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MINI REVIEW: PHYSICAL CHEMICAL COMPONENTS OF PROTEINS IN MEAT, BONES AND SKIN FISH

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ABSTRACT

Proteins are polymers of amino acids linked by peptide bonds. Protein is also a food substance that is very important for the body because this substance serves as a source of energy in the body as well as a building block and regulator. The purpose of this article is to determine the physical and chemical properties of proteins in denatured parts of fish such as meat, bones, and skin. Adding acids, bases, and heating. Fish meat, skin, and bones with observations in the form of pH, distilled water, acid-base solution, acid solution, and ninhydrin changed the pH value. Physical and chemical characteristics of fish flesh, skin and bones are clearly visible in color and texture. Protein denaturation is characterized by increased turbidity and the appearance of clumps. The process of protein coagulation occurs in the presence of lumps that occur due to the heating process. Fish meat, skin and bones given with ninhydrin reaction can also cause changes. Protein denaturation in fish meat is characterized by fading meat color, soft texture and lumps. Denaturation of protein in bone is characterized by soft bone texture and cloudy white color. Denaturation of fish skin is characterized by fading skin color and softened texture.

Keyword : fish meat, fish bones, fish skin, denaturation, protein

INTRODUCTION

Protein is a macro molecule composed of amino acids. In all biological processes, proteins have a complex main function (Katili, 2009). Proteins function as catalysts, as carriers and stores of other molecules such as oxygen, mechanically support the immune system and produce body movement. Unlike other macro nutrients (carbohydrates, fats), this protein plays a more important role in the formation of biomolecules than as a source of energy. Protein is also important in maintaining body stability (Salim and Rahayu, 2017). But if the organism is lacking energy, then this protein can also be used as an energy source. Protein has 4 structures, namely, primary, secondary, tertiary and quarternary structures (Wulandari and Muflikah, 2018). The specialty of protein, among others, is its structure which contains N, C, H, O, sometimes S, P and Fe. The uniqueness possessed by this protein can affect the taste and texture of the material containing protein, the configuration of the protein can be changed by physical or chemical treatment such as aquadest treatment, the addition of an acid-base solution and the protein can be degraded which results in simpler molecules and by-products.

Protein denaturation is a change in the spatial arrangement of the constituent poly peptide chains. Protein denaturation includes disruption and damage that may occur in the secondary and tertiary structures of proteins. Denaturation of protein in tissue can also cause inflammation (Farida and Amanda, 2018). Since it is known that the denaturation reaction is not strong enough to break the peptide bond, the primary structure of the protein remains the same after the denaturation process. There are two types of protein denaturation. The first is coagulation, which is the development of a polypeptide chain that will open the reactive group on the poly peptide chain and re-bind to the same or adjacent reactive groups. The formation of sufficient bonds can cause the protein to no longer be dispersed as a colloid. Heating will make the protein change its water binding ability. Denatured protein will experience a decrease in solubility. The development of the protein molecular structure can occur around the isoelectric point. Denaturation occurs due to disturbances in the secondary and tertiary structure of the protein.

Collagen is an example of a structural protein in food which greatly determines the physical and chemical properties of the material, such as hardness. The application of protein utilization can be used as a thickener, emulsifier, *gelling agent* and *foaming agent*. This study aims to understand the changes in protein properties due to various treatments with the addition of acids, bases and heating. Then, in order to understand the peptide bonds in proteins, the nature of protein coagulants is both amforter and *reversible*.

FISH PROTEIN PHYSICAL TESTING METHODS

Physical and chemical testing of fish protein uses laboratory equipment and several chemicals. The tools used are breaker glass which is used to mix the ingredients in liquid form, hot plate which is used to heat the sample, pH meter or pH indicator to determine the initial and final pH values in the sample, mortar which is a container for crushing the sample, petri dish to serve as a sample holder, test tube as a container for testing the chemical reaction of the sample, tube clamp, dropper, and measuring cup. The chemicals used are NH_3, NaOhH, H_2SO4, CH3COOH, ninhydrin reagent.

The procedure for testing the physical and chemical properties of protein is carried out in the following ways, 1) preparing 5 ml or 5 g of sample in a petri dish, or glass beaker, or test tube. 2) Measure the pH of the sample using a pH meter. 3) The addition of an acid or base solution that is adjusted to the treatment of the sample used. 4) The sample is heated on a hot plate. 5) Measurement of pH after heating using a pH meter. 6) Ninhydrin reagent is added when we have finished measuring the pH.

PHYSICAL CHEMICAL COMPONENTS OF FISH PROTEINS

Denaturation is a condition where there has been a change in the structure of the protein which includes changes in the shape and folding of the molecule, without causing a break or damage to the folds between amino acids and the primary structure of the protein. According to Welly, (2010) the denaturation of this protein will be higher if it occurs in strong acids and strong bases. Higher protein denaturation occurs in strong acids because strong acids denature proteins more, this is due to stronger acids attracting H+ atoms from proteins. While protein denaturation is higher in strong bases

because strong bases denature proteins more, this is due to strong bases attracting more OH atoms from proteins. The physical and chemical properties of protein in meat, bone and fish skin are presented in Table 1.

Tabel 1. Characteristics of Physical Chemical Components of Fish Proteins

No	Sampel	Solution	pH		Characteristic	Characteristics Final	
			Int	End		Aquadest/ Acid/Base	Ninhidrin
1.	Meat	Aquadest	6-7	6-7	Fish flesh is white, elastic and has a fresh odour	Fish flesh is white, and elastic.	There is a lump, stickiness and a denser texture.
		Acid	6-7	1-2	Fish flesh is white, elastic and has a fresh odour	Fish flesh is pale white	Clumps, stickiness and a denser texture
		Base	6-7	8-12	Fish flesh is white, elastic and has a fresh odour	Fish flesh is cloudy white	sticky and denser texture
2	Bone	Aquadest	6-7	5-7	Hard texture, white color, fresh aroma	Clear	color White color crunchy and smells a little sour
		Acid	6-7	2-3	Hard texture, white color, fresh odour	Color is cloudy white Color is dark	cloudy and has a strong sour smells
		Base	6-7	7-12	Hard texture, white color, fresh odour	Color is slightly cloudy	White color is cloudy brownish white, and has a fishy smell
3	Skin	Aquadest	6-7	6-7	white in color, porous scales and elastic skin texture	Colored grayish-white, porous scales and elastic skin texture	Fading skin tone, faded scales, elastic texture

		Acid	6-7	1-2	Grayish white in color, scales are porous and skin texture is elastic, skin tone	fades, and texture softens	Skin tone fades, scales fades, texture softens
		Base	6-7	9-13	Grayish-white in color, porous scales and elastic skin texture fading	skin tone, and softening texture	Skin color fading, and texture softened

(Source: Biochemistry Report, 2020)

Proteins function as catalysts, as carriers and stores of other molecules such as oxygen, mechanically support the body's immune system, produce body movement, transmit nerve movement and control growth and development. Elementary protein analysis produces elements C, H, N and 0 and often S. Besides that, some proteins also contain other elements, especially P, Fe, Zi and Cu (Hari, 1989). The role and activity of proteins in biological processes, among others, as enzymatic catalysts, that almost all chemical reactions in biological systems are catalyzed by macro molecules called enzymes which are one type of protein. Some reactions, such as the hydration of carbon dioxide, are simple, while others, such as chromosomal replication, are very complex (Staryer, 1995).

Fish meat, skin and bones are given a solution of strong acid, strong base, heating will show changes in texture, color and aroma. These changes indicate a denaturation reaction in fish protein. Fish meat that is given strong acid changes color to white, and when heated, fish meat becomes pale white and tends to be translucent. And after being given ninhydrin, the fish meat was denatured and the texture became solid. After being given a strong acid, fish meat has an extreme pH change from pH 6 to 1. Protein has a high sensitivity if it is influenced by physical and chemical substances and will cause changes in shape. Meat that has been given ninhydrin will experience denaturation and cause a change in shape in fish meat because the protein molecules contained in fish meat also undergo shape modification. Ninhydrin is used to detect the presence of amino acids (proteins). Ninhydrin will form an aldehyde with a lower C atom and will release NH3 and CO2 molecules. Denaturation is a process that causes changes in chemical, physical and biological properties and generally proteins that have been denatured cannot return to their initial form. This happens because of the provision of temperature or mechanical treatment of the protein.

Fish bones given strong or weak acids and bases will experience changes in the pH value. This change in pH causes changes in the color, texture, and aroma of fish bones. The characteristics of the bones are generally hard textured, white in color and fishy-scented. Fish bones that have undergone a characteristic change in texture that become soft and cloudy in color indicate the occurrence of protein denaturation in fish bones. In bone immersion with distilled water, the physical and chemical properties of fish bones are the same as in the initial conditions. The white color indicates that there is no protein denaturation. This is due to several factors, namely too much or too little acid added. Or it can also be caused by too little ninhydrin content added and too hot when the heating process is too high or even low and the heating time is too short or too long. Proteins have distinctive properties, namely they can undergo ionization, undergo denaturation, and can undergo a crystallization process (Probosari, 2019). Coagulation is protein denaturation due to heat and alcohol (Rachmawati SW, 2009). Protein denaturation is a condition where there has been a change in the structure of the protein

which includes changes in the shape and folding of the molecule, without causing a break or damage to the folds between amino acids and the primary structure of the protein.

The hydrophobic inner molecular layer will come out while the hydrophilic part will be folded inward. Folding will occur when the protein is close to the isoelectric pH and the protein will agglomerate and settle. The viscosity will increase because the molecule expands to be asymmetric, the optical rotation angle of the protein solution will also increase. Indications of protein denaturation can be seen in terms of color and texture in the sample (Daniel Sebastian Simangunsong, 2016). When the protein in the meat is heated, the protein will undergo a transition from the initial state to the denatured state. Thermal energy will also cause non-covalent interactions and will experience breaking but not breaking the peptide bond. In addition, the addition of pH can also affect the denaturation process. Generally, denaturation caused by pH is reversible or can return to its original state, but in some cases hydrolysis can cause the denaturation of proteins to become irreversible.

Amino acids, and proteins that dissolve in water will form ions that have positive and negative charges. In an acidic environment, protein molecules will form positive ions, while in an alkaline environment they will form negative ions. Thus, in the practical test of acids and bases on proteins, they can cause ionized proteins to become negative and positive charges. When given a solution of strong acid and weak acid the pH of the protein becomes low, and when given a solution of a strong base and a weak base the pH of the protein becomes high (Sumarno, 2002).

Strong acid solution (H2SO4) and strong base (NaOH) cause protein denaturation in fish. Protein denaturation is a change or modification of the secondary, tertiary, and quaternary structure of protein molecules without breaking covalent bonds. Denaturation occurs when hydrogen bonds are broken, hydrophobic interactions, salt bonds, and protein folds are opened (Triyono, 2010). Protein denaturation is the principle used in the practical testing of the physical and chemical properties of proteins where protein denaturation is a change in the spatial arrangement or poly peptide chain of a protein molecule. Protein structure consists of poly peptides that have long chains. Protein contains elements of amino acids C, H, O and N and does not have fat and carbohydrates. Protein is divided into three parts, namely myosin, actin and actomyosin (Alim, et al., 2018). Denaturation is a process that causes the breakdown of proteins and can change their original properties. Denaturation can be caused by heating, or mechanical treatment. Changes that occur after experiencing denaturation is a reduction in the solubility of the protein. The existence of a heating process can cause a decrease in the amount of amino acids depending on the type of processing and the duration of the processing because if there is a decrease of more than 10% it will have a significant effect on the quality of the food (Purwaningsih, et al. 2013).

CONCLUSION

Proteins have an isoelectric point where the number of positive and negative charges on the protein is the same. Proteins can be denatured which is characterized by forming lumps and the solution becomes cloudy. Protein deanturation occurs when an acid or base is added. The combination of acids and bases can disrupt the salt bridges found in proteins. Positive and negative ions in salt can alternate pairs with positive and negative ions from acids or bases so that salt bridges in proteins, which are one type of interaction in proteins, become chaotic and proteins can be said to be denatured. Fish meat, bones and skin undergo physical and chemical changes due to the application of acid, heat and a solution of nihy-

drin. Indications of protein denaturation can be seen from changes in color and texture. The decrease in the biological activity of the protein and the reduced solubility in the protein which causes the protein to easily settle is the denaturation of the protein

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