

CHAPTER-3

ENZYMES

Science Titbits

During the early nineteenth century, two French chemists, Payen and Persoz ground up barley seeds in water to make a crude mixture that would digest starch, they gave the name diastase whatever it was that digested the starch.

Science Titbits

How are enzymes formed? Enzymes are proteins, so they are formed as per message or base sequence in DNA. Enzymes are synthesized by living cells but they retain their catalytic action even when extracted from cells. i.e., they can act *In vitro*. These days' enzymes are also being produced by recombinant DNA technology.

Critical Thinking

Industrial pollution can change the pH of a pond, lake or river to make the water more acidic. How can this affect the metabolic pathways of the plants that live in water?

Ans: Acidic pH is much harmful for the metabolic pathways of animal and plants. Different enzymes of plants are adopted at certain pH values. Change in pH adversely affects the functioning of these enzymes. It in turn affects the metabolic pathway controlled by these enzymes.

Science Titbits

Penicillin blocks the active site of an enzyme unique to bacteria. When penicillin is taken, bacteria die but human are unaffected.

Teacher's Point

Teachers would guide the students to construct and interpret graphs based on data about the effect by temperature, enzyme concentration and substrate concentration on the rate of enzyme action.

Critical thinking

Suggest why substrate concentration has no effect on non-competitive inhibition?

Ans:

Non-competitive inhibitors bind to the other sites, may not be active site and reduces the activity but does not affect the binding of the substrate. Therefore, the extent of inhibition depends on the concentration of the substrate.

OR

In non-competitive inhibition, substrates do not compete with inhibitor. Here inhibitor molecules bind to enzymes other than active site and makes the enzymes inactive. Here active sites is free but it cannot attach substrate molecules due to change in its shape. Hence, increase in concentration of substrate has no effect on non-competitive inhibition.

Skills: Analyzing

Identify the competitive and non-competitive inhibitors from the given list of chemicals (consult a book of biochemistry or enzymology).

Ans:

Competitive inhibitors:

Antibodies antimetabolites, penicillin, iodoacetate, melonate CoA (high concentrations)

Non-competitive inhibitors:

Acetaldehyde Di-isopropyl fluorophosphates (DFP- nerve gas), mercury, silver copper cyanide.

Science Tidbits

How are enzymes named?

- (a) Enzymes are named by adding "ase" to the name of substrate they act.
E.g. protease, lipase etc.
- (b) Enzymes are named according to the types of reaction they catalyze. E.g. oxidases, reductases etc.
- (c) Enzymes are named by taking into considerations both the substrate acted upon and the type of reaction catalyses e.g. DNA-polymerases
- (d) Some enzymes are named as per substance synthesized e.g. rhodanase catalyses synthesis of rhodanate from hydrochloric acid and sodium thiosulphate

Science, Technology and Society connections

List the diagnostic uses of enzymes.

- (a) Aldolase:

Progressive muscular dystrophy, viral hepatitis and advanced cancer of prostate

(b) Creatine phosphokinase:

Damage to muscle cells

(c) Gamma-glutamyl Transpeptidase:

In assessing liver function

(d) Lactic dehydrogenase:

In differentiating heart attack, anemia, lung injury or liver disease.

(e) Lipase:

Damage to the pancreases.

Science, Technology and Society connections

Venoms as enzymes inhibitors

Snake venom is highly modified saliva that is produced by special glands of certain species of snakes. Snake venom is a combination of many toxins (proteins) and different enzymes use for the purposes like increasing the prey's uptake of toxins. Snake venom is an inhibitor of cholinesterase to make the prey lose control of its muscles. Venom is an inhibitor for an essential enzyme's cytochrome oxidase in the cells. There are three distinct type of venom that act on the body differently.

- (1) Hemotoxic venoms act on the heart and cardiovascular system.
- (2) Neurotoxic venom acts on the nervous system and brain
- (3) Cytotoxic venom has a localized action at the site of the bite. Venom occupies the active site of the enzyme or combining with the iron which may present in the prosthetic group or which may be required as an enzyme activator.

Activity

1. Performing of chemical test to demonstrate that enzymes are proteins.
2. Performing amylase test on starch with boiled amylase and un-boiled amylase in separate test tubes and confirmation through iodine test.

