Write an essay on enzymes; definition, examples, functions and structure.

Enzymes are substances produced by living organisms, which act as catalysts to bring about specific biochemical reactions. In other words, enzymes are organic catalysts which are protein in nature. As catalysts, they speed up or slow down the rate of chemical reactions in the body without themselves being used up. Enzymes are produced in living cells and they are of two types; intracellular and extracellular. Intracellular enzymes are produced and used within the cells which produce them, for example, respiratory enzymes. On the other hand, extracellular enzymes are produced by cells but used outside the cells which produce them, for example, digestive enzymes.

Enzymes can be named either trivially, or by adding suffix -ase. In the trivial method of naming, enzymes are named based on the names of persons who discovered them. The names of such enzymes end with the suffix -in, for example, pepsin, trypsin and ptyalin. Using suffix -ase is the modern method of naming enzymes. In this method, the suffix-ase is added to the type of food (substrate) or the reaction which the enzyme catalyzes. Based on the substrates they act on, the enzymes include sucrose for sucrose, lipase for lipids, and protease for proteins and amylase for starch, such as amylase. Based on the specific reactions they catalyze, the enzymes include oxidase for oxidation, hydrolase for hydrolysis and reductase for reduction.

Enzymes have their own specific properties. Like proteins, enzymes are affected by changes in temperature and ph. Enzymes are substrate specific; this means that a particular enzyme will only act on a specific substrate; for example, maltase will only speed up the breakdown of maltose to glucose and no other substrate. Enzymes are very efficient, thus they are required in small quantities. Enzymes are not affected by the reactions they catalyze; hence they are available for reuse. Most reactions catalyzed by enzymes are reversible.

Enzyme-controlled reactions can be affected by various factors such as temperature, pH, substrate concentration and enzyme concentration, as well as enzyme co-factors and co-enzymes. Considering temperature, enzymes are protein in nature hence they are sensitive to temperature changes. They work best only within a narrow range of temperature. Most enzymes have an optimum range of between 35 to 40 degrees Celsius (°C).As the temperature increases, the optimum temperature is attained where the rate of reaction is at its maximum. Above the optimum temperature, the rate of reaction decreases sharply because higher temperature denatures the enzymes, making them non-effective. A decrease in temperature decreases the rate of reaction due to inactivation of enzymes. However, low temperature does not destroy the enzymes because when temperature is increased again, the enzymes become active again.

*pH* also affects enzyme-controlled reactions. pH refers to the acidity or alkalinity of a substance. Most enzymes have an optimum pH close to 7 which is the intracellular *pH*. However, some enzymes work best in acidic conditions while others work best in alkaline conditions. If the pH changes from the optimum for an enzyme, the rate of enzyme activity decreases Extreme change of pH range from the optimum denatures the enzymes.

Substrate and enzyme concentration is another factor that determines enzyme reactions. When substrate concentration is increased; the rate of an enzymatic reaction also increases up to a maximum level. However, further increase in substrate concentration does not result in an increase in the rate of reaction. This can be explained in terms of active sites of enzymes. Increase in substrate concentration results to all active sites of an enzyme to be occupied. At this point, the enzyme concentration becomes the limiting factor when the concentration of the enzyme molecules is increased; it causes a proportional increase in the rate of reaction. Enzyme co-factors and co-enzymes also affect enzymatic reactions. An enzyme co-factor is a non-protein substance that activates an enzyme.

In the structure of enzymes, enzymes are a linear chain of amino acids, which give rise to a three-dimensional structure, which involves the primary, secondary and tertiary structure. In the primary structure, enzymes are made up of amino acids which are linked together by peptide bonds in a linear chain. The resulting amino acid chain is called a polypeptide or protein. The specific order of amino acid in the protein is encoded by the DNA sequence of the corresponding gene In the secondary structure of enzymes, the hydrogen in the amino group (NH2) and oxygen in the carboxyl group (COOH) of each amino acid can bond with each other by means of hydrogen bonds, where the amino acid in the same chain can interact with each other. This results to the protein chain folding up on itself, and this can happen in two ways, resulting into two secondary structures; either wrapping round or folding on top of itself. In the tertiary structure of the enzyme, as a result of the folding up of the two-dimensional linear chain in the secondary structure, the protein can fold up further and in doing this, it gains a three-dimensional structure.

Enzymes play a huge role in areas of muscle and tissue growth, clearing up toxic substances from the body and others. In the digestive system, salivary glands, pancreas and small intestine produce amylase. Ptyalin is a form of amylase from the salivary glands, and works on carbohydrates when food is in the mouth; and still remains alive even when food is swallowed. Pancreatic amylase is transferred to the small intestine. The starch granules break down into carbohydrates, and are metabolized into glucose by other enzymes. It is then drained through the membrane of the small intestine into the body's circulatory system. The stomach, pancrease and small intestine generate protease. Enzyme pepsin destroys proteins in the intestine; and its digestive function begins when proteins enter the small intestine. The pancreas and small intestine produce lipase. Lipids play long-term roles such as energy conservation and cellular safety service.

Enzymes present in the body preserve all core processes of the system such as cell regeneration, anti-carcinogenic detoxification, digestion, enhancement of immunity, energy supply and flow of blood as well.

Enzymes also bear important manufacturing uses such as the curdling of cheese, fermentation of wine, brewing of beer, leavening of bread and pharmaceutical functions. In the health and medication section, enzymes are used to destroy disease causing microorganisms, encouraging the healing process and diagnosis of certain diseases. Particularly, the enzyme thrombin is used in the healing process.

Examples of enzymes and enzymatic substances are such as beverages, such as alcoholic beverages; food products such as bread; and also drugs and pharmaceutical products.

Enzymes are significant features in a living organism. There are a large number of biochemical reactions taking place in a cell at any given time. Some reactions are too fast while others are too slow. Enzymes being biological catalysts control these reactions and regulate them so that they proceed at a pace that is sustainable for sustaining life. Thus, enzymes regulate cellular activities. Enzymes also ensure that only the required reactions take place and progress to their appropriate extent. This ensures order in living systems.

Ikinya, J.,Kiura,J.,Okumu,G.(2018).*Secondary Biology, Book 1*(Fifth Edition).Kenya Literature Bureau.