SOLUTION OF PROTEINS AND FACTORS AFFECTING IT

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Annotation: The article provides information on the solubility of proteins and the factors that affect it, as well as the importance of their content.

Keywords: protein, hydrophilic, collagen, gelatin, neutral salts, temperature effects, globulin, pepsin, muscle phosphorylase, polyanion, salinity.

Proteins are hydrophilic, aquatic colloids. Dry protein dissolved in water swells like all high-molecular hydrophilic compounds, and then the protein molecules slowly begin to dissolve. During swelling, water molecules pass into the protein and bind to its polar groups. The solid layer of the polypeptide chain swells. The digested protein can be considered as a recyclable solution. Further absorption of water causes the protein molecule to separate and dissolve from the total mass. But bloating does not always lead to melting; Some proteins, such as collagen, remain suffocated even if they absorb a lot of water.

The process of melting occurs on the basis of the hydration of proteins, that is, the binding of water molecules to proteins. The hydrated protein is strongly bound to the water molecule, which is very difficult to break. This is not simply adsorption, but shows the electrostatic bonding of water molecules with the polar groups of negatively charged acidic and positively charged basic amino acids.

A portion of the hydrated protein is bound to peptide groups by water molecules using hydrogen bonds. For example, proteins with a non-polar side chain also bind to water. An example of this is the non-polar amino acids stored in collagen that bind large amounts of water. Under the action of water bound to peptide groups, the polypeptide chain is elongated. However, the bonds (chains)

between the chains prevent the protein molecule from breaking apart and dissolving. When the collagen-containing product is heated, the inter-chain bonds in the collagen fibers are broken and the separated polypeptide chain is dissolved. Partially hydrolyzed soluble collagen is called gelatin. Gelatin is chemically close to collagen, it absorbs easily and forms a sticky solution in water. Gel formation is a key feature of gelatin. Aqueous solutions of gelatin are used in practical medicine as a plasma substitute and hemostatic agent, and the gel is used in the manufacture of capsules in pharmaceutical practice.

Factors affecting protein solubility. The solubility of proteins depends on their amino acid composition (polar amino acids are better soluble than non-polar amino acids), structural properties (globular proteins are better soluble than fibrillar proteins) and solvent quality. For example, plant proteins - prolamins are soluble in 60-80% alcohol, albumins - in water and weak solutions of salts; collagen and keratin are insoluble in most solvents.

The stability of protein solutions depends on the charge of the protein molecule and the hydrated shell. There is an organic link between the charge of a protein or the number of polar amino acids in it and hydration: the more polar amino acids in a protein, the more water is bound (per 1 g of protein). In some cases, the hydrated shell of the protein is enlarged, and the hydrated water can dissolve 1/5 of its weight.

Some proteins are strongly hydrated but poorly soluble. For example, collagen binds more water than well-soluble globular proteins, but is insoluble. Its solution is hindered by structural features - transverse bonds between polypeptide chains.

The solubility of a protein depends on the number of hydrophilic groups in the molecule, the size, shape and total charge of the molecules. The solubility of proteins decreases at the isoelectric point. Because there is no electrostatic force between the molecules that pushes them apart.

The effect of neutral salts. Neutral salts (Na2SO4, MgSO4, (NH4) 2SO4) increase the solubility of even insoluble proteins in pure water, such as

euglobulins. Salt ions interact with the oppositely charged molecules of the protein, breaking the salt bridges between the protein molecules. Excess salt (increased ionic strength of the solution) has the opposite effect.

The effect of environmental pH. The pH of the medium affects the charge of the protein, as well as its solubility. A protein is unstable at its isoelectric point, ie when the sum of its charges is zero. The loss of charge facilitates the approach, adhesion and precipitation of protein molecules. Therefore, the solubility and stability of a protein is minimal at the pH of the medium at its isoelectric point.

The effect of temperature. There is no strong correlation between protein solubility and temperature. But proteins such as globulin, pepsin, and muscle phosphorylase are good with increasing temperature in water and saline solutions; proteins such as muscle aldolase and hemoglobin are poorly soluble.

Effects of various charged proteins. Aggregates are formed if polyanion-based proteins are added to polyanionic-acidic proteins. In such cases, as a result of neutralization of charges, stagnation disappears and proteins precipitate. This property is sometimes used to separate the desired protein in a protein mixture.

Water-soluble substances, organic solvents - ethyl alcohol, methyl alcohol, acetone, alkali metals - thick solutions of neutral salts break down the water membrane of the protein and reduce its solubility. When organic liquids - ammonium sulfate, sodium sulfate, sodium chloride, sodium phosphate and other solutions are added to the protein solution, the protein usually precipitates.

Salting. When various salts are added to a protein solution, its precipitation is called salinization. Under these conditions, the protein molecules are free of the hydrate shell that gives it stability, combine easily with each other and form large aggregates. Salinization often does not change the native state of the protein (initial, natural), when the salt ions are separated from the precipitate by dialysis, the protein is re-dissolved. Therefore, the method of salting with ammonium sulfate and sodium sulfate is widely used in the separation of proteins without disturbing the structure. Different protein solutions precipitate when they are saturated with salt to varying degrees. Therefore, it is possible to precipitate some

proteins separately by saturating a solution consisting of a mixture of proteins with a concentrated solution of ammonium sulfate. For example, when serum is semi-saturated with ammonium sulfate, globulins are released, filtering the globulin precipitate and adding salt powder until the solution is completely saturated, precipitating albumins.

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