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Amylase

Amylase is a digestive enzyme that aids in the breakdown of carbohydrates by breaking the bonds between sugar molecules in polysaccharides through a hydrolysis reaction. It can be found in animals, plants, and bacteria.

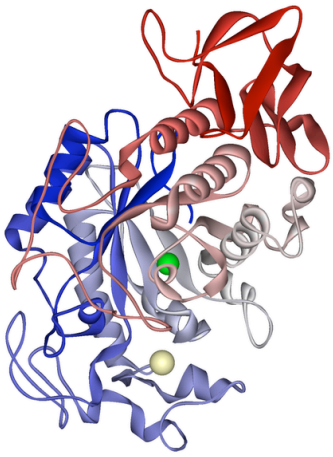
Amylase can be classified into three types: alpha-amylase, beta-amylase, and gamma-amylase. The three types differ in how they hydrolyze the polysaccharide bonds. Neither beta nor gamma-amylase is found in animal tissue. This information sheet will focus on alpha-amylase, which is an important enzyme in digestive and metabolic processes.

History

In 1815, Kirchhoff preformed an experiment, which converted four parts of water, two parts of starch, and malt into a starch paste. This paste began to liquefy into a sweet syrup. His results showed that gluten had the capacity to convert a larger quantity of starch into sugar. Thus, Kirchhoff laid the foundation for the discovery of Amylase.

In 1833, Anselme Payen and Jean-François Persoz further describe and isolate diastase (amylase) in powder form from barley malt, showing it to be heat labile. They postulated the central importance of what would later be named "enzymes" in biology.

Structure



To the right is a ribbon diagram of alpha-amylase composed of beta-sheets and alpha-helices. It consists of 496 amino acids, one calcium ion, one chloride ion and 170 water molecules. The Ca(2+) ion, which is required for its function, is bound to an aspargine, argine, asparate, histidine and three water molecules. In addition, the Cl(-) ion is bound to an argine, asparagine and argine and one water molecule.

Function in the Body

Amylase is critical in the digestion of starch into sugars to make them available energy sources for the body. Amylase is found in two primary places within the human body, and the two types are classified according to where they are found. Salivary Amylase is a component of saliva, and breaks starch into glucose and dextrin. It hydrolyzes the bonds between long-chain polysaccharides found in food, breaking compounds such as glycogen and starch into their useful monomers, glucose and maltose. Pancreatic Amylase is added to the small intestine to further digest starches; amylase is denatured in the acidic stomach. Amylase is also present in blood where it digests dead white blood cells.

Industrial Uses for Amylase

Amylases can be used in the production of high-fructose corn syrup, as well as in alcohol production and brewing industries. Agriculturally, amylase has been used to develop a more digestible feed for animals. In addition, Amylase is found in yeast, which is used in bread making. It is important when breaking down the flour (starch) into simple sugars to feed to yeast. The yeast then breaks down the sugars into alcohol and carbon dioxide to cause the bread to rise and give it its tasty flavor.