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A Buyer's Guide to Enzymes

Introduction

Enzymes are used today in a varied and growing number of industries - from animal feed to alcohol production; from dairy products to detergents; from tenderizing to textiles. As the number of applications continues to grow and become specialized, the selection of the appropriate enzyme becomes critical. There are numerous enzymes available from many suppliers, further complicating the selection process. The most important thing to remember is that enzymes do vary from type to type, and from supplier to supplier. However, with a basic understanding of these differences, the selection process becomes much easier. This brochure is written as a basic guide, to facilitate the purchasing selection process.

What are Enzymes?

Enzymes are proteins, which act as a catalyst in many reactions. They are present in all animals, organisms, and some plants, to help break down various foods into components that are readily utilized. In nature, enzymes only catalyze a single type of reaction; therefore, their commercial use is also very specific. Enzymes are not living organisms, although they are derived from living organisms (including plants and animals). It is through the careful isolation and extraction of these enzymes that commercially available products are available to the market.

Important Buying Criteria

Oftentimes, the research department or the marketing department will not give the purchasing agent the information needed to make wise buying choices. The PA may be told, "We need a price for X enzyme". There is not enough information!

This is no different than telling the PA to "go buy a horse" or, to "go buy a car". There is not enough information to know what to buy. The buyer could buy a racehorse or a broken-down nag. The buyer could buy a Porsche or a rust bucket. In both cases, the PA has done what was requested.

There are many important criteria to be considered when selecting or purchasing enzymes. An understanding of these criteria is essential to help select the appropriate enzyme, but also to help the buyer compare costs of enzymes from various suppliers.

Category of Enzyme

Enzymes are categorized by the reaction they catalyze. Most of the food enzymes are broadly considered hydrolases. These are further broken down to carbohydrases, (such as amylases), proteases, lipases, cellulases, pectinases, xylanases, hemicellulases, and others.



Activity of the Enzyme

Without a doubt, this is the single most important piece of information the purchasing agent needs. Enzymes are ALWAYS sold on the basis of the potency. The activity/potency is a measure of how much enzyme is needed to accomplish a specific reaction within a specified time. For example, one gram of lactase testing 1000 FCC lactase units per gram may convert 99% of the lactose in one liter of milk at a specific temperature within 24 hours. Lactase testing 10,000 FCC units per gram would only require one tenth of a gram to do the same job. Lactase testing 100,000 FCC units per gram would only require one one-hundredth of a gram to do the same job. If the price of the 100,000 u/g lactase is less than 100X the price of the 1000 FCC lactase, then the concentrated lactase is the better value.

Enzyme activity may not be stated in the same units from company to company. For instance, an alkaline protease from one company testing 2.4 AU/g is considered equivalent to an alkaline protease from another company that is sold basis 560,000 DU/g.

The expression of the units of activity also makes an impact on the price. The units should be similar to the way the enzyme is purchased. For example, a guarantee of X units per gram is compatible with purchasing based on pounds or kilos. It is not compatible if the enzyme is guaranteed at X units per milliliter, but sold basis pounds or kilos. The specific gravity could change and you would end up paying more.

In food supplements, the industry is being encouraged to move to the assays published in the Food Chemicals Codex. This will make it easier for the consumer to understand the enzyme dose in relation to his or her particular situation and, it makes it easier for the purchasing agent to make direct comparisons between vendors.

As an example, papain is sold by the following activities: TU (tyrosine units), MCU (milk clot units), or FCC, bromelain is sold by: BTU (bromelain tyrosine units, MCU (milk clot units), CDU (casein digestion units), GDU (gelatin digestion units) and FCC. In order to know what you are buying, you will need to have the same enzyme tested by the same assay method. Also, while "rules of thumb" do exist, they are no guarantee of the required activity.

Another important point is that the assay method to determine the activity must be made available to your company and your quality assurance people. If your supplier will not give you a copy, how can you check incoming material? Further, how can you check your own product quality?

Quality Assurance of the Enzyme

Do your vendors do their own testing on most or all of the important criteria, or do they rely on third party tests or previous certificates of analysis? As a buyer, it is important to know when the activity of the enzyme was tested, who tested it, and if all the other tests such as micro were completed by the same company on your specific shipment.

Labeling the Enzyme of the final Product

As the purchasing agent, you also have to have some information on the final use of the enzyme and how it is labeled. Is the company making a premium product with accurate information on the label for the consumer? Or, is the enzyme to be window dressing? It is the shame of the industry and the detriment of the consumer that there is no requirement to list the enzyme activity.



A top quality company selling a tablet that has 500 mg of papain testing 50,000 FCC units/mg must compete with a company selling a tablet that has 500 mg of papain testing 2,000 FCC units/mg and the low activity company can still claim the product as “papain” when in fact, that 500 mg of “papain” is 1 part 50,000 FCC papain with 24 part filler. Unless the activity is put on the label, the consumer has no way of determining that they are being misled.

Enzymes are often added into products such as beverages. If a premium product is to be produced, the amount of enzyme and the activity of the enzyme per dose should be on the label. If window dressing to match a label ingredient statement, then it makes no difference what activity you use. One gram of low activity enzyme in a ton of final product still allows the enzyme to be included on the label.

Standardizing Agent

Enzymes are manufactured to meet various activities. Many times a concentrated product is diluted to achieve the desired activity level. The product added to the enzyme is the standardizing agent. Examples of standardizing agents include salt, dextrose and maltodextrin. It is important that a standardizing agent be selected that is compatible with the finished product.

Other Certification Issues

As with all food ingredients, enzymes must be manufactured and processed under guidelines set forth by the government. In the U.S., enzymes for food applications are manufactured to meet the specifications outlined in the FCC (Food Chemicals Codex). There are other grades that meet stricter guidelines for specific applications, such as USP grade (U.S. Pharmacopeia) for pharmaceutical and related applications. Another important consideration is whether or not the product needs to be Kosher certified. Most enzymes can be certified, however, there are some that cannot because of their origin or standardizing agent. Usually, manufacturing an enzyme to meet stricter guidelines will add to the cost of the product.

Handling and Safety

Enzymes are proteins, and as is the case with all proteins, people can have allergic reactions when exposed to them. Most enzymes that are sold are in a dry form, so airborne contamination and exposure is possible. It is important that workers be aware of proper handling techniques.

However, if exposure is a concern based upon the specific manufacturing environment, preparations are available that are either in a liquid form, or specially processed to minimize the dust. Consult with your enzyme vendor to help identify potential risks and to develop handling practices and techniques to reduce worker exposure to airborne proteins (not just enzymes) and protein aerosols.

Other Resources

The Enzyme Technical Association has published booklets on safe handling of enzymes and of suggested guidelines for enzyme use in the dietary supplement industry. This information can be downloaded directly from their web site. The site is <http://www.EnzymeTechnicalAssoc.org>
Enzymes, A Practical Guide for the Food Industry; Eagan Press, St. Paul, MN

Conclusion

Selecting the appropriate enzyme is critical to the success of the manufacturer, from both a performance and cost effectiveness perspective. There are many important factors to be considered when selecting and purchasing enzymes. It is important that the lines of communication remain open between the technical and purchasing personnel, and especially with the enzyme supplier, who can assist in the selection process.

These suggestions and data are based on information we believe to be reliable. They are offered in good faith, but without guarantee since conditions and methods of use of our products are beyond our control. Suggestions for use of our products should not be understood as recommendations that they be used in violation of any patents or government regulations. 3



ENZYME PURCHASING / SPECIFICATION WORKSHEET

Type of enzyme _____
Example: protease, amylase, lipase

Source of enzyme _____
Example: A. oryzae, A. niger, B. subtilis, pancreatin, papain

Activity required _____
Example: amylase (SKB/g; DU/g) protease (HUT/g)

Is the assay published or available? Yes No

Expression of activity: unit/gram unit/ml unit/mg other _____

Standardizing agent _____
Example: maltodextrin, starch, lactose, salt

Will the enzyme activity be part of the label? Yes No

Will there be any stated guarantee of enzyme activity on the label? Yes No

Are written specifications available to give to the vendors? Yes No

Quality standards, who tests? Vendor Third party

Other certifications required? Kosher Halal

Free of certain ingredients? _____
Example: Wheat, Lactose