cell divides and becomes two. Some can reproduce at a very rapid rate under ideal conditions. If food and moisture are adequate and the temperature is perfect, certain bacteria can reproduce in as little as twenty minutes. In only eight hours, the original cell will have multiplied to nearly 17 million new bacteria.

Select bacterial cultures are grown in a medium. Upon inspection, this first stage inoculum is transferred to sterilized 250 liter (66gal) biofermenters for a growth period of twelve hours.

Following a quality check to verify purity, the inoculum is transferred to sealed and sterilized 5,000-liter (1,321 gal) stainless steel production fermenters. Under proper pH control, sterilized sugars and oxygen will be fed to the bacteria. Throughout the cycle, the medium is sampled for asepsis and population growth parameters.

Within 24 hours, the medium is harvested with the bacteria being concentrated through gentle ultra centrifugation. A patented process of microencapsulation coats the concentrated bacteria with betaglucon gum. This process serves as a barrier against moisture to maintain viability under storage or when mixing with a carrier.

The product is then quickly frozen in a fluid freezing system prior to long term freeze-drying at –40 degrees F in a larger walk-in system. This two-step freeze-drying process, where 95% of the moisture is removed, ensures high survivability of the bacterial species that are now ready for incorporation into the final inoculant formula. All batches are tested to be salmonella free.

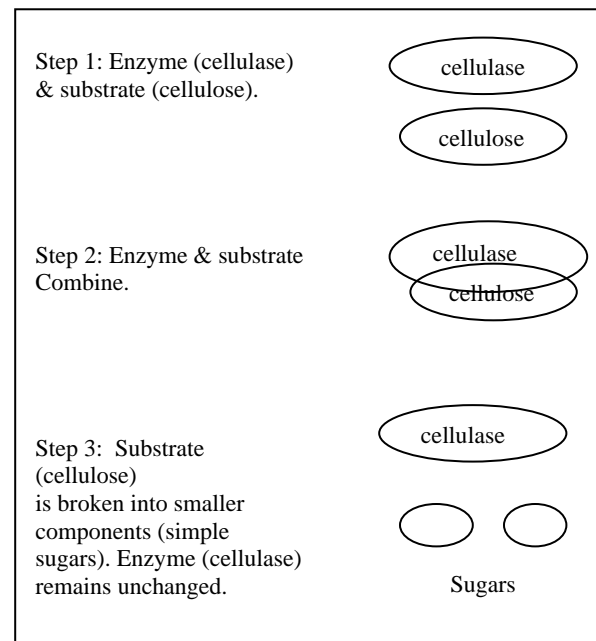


## EXPLAINING ENZYMES

### What are Enzymes?

Enzymes are proteins that are produced naturally by plants, animals, bacteria, fungi and all other living things, and are absolutely necessary for life. They are catalysts that accelerate the rate of chemical reactions without changing themselves. Commercially available enzymes are derived from bacteria and fungi such as Bacillus, Aspergillus and Trichoderma species.

### How Do Enzymes work?



Enzymes work by breaking apart large complex compounds (substrates) into smaller, more readily absorbed nutrients that the bacteria can utilize. Enzymes from different sources have a specific temperature and pH range at which they are optimally effective, which is an important consideration when choosing an enzyme product.

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Enzymes are classified by the substrate they work on. For example, proteases work on proteins, breaking them down into amino acids and peptides. Cellulases break down cellulose, the major indigestible component of plant cell walls, into simple sugars. Only very small quantities of enzymes are needed to change very large quantities of substrate: typically, enzyme to substrate ratios can range from 1:1,000 to 1:1,000,000.

### Are Enzymes Stable?

To be effective, enzymes need to withstand storage, and acidic and proteolytic breakdown. Our enzymes are produced using optimum microbial strains and technology, and then stabilized using a patented process. When blended, the activities of our enzymes are not affected by extended storage, oxidizing compounds such as vitamins and minerals, or digestive conditions.

### How can different enzyme products be compared?

With many enzyme products offered on the market, the concern for accurately comparing the quality of these products is important. Unfortunately, there is currently no standardized way of testing or expressing enzyme activity. There seems to be as many enzyme-testing methods and activity units as there are enzyme manufacturers, making it impossible to directly compare products. Some products may list the enzyme in very large numbers, making it appear highly concentrated, but keep in mind that the number is relative to the assay and activity unit used. The best approach is to simultaneously test similar products at one laboratory using one testing method. Another unique process that EcoSolutions uses in its formulas are purified enzymes that are approximately 10 times more effective than other enzyme products that use by-product enzymes.

**"Solutions for a cleaner environment"**