

What are Enzymes and How do they Work?

Enzymes are natural proteins! They are secreted by all animals as part of the process of feed digestion. The stomach, small intestine, and pancreas all secrete a wide range of enzymes to digest carbohydrates (major source of energy), lipids (also a good source of energy), proteins (amino acids), and mineral complexes. Enzymes literally chop down large compounds (such as starch, for example) into smaller pieces (such as maltose and dextrin) and eventually into component building blocks or units (in the case of starch, being glucose – a simple sugar). These simple compounds are then absorbed to be used by the animal for maintenance and production purposes.

Without the digestion process provided by enzymes virtually no nutrient can be absorbed.

To work, enzymes need two conditions. First, they need the suitable substrate. Thus, a protease cannot break down a carbohydrate, nor a phytase can work on a protein. So, there must be a match between each enzyme and its substrate. The enzyme recognizes and attaches itself on the substrate in a mechanism that resembles the likeness of a key-and-lock analogy. Second, they need the proper environment in terms of acidity or alkalinity. For example, enzymes secreted in the stomach work best under low pH (acidic) as this is the natural environment of the stomach. In contrast, enzymes secreted in the small intestine work best in a higher pH environment, for the same reason.

Enzymes secreted by the animal are called endogenous. Those added in the animal's feed are called exogenous. Commercial enzymes (exogenous) are used to enhance the natural process of digestion. Examples include amylase (starch) and protease (protein). Other enzymes are used to provide for the digestion of substrates that are not digested by the animal. This includes phytase (phytate phosphorus) and xylanase-glucanase (fiber compo-



Dr. Jon Wilson
Global Innovation
Project Manager
Feed Enzymes, DSM
Jonathan-W.Wilson@dsm.com

nents). The majority of the commercial enzymes have been that of the latter form, although amylases and proteases are being used with increasing frequency and success.

Exogenous enzymes are also natural proteins, produced by controlled microbial fermentation, and they work under the same principles as endogenous enzymes. Like their endogenous counterparts, they too require the proper substrate and correct pH conditions to exert their full effect. In addition, there are a few other requirements for exogenous enzymes: they must be stable under diverse feed processing and storage conditions, they must be safe for human operators, and of course, their use must improve profitability for the animal producer!

Today, we can easily expect a 10% improvement in phosphorus digestibility by a modern phytase. Likewise, a glucanase or xylanase enzyme can improve metabolizable energy in feed by about 50 kcal/kg, or even more (up to 150 kcal/kg is not unreasonable for low quality cereals). Finally, a protease improves protein digestibility around 2-5% depending on the type of ingredients used. In the animal industry where profit margins are thin, such improvements as those conferred by exogenous enzymes are indeed substantial.

In conclusion, enzymes are natural, safe, and important for the animal. Supplementation in feed enhances the process of digestion, and reduces the amount of feed being excreted. This, in turn, improves animal performance, profitability, and reduces environmental pollution.



DSM

BRIGHT SCIENCE. BRIGHTER LIVING.