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Enzymes and Protein Drugs - An Overview

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Abstract: Enzymes are act as biological catalysts. They participate a very important function in the utility of cells and activates of an organism. Enzymes are soluble in water and dilute alcohol concentrated alcohol concentrated alcohol precipitates them. Enzymes activity is reduced by formaldehyde, free iodine, heavy metals and tannins. Proteins are compound nitrogenous organic substances of plant and animal derivation. They are of great importance in the functioning of living cells. They are produced by and associated with living matter. In animals they are present as structural material in the form of collagen keratin, casein and plasma proteins. Here we described the enzymes and protein containing crude drugs.

Keywords: Enzymes, plasma, animal origin, plant, keratin, casein

ENZYMES

1.0 Introduction:

Enzymes are the proteins which act as natural catalysts. They play a very important role in the task of cells and activates of an organism. The enzymes show maximum activity between 35^0c to 40^0c. They are just about inactive at 0^0c and beyond 65^0 c get denaturated. Although they are soluble in water and dilute alcohol concentrated alcohol concentrated alcohol precipitates them. The factors like PH of mediuk has direct effect on their action. Enzymes

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activity is reduced by formaldehyde, free iodine, heavy metals and tannins. The properties of enzymes which make them exceptional catalysis are as under.

1. They catalyse only a specific range of reactions and in many cases onl one reaction is catalysed by a given enzyme. Some of them have a low degree of specificity like pepsin , which hydrolysis almost all soluble native proteins. Hence, specifically is one of the most important characters of enzymes.
2. As a group, they are exceptionally versatile catalysis they effectively catalyse hydrolytic reactions, dehydration , oxidation reduction reactions acyl transfer reactions, aldol condensations, polymerisation and free radicals.
3. They are exceedingly efficient “under optimal conditions. Most of the enzymatic reactions keep on 8 to 10 times more rapidly than the corresponding non-enzymatic reactions

1.1 The enzymes are classified into following categories :

1. Hydrolyses for catalysis of hydrolytic reactions
2. Transferases for the transfer of chemical group fron one molecule to another.
3. Oxido-reductases catalysis the oxidation-reduction reactions
4. Lyses catalyses the addition of group to double bonds or vice versa
5. Isomerises are responsible for intra molecular rearrangements.
6. Synthesises catalyses the condensation of two molecules coupled with the cleavage of pyrophosphate bond of ATP or similar triphosphate.

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Further on the basis of site of action enzymes can be grouped as under:

(a). Those which act only inside the cell are known as endoenzymes or intracellular enzymes. Those involve in the synthesis of cell components, food reserves and bioenergetic i.e liberation of energy from food stuffs. Since these processes are intrecellular, enzymes involved are also intracellular. Examples are synthetases, isomerases and phosphorylases.

(b) The enzymes which are secreted outside the cell are known as exoenzymes or extracellular enzymes. These are normally digestive in their function. They hydrolyse very complex molecules into simpler compounds i.e. proteases, lipases amylases acting on protein lipids or starch respectively.

Many of the enzymes also possess non possess chemical groups. An enzyme mostly comprises of a protein component ‘ apoenzyme’ and a prosthetic representing non-protein component. The latter is also called as cofactor or coenzymes. Certain metals and vitamins are coenzymes.

2.0 DIASTASE

2.1 SYNONYM:

Amylase

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2.2 BIOLOGICAL SOURCE

It is one of the amylolytic enzymes present in saliva i.e salivary diastase or ptyalin and pancreatic diastase or amylopsin, found in the digestive tract of the animals.

It is also formed during the germination of barley grains and known as Malt-diastase.

Several other amylotic enzymes or carbohydrates of commercial importance are known, many of them are also used in therapeutics.

2.3 DESCRIPTION

It is a yellowish white amorphous powder obtained from the infusion of malt. Diastase has faint characteristic odour.

2.4 SOLUBILITY

Colloidal in nature with water.

2.5 Properties

Like other enzymes, it is therolabile and sensitive to a temperature more than 45 c. Diastase is active between 35 c to 40 c. It is active in solution having PH range of 6-7 Acidic range upto 4 causes its deactivation.

Diastase catalyses the hydrolysis of 1,4 glucosidic linkage of polysaccharides such as starch and glycogen. Diastase can convert 50 times its weight of potato starch into sugars.

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2.6 USES

Diastase from various sources is used as digestant. It is used in the production of pre-digested starchy foods and also for the conversion of starch t fermentable and browing industries

3.1 Pepsin

Pepsis is a photolytic enzyme and is there in the gastric juice of animals.

4.0 RENNIN

It is a partially purified, milk- curdling photolytic enzymes form glandular layer of the fourth or true digesting stomach of the calf, bos tauras.

Rennin has peculiar odour and characteristic saline taste. It is available as scales or powder. It has hygroscopic nature, yellowish white or greyish-white colour. For production of rennin, the glandular layers of digesting stomach of calf are minced and macerated in 0.5 per cent sodium chloride solutions, followed by filtration. The filtrate is acidified with Hcl and rennin is precipitated by saturating the filtrate with sodium chloride. Rennin is used to prepare junkets and cheese. It is also used to coagulate milk and hence making the milk easily digestible for weak patients.

5.0 PANCREATIN

It is a preparation extracted from pancreas of certain animals like hog Or ox. Pancreatin contains enzymes namely amylase, lipase and protease. Pancreatin is amorphous powder with white or buff colour. Pancreatin is employed as digestive aid

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for converting starch into dextrin and sugar, proteins into proteoses and derived substances, and fats into glycerol and fatty acids.

Each gramme of pancreatin contains not less than 12,000 units of amylase activity, 1000 units of protease activity and 15,000 units of lipase activity.

6.0 PANCREALIPASE

It is a substance which contains enzymes mainly lipase along with protease and amylase. It is obtained from pancreas of the hog. Sus scrofa var. Domesticus belonging to family suidae.

Pancrealipase is more concentrated form of pancreatin in which the lipase activity is increased. It occurs as cream coloured amorphous powder with a characterstic odour. Each mg contains not less than 24 units of lipase activity. 100 units of protease activity and 100 units of amylase activity.

Pacrealipase is used in treatment of chronic pancreatitis, cystic fibrosis and partial or complete surgical pancreatectomy.

7.0 TRYPSIN

It is obtained by alcoholic or aqueous acid extraction of its precursor trypsinogen and further conversion to crystalline trypsin.

8.0 CHYMOTRYPSIN

Chymotrypsis is an amorphous odourless powder with white to yellowish colour.

It is soluble in water and shows maximum activity at PH 8. Each mg of chymotrypsin contains not less than 1000 USP units

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It is also used topically to reduce soft tissue inflammation from abscesses, ulcers, fistulas and necrotic wounds.

9.0 UROKINASE

It is an enzyme formed by kidney and obtained from human urine It is a lyophilised white powder, soluble in water.

10.0 FIBRINOLYSIN

Synonym : plasmin

It is a proteolytic enzyme obtained from activation of human plasminogen by highly purified streptokinase. It is stable in dried form and loses its activity in solution within 4-8 hours.

It is used in treatment of throbotic disorders due to its fibrinolytic nature.

11.0 DEOXY-RIBOUCLEASE

Synonym : pancreatic dornase

It is a nuclelytic enzyme prepared by fractional precipitation of aqueous acid extracts of ellf pancres, which is followed by dialysis, sterilisation by filtration and freeze-drying.

It is available as white powder, soluble in water. It is stable in dry form, but losses its activity in solution. The maximum activity is exhibited at PH 6-7. Magnesium ions are necessary for its activation.

It is used in the treatment of local abscesses and haematomas. It is also used in the form of aerosols to reduce the viscosity of pulmonary secretions and to enhance the expectoration of sputum in bronchopulmonary infections.

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12.0 COLLAGENASE

It is an enzyme derived from fermentation of clostridium histoyticum. It has the capacity to digest native and denatured collagen.

The potency of collagenase is expressed in terms of its ability to digest undenatured bovine. Collagen in vitro. It shows maximum activity between pH 7 and 8.

It is used for debridement of dermal ulcers and burns and other necrotic lesions. It is used in the form of ointment.

13.0 SUTILAINS

Syutilains contain the proteolytic enzymes derived from Bacillus subtilis. It is available as cream coloured odourless powder. Each gramme of sutilains contain 2,50,000 N.F. casein units of proteolytic activity.

It is used for biochemical debridement of second and third degree burns, incisional traumatic and pyrogenic wounds and ulcers ccurring due to peripheral vascular diseases. It is used in the form of ointment.

14.0 L-ASPARGINASE

This enzyme is obtained from Escherichia coli. It also contains asparagines without ant leukemic activity and it is removed during the purification of enzymes. L-asparginase is also obtained from plant and animal tissues, fungi and yeast in pure form. This enzyme catalyses hydrolysis of L-aspargine to L- aspartate and ammonia.

It is available as white and crystalline powder, soluble in water. Each mg of L-asparginase contains 250 units.

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This enzyme interferes with the growth of malignant cells, which are not capable of synthesizing L-asparginase for their metabolism and hence, it is used n chemotherapy of acute lymphocytic leukaemia in sequential combination with other drugs. It is also useful for induction of remission in children with relapse of acute lymphocytic lymphoma. It also shows immune-suppressive activity.

15.0 BROMELAIN (BROMELIN)

Biological Source

Ananas comosus, belonging to family Bromeliaceae.

DESCRIPTION

It is available as odourless to slightly putrid buff coloured powder with irritating taste.

SOLUBILITY

It has slight solubility in water.

USES

It is used in treatment of soft tissue inflammation and oedema due to surgery and injury.

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16.0 PAPAIN

Fig *Carica papaya*

Biological source

Carica papaya. Caricaceae. The different proteolytic enzymes present in papain are the mixture of papain and chymopapain, proteolytic enzymes act on polypeptides and amides.

IDENTIFICATION

1. It decoloursises aqueous potassium permanganate solutions.

USES

- ❖ It is used in clarification of bevarages and as a meat tenderiser. It is employed in cheese manufacture as a substitute of rennin. It is also used for defumming of silk fabrics in textile industry and in leather industry for dehairing of skins and hides.
- ❖ It is used as an anti-inflammatory agent. It has shown relieving symptomsOf episiotomy.

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- One N.F. unit of papain represents the activity which releases equivalent of 1µg of tyrosine from a standard casein substrate.

17.0 SERRATIOPEPTIDASE

It is a photolytic enzyme derived from the bacteria. Unlike chymotrypsin, serratiopeptidase, being a bacterial enzyme, shows rarely the allergic reactions.

18.0 PROTEINS AND PRTEIN DRUG

Proteins are complex nitrogenous organic substances of plant and animal origin. They are of great importance in the functioning of living cells. They are produced by and associated with living matter. Apart from the fact that they are essential food stuffs, like carbohydrates and facts, they also provide very important group of therapeutically active compounds such as hormones, enzymes, sera, antitioxins etc., they are easily extreactable from plant sources and are generally stored in the form of aleurone grains in plants.

In animals they are present as structural material in the form of collagen keratin, elastin, casein and plasma proteins. Casein, gelatine, heparin and haemoglobins are pharmaceutically important proteins of animal origin.

Proteins contain carbon, hydrogen, oxygen, nitrogen and rarely sulphur. The ultimate products of complete hydrolysis of proteins either by chemical reagents or enzymes

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are amino acids. Proteins are the compounds of high molecular weight formin colloidal solution in water. Proteins are amphoteric in nature and get easily denaturated due to heat, changes in pH, treatment of organic solvents or by ultraviolet radiation. Depending upon the products of hydrolysis, they are classified as simple, conjugated and derived plants.

Proteins are broadly classified as under :

1. **Simple Proteins**: they yield only amio acids on hydrolysis.
    1. **Albumins** are EGG ALBUMIN and lactalbumin.
    2. **Globulins** are insoluble in water but are soluble in dilute salt solution. They are precipitated by half-saturating their solution with ammonium sulphate, and are also coagulated by heat. Examples are ovoglobulin, myosin, arachin. And serum globulin.
    3. **Glutelins** are gluteinin and wheat and oryzenin of rice.
    4. **Prolamins** are soluble in 70-80% alcohol, and insoluble in water, dilute salt solution, or absolute alcohol. Examples are zein of corn, gliadin of wheat and hordein of barley.
    5. **Scleroproteins** are keratins of hair, horns, elastin of connective tissues, collagen of bones, fibroin and sercin of silk.
    6. **Histones** are soluble in water and insoluble in dilute ammonia. Examples are goblin and gadus histone of codfish sperm.
    7. **Protamines** are the simplest of the proteins.

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11. CONJUGATED PROTEINS:

They are composed of a simple protein combined with a non protein group, known as the prosthetic group.

1. **Chromoproteins** are proteins united with coloured prosthetic groups such as haemoglobin or chlorophyll.
2. **Lipoproteins** are the combination of proteins with lipids such as lecithin of fatty acids . they are found in blood, milk, egg yolk, and the chloroplasts.
3. **Metalloproteins** are proteins which contain heavy metals such as Fe, Co, Mn, Zn , Cu, Mg, etc. Many enzymes belong to this group.
4. **Mucoproteins** are proteins and mucopolysaccharides. They are found in serum, human urine and albumin.
5. **Nucleoproteins** are the name indicate are proteins and nucleic acids. The plant and animal vruses are ribonclеoproteins, since they consist chiefly of protein and RNA. The tobacco mosaic virus is best known nucleoproteins.
6. **Phosphoproteins** contain phosphoric acid. They are available in casein and egg yolk.

Some of the animals, as well as plant proteins are very poisonous. Toxalbumin, ricin from castor seeds, and abrin from Abrus precatorius are very toxic to human beings.

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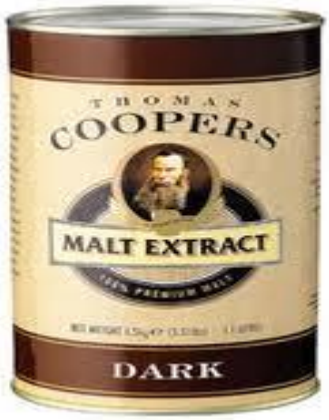
19.0 MALT EXTRACT



It is used as nutritive, and a flavouring agent for masking bitter taste. It is mainly used as a vehicle for preparations containing cod liver oil and halibut liver oil.

20.0 PROTAMINE SULPHATE

It is a purified mixture of different sample proteins obtained from the sperms or maturated testes of fish, belonging to the family Clupeidae or Salmonidae.

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It occurs as a hygroscopic crystalline powder with white or grey yellowish colour and an astringent taste. It is sparingly soluble in water and alcohol, while insoluble in ether and chloroform.

For the preparation of protamine sulphate, the testes of salmon are isolated, frozen and then minced, washed with water, centrifuged and then dehydrated using solvents and dried under vacuum. It is further subjected to extraction by sulphuric acid, faltered and protamine sulphare rich fraction is precipitated by adding cold alcohol. By dissolving in water, the fraction separates out as on oily layer on cooling. This layer is separated and dissolved in hot water and fractionated using cold alcohol. The fraction is further solvent dehydrated and finally dried under vacuum.

Protamine sulphate is a heparin antagonist and used to counteract the effects due to heparin over dosage like haemorrhage.

21.0 HEPARIN SODIUM (SOLUBLE HEPARIN)

It is a sterile preparation of active glycosaminoglycans, which are present in the mammalian tissues like lungs and intestinal mucosa.

Heparin has a significant role in mammalian body as a natural anticoagulant, thereby maintaining the fluidity of blood. Each mg of heparin contains not less than 110 units and

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heparin not less than 130 units. It is obtained as a white, hygroscopic powder without any colour or odour. It is soluble in water, saline ,alcohol, glacial acetic acid and acetone.

Heparin is mainly used as an anticoagulant in vascular surgery and some times in blood transfusions. It is used in treatment of arterial and venous thrombosis. It is also recommended for treating primary and post-operative thrombocytopenia.

22.0 PROTEIN HYDROLYSATE INJUCTION

It is sterile solution of short chain peptides and amino acids, which represent approximate nutritive equivalent of plasma, fibrin, lactalbumin, casein or other suitable protein, from which it is derived by acid, enzymatic or other method of hydrolysis.

It occurs as a yellowish to reddish amber transparent liquid and contains not less than 50% total nitrogen in the form of α-amino nitrogen.

It is used to maintain the positive nitrogen balance in the conditions of severe proteins deficiency, which arise due to starvation, surgical operations of G.I. tract or severe illness. It is given along with glucose or other carbohydrates which act as source of energy. Protein hydrolysed injection is given by infusion into superficial vein or by catheter into the large central veins.

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23.0 COLLAGEN MICROFIBRILLAR

It is an animal originated preparation containing polypeptide substance which occurs as the main constituent of skin, connective tissue and organic substances of bones.

It is used to stop bleeding in surgery. It is the character of collagen that platelets adhere to it and in turn, they ssecrete a substance which further enhances aggregation. It is absorbed within 84 days. Normally, it is used on those wounds where surgical ligatures cannot be used.

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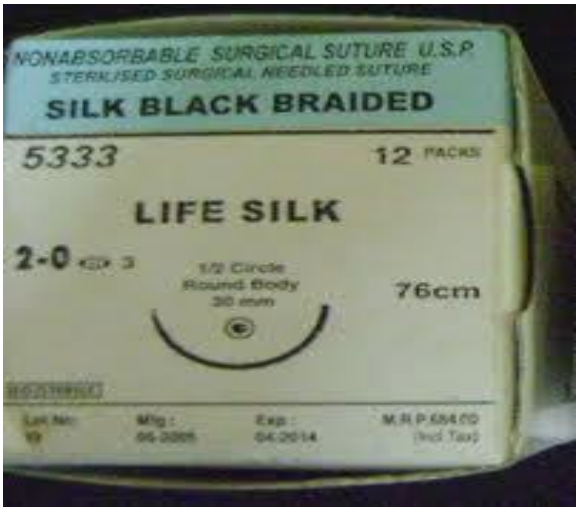
24.0 ABSORBABLE SURGICAL SUTURE

It is also called as surgical catgut or catgut suture. It is a sterile strand prepared from collagen, which is derived from healthy mammals or from a synthetic polymer. It is available as flexible strand which varies in diameter, size, colour and capable of getting absorbed into living mammalian tissue. The extent of absorption is varied by certain modifications. It is coated with a suitable antimicrobial substance and is coloured with suitable colouring agent approved under Drug Act.

25.0 NON-ABSORBABLE SURGICAL SUTURE



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It is sterile or non sterile strand of material that is suitably resistant to action of living mammalian tissue. It may be modified to reduce capillarity, suitably bleached and also coloured with approved colouring agents. It is also coated with an antimicrobial agent. The various materials used in preparation of non-absorbable surgical suture are /silk, synthetic fibres, and monofilament or multifilament metal wire

26.0 GELATIN

Synonyms

Gelatine , Gel foam , Puragel

Biological Source

Gelatine is a protein extracted by partial hydrolysis of animal collagenous tissue like skins, tendons, ligaments and bones with boiling water.

Description

This protein product is available in the form of flakes, shreds or a coarse or fine powder. It has a characteristic odour and faintly yellow to amber colour.

Solubility

It is unsolvable in cold water, but soluble in boiling water. In cold water, it swells, softens and absorbs about 5-10 times its weigh of water. With hot waste, it forms a jelly on cooling.

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It is soluble in a mixture of glycerine and water, but insoluble in fixed and volatile oils, alcohols, chloroform and ether.

In dried condition, gelatine remains stable in air, but when moist may be degraded due to microbial attack.

The quality of gelatine is expressed as 'bloom strength'. It is the weight in gramme, which when applied to a plunger. 12.7 mm in diameter, under controlled conditions shall produce a depression exactly 4 mm deep in a jelly matured at 10 C and containing 6.66 percent w/w gelatine in water.

Preparation of gelatine

For the manufacture of gelatine, the bones are to be defatted and decalcified with organic solvent and mineral acid respectively. The material obtained by this treatment with water at 85C in successive quantities, due to which collagen dissolves into gelatine. It is further bleached and concentrated under reduced pressure to specific gelatine content and allowed to set in shallow trays. Such moulded gelatine in dried in drying room to eliminate moisture.

Chemical constituents

As a protein, chemically, it contains different amino acids out of which major is lysine, an essential amino acid, but does not contain tryptophan. Gelatin is composed of glutin protein.

Solubility

For confirming the identity of gelatine, the following chemical tests are applied.

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Identification

1. It evolves ammonia when heated with soda lime
2. It gives a white precipitate with mercuric nitrate and on warming turns to brick red colour.

Uses

1. In the manufacture of hard and flexible capsules shells.
2. In the preparing pessaires, pastes and suppositories
3. Gelatine in the form of absorbable gelatine sponge is used as haemostatic.

27.0 ABSORBABLE GELATIN SPONGE

Absorbable gelatine sponge is a hygienic, white, tough and finely porous elastic material, which is absorbable and water unsolvable.

For the preparation of this material, the warm solution of gelatine is whisked to a foam of uniform porosity and then it is dried, cut into pieces of specific size and finally, sterilised at 150 C for one hour.

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It is used as a haemostatic. It is moistened with sterile sodium chloride solution and put within a surgical incision where it gets absorbed in 4-6 weeks. It is also used as a local coagulant and haemostatic.

28.0 THAUMATIN

Biological soruce

Thaumatin is a highly potent sweetener obtained from the fruits of the plant known thaumatoccoccus danilli

Family

Marantaceae

Geographical source

The plant to found in Africa, specially in Ghana, Ivory coast , Siera Leone and Togo

Macroscopic characters

The plant bears reddish trigonal fruits with 2-3 seeds. Seeds of the plant are covered with fleshy aril. Arils contain active constituents and are sweet in taste.

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Chemical constituents

The aqueous extract of the arils is a mixture of two soluble proteins thaumatin 1 and thaumtin 11.

Uses

Thaumtin to used on sweetening agent for market products such as chewing gums and branch fresheners.

Market products Under patented name TALIN. It is commercially available is USA and japan.

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