

## **Detailed Wastewater Product Guide**

The information in this bulletin answers the most frequently asked questions by sales representatives, manufacturers, product chemists and formulators. The information is technical in some areas which may be required by individuals producing bulletins or labels of their own or adding copy for waste treatment products. This information should also help those persons involved in the promotion, sales, use of or evaluation of micro-organism/enzyme containing products.

Aquatic BioScience, LLC biological products are made from a unique semi-solid fermentation of specially selected cultures of beneficial micro-organisms and fungi. The manufacturing method is the subject of several textbook articles and U.S. Patents. The strains of microorganisms that are manufactured produce high concentrations of hydrolytic enzymes. Throughout this document, the term enzyme complex product will be used to denote a combination product of enzymes plus special strains of microorganisms or "seed cultures". From a promotional standpoint, enzymes are often referred to as "hydrolytic organic (or Protein) catalysts". In addition to sounding quite technical, "hydrolytic organic catalyst" is a term that accurately describes the function and characteristics of these degrading enzymes. These products have also been called "bio-augmentation" products. Enzymes are basically proteins which act to speed up various biochemical reactions without being changed themselves. Since they are proteins, enzymes are subject to the conditions that often affect proteins. They are very useful hydrolytic organic catalysts. They are an essential building block in nature's scheme.

Since enzymes are bio-chemically active compounds and may be principally made up of protein, they are sensitive to environmental conditions. Some enzymes are more sensitive than others. Some enzymes are extremely stable and may even be boiled in water without completely losing their activity. Traditionally those enzymes produced by the genus of micro-organisms known as *Bacillus* (which is comprised of long cylindrically shaped micro-organisms) are reasonably stable and are well suited for numerous types of industrial use. However, all enzymes are sensitive in some degrees to temperatures. When subjected to moisture and temperatures in excess of 55C for times over thirty minutes, rapid degradation will occur with a concurrent loss of activity. Since enzymes as well as beneficial micro-organisms are affected by heat and environmental factors in varying degrees, it is best to take whatever precautions that are practical in the storage and transport of these products to ensure maximum activity is retained.

**Enzyme/micro-organism products should not be stored:**

- 1. In direct sunlight.**
- 2. In enclosed truck bodies or metal building unless ventilated adequately.**
- 3. In areas where toxic or oxidizing vapors are present.**
- 4. In areas of extremely high humidity or moisture that could contact the product.**
- 5. In other areas where constant high temperature (50+C) is encountered.**

**Since the enzymes are most active at warm (**NOT HOT!!**) temperatures, and seed microorganisms are most active in the range also, it is usually helpful to advise the user that maximum effectiveness can be expected during warm conditions**

**It is also much better to ensure that these products are used in a regular program of routine maintenance rather than purge treatments to eliminate stoppage and plugs.**

**Our dry products will remain quite stable for many months as long as they are kept dry and reasonably cool (below 50C). The micro-organisms and enzymes remain in a dormant state ready to immediately go to work like dried active yeast once they are moistened. Once they are moistened the product should be used within hours.**

**Enzyme-culture products should not be represented as a remedy for faulty engineering and design problems in a waste treatment system. These products were designed to assist in the biological treatment of waste elimination and attain peak efficiency. Furthermore, the products can help to re-establish micro flora in a system that has encountered hydraulic or toxic overload.**

**Enzyme-micro-organism culture products will not attack inorganic matter in treatment systems. These inorganic materials include sand, grit, glass, bits of metal, plastic, ceramic materials, rubber, nylon, etc.. Wood or high cellulose products generally undergo very slow digestion.**

**The following is a review of the advantages that these enzyme-micro-organism culture products have over harsh drain cleaning chemicals, enzyme-culture products:**

- **harmless to pipes and traps.**
- **will not damage biological treatment systems as do high caustic or acid cleansers; conversely, they help reactivate septic as well as aerobic systems and help stabilize the pH problem these systems might have.**
- **being catalytic in action they are not totally tied up in a chemical reaction and they continue to act for hours or days after initial use.**
- **they include micro-organisms which can start multiplying and producing more digestive enzymes within the traps, drains and biological treatment system.**
- **non-caustic and non-poisonous to pets and fish for increased use and safety.**
- **environmentally safe, containing biodegradable components and naturally occurring micro-organisms that cause no problem with residual toxicity in the environment.**

**Activity and the stability of enzymes are also affected by pH and the types of chemicals present in their environment. Concentrated acids, bases and urea can destroy not only the enzyme, but also the microorganism that produces the enzyme.**

**Microbial enzymes for waste treatment perform best in a range of pH 4.5-9.5 and have an optimal activity in the pH 6-7 range.**

**There are several types of beneficial enzymes contained in the products we offer for waste treatment: One enzyme contained in these products is amylase, a starch digesting and liquefying enzyme which changes starch substrates into simpler, more soluble sugars. Other synonyms for specific types of amylase include: alpha-amylase, beta-amylase, diastase, iso-amylase, pullulanase, amyloglucosidase and gluco-amylase.**

**Also included in our products are proteases, or protein digesting and liquefying enzyme that accelerate the breakdown of the peptide bonds. The bonds link together the amino acid building blocks of each protein chain. The hydrolytic action of these protease's causes the solubilization of the protein. Protease's are known sometimes as proteinases, peptidases, proteolytic enzymes and other more specific names for miscellaneous**

**enzymes of this type with specific action of limited kinds of protein substrates.**

**The lipases contained in our products are of several types. These enzymes are microbial and animal origin which gives the broadest spectrum of activity and effectiveness possible. The enzymes are effective on animal and vegetable fats and oils (not petroleum or mineral grease and oil). The products of the lipolytic action of these enzymes are water soluble or dispersible. They will not redeposit themselves. Lipases, therefore, will help degrade animal, food or vegetable greases relieving buildups or restrictions caused by these types of organic materials. Lipases are much more effective in digesting fats when the enzymes are combined with a biodegradable surfactant. A surfactant (or detergent or surface active agent) helps to emulsify fats and oils. This means that these fats and oils are suspended in smaller micro-globules, giving the greasy deposit much greater area and increasing the area of attack by the lipase.**

**Cellulases included in the products help to catalyze the digestion of toilet paper, tissue and other entrained cellulosic particles.**

**When all four of the mentioned, primary type enzymes are included in our fermentation products, these degradative catalysts are effective in accelerating the digestion of starches, proteins, cellulose and animal or plant fats and oils. These are the principle constituents of the wastes produced by packing plants, hotels, restaurants, institutions, schools, hospitals and domestic households. Along with the primary enzymes, other secondary enzymes are included in these products. These enzymes include pectinase for accelerated action on fruit containing wastes; beta glucanase for activity in breaking down vegetable gums; hemicellulase and xylanase for digestion of other types of polymeric gums and polymers.**

#### **Q & A's**

**One might ask, "Why add a combination enzyme along with microbial culture products to a treatment system?" The reason our products for waste treatment appear as an integral enzyme/culture combination is three fold:**

- First, it is more economical to harvest the total culture with its entire compliment of degradative enzymes than it is to separate the enzymes from the microbes, go through an expensive procedure for purifying the enzymes, and re-blend them.**
- Second and most important, there is the fact that these enzyme/culture products have the capability to act as a microbial**

**seed. This allows the micro-organisms contained in such products to multiply within a waste treatment system. As these specific microorganisms in the product multiply in the treatment system, multiplying the original products effectiveness in preventing occlusions, attacking organic impediments and degrading organic wastes.**

- Third, frequent use of common household bleaches and disinfectant/cleaners, as well as simply flushing large volumes of water can kill or wash out natural, beneficial microorganisms working within the pipelines and treatment systems normally degrading the organic wastes. These combination enzyme/cultures can help replace the natural waste degrades lost through toxic chemical shock and washout. Similarly, harsh chemicals such as bleaches, caustics and disinfectants, upon contact, will reduce the effectiveness of these enzyme/cultures. Therefore it is best to specify in the directions for use that the products application should be at times when chemicals have been flushed from the system. Another alternative is that the products should be used more often when harsh chemicals are routinely conveyed by the treatment system and lines.**

**Enzyme/culture products will not by themselves directly eliminate B.O.D. or C.O.D. in a waste system. B.O.D. and C.O.D. are a measure of oxygen needed to biologically stabilize a given lot of waste water. Therefore, these are trough measurements of the concentration of degradable waste or polluting substances present. Top quality enzyme/culture products can, however, help a waste treatment system reach a level of high treatment efficiency and thus help the system to eliminate B.O.D. as rapidly as possible from a waste water flow. These products can help to liquefy solids and re-establish beneficial micro flora in a biological waste treatment system. Some misinformed people have argued that, because many wastes have naturally high micro-organisms counts, to add a small number of specific micro-flora to a treatment system may not be very useful. However, these individuals fail to recognize the fact that the industrially significant, specially selected and acclimated strains of microorganisms supplied in our products produce millions of times the levels of organic digesting catalysts produced by wild types of microorganisms found naturally in various wastes. Therefore, a relatively small seed of these superior microbes can significantly affect the overall activity of a waste holding, conveying or treating facility.**