Benha University 4th year Exam.

Faculty of science January 2013

Botany department

PLANT ENZYMES

Q1: Define the following:

1- Enzyme 2- prosthetic group

Q2: Mention to some general properties of enzyme

Q3: compare between α-amylase and β-amylase.

Q4: Explain the types of lyases enzymes.

Q5: write short notes on **Two only** of the following:-

1- Co-factor

2-Co-enzyme

3-R-enzyme

4-Z-enzyme

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Answer

Q1: Define the following:

1- Enzyme

An enzyme is a protein formed by the body that acts as a catalyst to cause a certain desried reaction. Enzymes are very specific. Each enzyme is designed to initiate a specific response with a specific result.

2- Prosthetic group

A characteristic nonamino acid substance that is strongly bound to a protein and necessary for the protein portion of an enzyme to function.

Q2: Mention to some general properties of enzyme

1-Enzymes are proteins that are biological catalysts
2-They reduce the activation energy required for a reaction to occur and thus speed up a reaction
3-Temperature, above a certain point (optimum temperature) causes them to break down and they are gradually destroyed (denaturing)
4-They work best at a particular pH (optimum pH) and are once again destroyed by low or high pH's
5-They have a specific shape, with one particular part, known as the active site, that is specific to the substrate they speed the reaction of. These means they are specific to one type of reaction.

Q3: compare between α-amylase and β-amylase.

α-Amylase

1- is present in germinated barley grains.

2-It attacks the 1:4 **α** linkages in either amylase or amylopectin in randam fashion to splite the macromolecules into a number of low molecular weight (short chain) **α**-dextrine.

3-It can attack the 1:4 **α** linkages in both the free ends or chains between the branch points.

β -amylase

1-appear**s** to be absolutely specific for 1:4 **α** linkages and it differs from α-amylase in that it does not attack 1:4 **α** linkages between the branched point in amylopectin

2- β-amylase removing pairs of glucose units in form of maltose.

3-it acts up on the open ends of the chains of amylopectin unit a branching link 1:6 **α** linkages

Q4: Explain the types of lyases enzymes.

1-Enzymes adding or removing water (hydrolyases).

a-aconitase: it is classified either as a lyases or isomerases it catalyzes the interconversion of citric and isocitric acids to cis- aconitic. The enzyme inhibited by trans- aconitate.

b-fumerase: convert fumeric acid to maleic acid.

2-Enzymes adding or removing CO_2 (carboxylases).

a-amino acid decarboxylases: each highly specific with respect to aparticular amino acid.

b-carbonic anhydrase: an enzyme catalyzing the splitting off of CO_2 from carbonic acid (present in animal than plant)

c-carboxylases: originally in yeast, and occur in microorganisms and plants.

Q5: write short notes on **Two only** of the following:-

1- Co-factor

A substance, such as a metallic ion or a coenzyme that must be associated with an enzyme for the enzyme to function. Cofactors work by changing the shape of an enzyme or by actually participating in the enzymatic reaction.

Cofactors can be classified depending on how tightly they bind to an enzyme, with loosely bound cofactors termed **coenzymes** and tightly bound cofactors termed **prosthetic groups**. Some sources also limit the use of the term "cofactor" to organic substances. An inactive enzyme, without the cofactor is called an apoenzyme, while the complete enzyme with cofactor is the haloenzyme

Some enzymes or enzyme complexes require several cofactors. For example, the multienzyme complex pyruvate dehydrogenase at the junction of glycolysis and the citric acid cycle requires five organic cofactors and one metal ion: loosely bound (TPP), covalently bound lipoamid and (FAD), and the cosubstrates (NAD^+) and (CoA), and a metal ion (Mg^{2+}).Organic cofactors are often vitamins or are made from vitamins. Many contain the (AMP) as part of their structures, such as ATP, coenzyme A, FAD, and NAD. This common structure may reflect a common evolutionary origin as part of ribozymes in an ancient RNA. It has been suggested that the AMP part of the molecule can be considered a kind of "handle" by which the enzyme can "grasp" the coenzyme to switch it between different catalytic centers

2-Co-enzyme

Coenzyme - a small molecule (not a protein but sometimes a vitamin) essential for the activity of some enzymes molecule - (physics and chemistry) the simplest structural unit of an element or compound carboxylase, thiamine pyrophosphate - a coenzyme important in respiration in the Krebs cycle coenzyme A - a coenzyme present in all living cells; essential to metabolism of carbohydrates and fats and some amino acids NAD, a coenzyme present in most living cells and derived from the B vitamin nicotinic acid; serves as a reductant in various metabolic processes NADP, - a coenzyme similar to NAD and present in most living cells but serves as a reductant in different metabolic processes triphosphopyridine nucleotide - a coenzyme of several enzymes coenzyme Q, ubiquinone - any of several quinones found in living cells and that function as coenzymes that transfer electrons from one molecule to another in cell respiration

3-R-enzyme

An enzyme in plants that catalyses hydrolysis of α 1-6-glucan branch points in starch, in the reaction: branched α1-4(α1-6)-glucan + H_2O = linear α1-4-glucans. The α1-6 linkage acted on carries an α1-4-glucan chain about four residues long that cannot be cleaved by starch phosphorylase

4-Z-enzyme

Enzyme found associated with amylase, that attacks the few β-1, 3-links present in amylose. Pure, crystalline β-amylase will convert only 70% of amylose to maltose; it requires the presence of the Z-enzyme for complete conversion.