GENERAL PROPERTIES OF AMINO ACIDS

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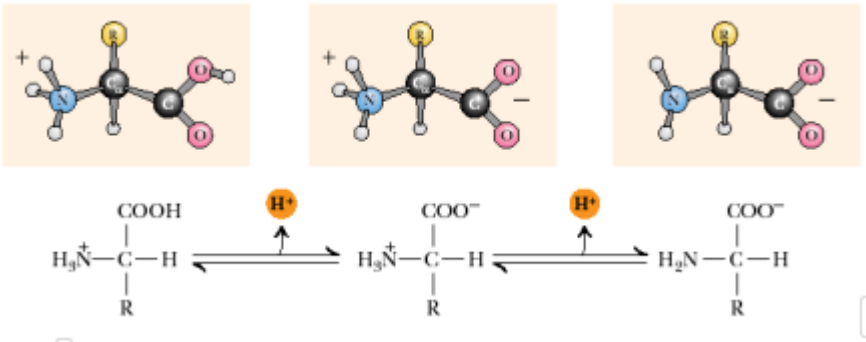
Annotation: The article provides an overview of amino acids, their properties and important features, and information about the importance of individual amino acids.

Keywords: amino acid, L and D conformation, dipole, isoelectric point, asymmetry, serine, cysteine, phenylalanine, histidine, proline.

The amino acids in proteins are white crystalline substances that are solid and stable at room temperature. Amino acids do not decompose when briefly heated in aqueous solutions at 100–200 ° C, but a number of amino acids decompose when proteins are hydrolyzed in the presence of acid or alkali. The solubility of amino acids in water varies. Cystine and tyrosine are less soluble, while proline and oxyproline are well-soluble amino acids. Most amino acids are extremely insoluble in absolute alcohol.

The dual polarity of amino acids affects their physicochemical properties, in particular, the fact that most amino acids are highly soluble in water and sparingly soluble in organic solutions depends on their ionization. Depending on the pH of the medium, amino acids are amphoteric in the form of anions, cations or electroneutral bipolar ions: in strongly acidic solutions amino acids are positive ions (moving in the electric field towards the cathode), in alkaline solutions they move in the form of negative ions (moving in the electric field towards the anode).



Picture 1. Charging of amino acids.

The dissociation constant of carboxyl and amino groups (K1 and K2) is the ratio of dissociated ions to non-dissociated forms, ie 50% of amino acids are dipole and 50% are ionic.

All amino acids are in aqueous solution in the form of bipolar ions or sweater ions, ie the carboxyl group of amino acids is dissociated, the amino group is protonated.

Therefore, depending on the pH of the medium, the sum of charges in amino acids can be 0, positive or negative.

A state in which the charge of amino acids is zero is called the isoelectric state. The pH value at which an amino acid does not move to the anode or cathode in the electric field is called the isoelectric point and is determined by the pH i. The isoelectric point clearly reflects the acid-alkaline properties of different groups of amino acids and is the most important constant that characterizes the amino acid.

In human and animal cells and intercellular fluids, the pH of the medium is close to neutral, under which alkaline amino acids (lysine, arginine) are positively charged (cations), acidic amino acids (asparagine and glutamine) are negatively charged (anions), and the remaining amino acids are dipole. have.

Almost all amino acids have optical properties and the ability to distort the level of polarized light (only glycine is not included). This property is due to the

fact that the alpha-carbon atom in them is bound to four different groups of four valences. A molecule with such a structure has the property of chirality, ie it does not have a center of symmetry and a level of symmetry. Compounds with chirality are in the form of double isomers that represent each other in the mirror. They differ from each other in the spatial orientation of the groups attached to the alpha atom. The two resulting configurations are called D- and L-stereoisomers. When one of these isomers is placed on top of the other, they do not overlap like the right and left palms. They are called enantiomers. Chiral compounds have the same chemical and physical properties, differing only in the fact that they turn the level of polarized light to the left or right, and their angles of rotation are the same. This type of ability is indicated by a + or - sign, but the beam deflection sign does not have to match the D or L configuration of the molecule. The symbols L (leve, left) and D (dexter, right) indicate which row the enantiomers belong to.

Based on the spatial structure of amino acids, their division into two rows is of biological importance. Proteins contain only L-amino acids. However, some D-amino acids are also released from the body. Some D-amino acids are freely found in the cell membrane of bacteria (anthrax rods) and in antibiotics produced by microorganisms.

Amino acids in a protein are L-series amino acids that have the following properties:

L-Glycine is not optically active because it does not have an asymmetric C-atom. Glycine is involved in the synthesis of nucleic acids, glutathione, bile acids, as well as in the neutralization of benzoic acid.

L-Alanine deamination produces pyruvic acid. In the body, in addition to - a alanine, there is also b - alanine, which is a component of muscle extractives, coenzyme A, vitamins pantothenic acid.

L-Serine milk protein - contains a large amount of casein. Phosphoric ether of serine - phosphoserine is involved in metabolism.

L-Treonin is an irreplaceable amino acid.

L-Cysteine is a sulfur-containing amino acid in construction. The presence of sulfhydryl-SH group in the molecule makes it easy to oxidize and damage from light; has the property of protecting the body from highly oxidizing substances that occur when poisoned by arsenic, phosphorus and other harmful substances. There is an S-S-disulfide bond in the tertiary structure of proteins.

L-Methionine is characterized by the presence of an easily mobile methyl group. These groups are used in the synthesis of lipotropic factor that prevents lipid infiltration of the liver - choline, muscle extractives - creatine, a component of DNA - thymine, hormone - adrenaline.

L-Valine is not synthesized in the human body, so it must be ingested with food.

L-Lecin is used in protein biosynthesis.

L-Glutamate and L-Aspartate are of great importance. They are involved in protein biosynthesis, the neutralization of ammonia, as well as the formation of other amino acids in the brain. Derivatives - a - ketoglutarate and oxaloacetate are important substrates in energy metabolism. A derivative of glutamate - g-amino acid is involved in the inhibition of the nervous system. The sodium salt of glutamate is widely used in the food industry to improve the taste of food. These two amino acids are used to determine the activity of transaminases in serum (as a substrate).

L-Lysine is not synthesized in the human body, so doino should be included with food. Lack of lysine leads to disruption of protein biosynthesis, which stops the growth process.

L-Arginine is involved in protein biosynthesis in the body, the main way to neutralize ammonia - is one of the components of urea formation.

L-Phenylalanine is not synthesized in the human body and must be ingested with food. Participates in the biosynthesis of proteins.

L-Tyrosine is a precursor to the biosynthesis of proteins and a number of hormones - thyroid hormone - thyroxine, adrenal cortex hormones - adrenaline and noradrenaline and others.

L-Tryptophan is not synthesized in the human body and must be ingested with food. Involved in the biosynthesis of proteins, vitamin PP, a biogenic amine that facilitates the conduction of nerve impulses - serotonin, vasoconstrictor - tryptamine and others.

L-Histidine is a major source of histamine, a biogenic amine that expands protein biosynthesis and blood vessels and increases HCl secretion in the stomach.

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