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Review Article

PROTEINS AND ITS FUNCTIONALITY

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Functionality refers to any property of food ingredient, except its nutritional value, that effects its utilization (Kinsella,1976). Either as a processing aid, or as a direct contributor of product. Includes colour, flavour, texture, smoothness, emulsifying, foaming, gelling, water holding, stabilising, adhesion, extrudability gritiness chewiness adhesion. Proteins are regarded as one of the main classes of building blocks used in many semi-solid foods for conferring mechanical properties (Dickinson, 1997). Proteins are also recognised as one of the main classes of surface-active agents in liquid foods for stabilizing dispersed particles and fat droplets (Dalgleish, 1997), due to the polarised distribution of hydrophobic and hydrophilic groups along the back bone.

Protein molecules adsorb at the oil–water interface to lower the interfacial tension and, therefore, make such thermodynamically less favourable dispersed systems stable for an extended shelf life. The importance of protein application in foods can also be seen in many other aspects. For example, it was reported that, in combination with polysaccharides and starches, proteins could be applied as a meat alternative, as a fat replacer or a filler in manufacturing healthier foods (Roger, 2001). Proteins also have special uses as foaming agents or as functional ingredients for nutrient delivery in foods (Chen *et al.,* 2006; Doi, 1993; Hettiarachchy *et al.,*1996). Thus it is very important to remain that the proteins while during extraction in no way it should lose its functionality that is the protein should be extracted in its native functional form and it should not get denatured during the process of extraction. Before proceeding towards the actual part of extraction it is essential to know about the structure of proteins.

STRUCTURE OF PROTEINS: Proteins are complex organic macromolecular substances of very high molecular weight made up of smaller units called amino acids. These amino

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acids were held together by means of peptide bonds. The study of protein structure is essential to understand the mechanism of protein extraction and the mechanism understanding is essential for further exploration of protein extraction. The structure of proteins is of three types namely primary, secondary, and tertiary (Nelson and Cox, 2000).

Structure:

- Primary (1^o) - Sequence of amino acids held together by means of peptide bonds.
- Secondary (2^o) - Most of the structural fibrous proteins were formed by the secondary structure. Free electronegative oxygen and nitrogen atoms with two free electrons in one amino acid have the tendency to form hydrogen bonds with hydrogen atoms of another amino acids which causes the protein to fold as to the local 3-D shape α-helix ß-pleated sheet (e.g.) Collagen triple helix of connective tissue, Keratin of feathers, hairs, and horn and hooves.
- Tertiary (3^o) - For a protein to be functional it should be in its tertiary structure. Proteins are normally said to be amphipathic that is it contains both hydrophillic and hydrophobic portions the hydrophobic aminoacids have the tendency to aggregate with one another forming the core of tertiary structure surrounding which it is the hydrophillic portions with polar side chain groups thus we get the global 3-D shape. This hydrophobic interactions play an important role in stabilizing the tertiary structure of proteins (e.g) Hemoglobin, Myoglobin, Enzymes, Hormones.

Other Structure Stabilizing Interactions:

Noncovalent:

- Van der Waals forces: Van der Waals forces which is a transient, weak electrical attraction of one atom for another
- Electrostatic Interaction: An electrostatic interaction is the attraction b/w polar amino acids that are the interaction between positive charges of one amino acid with negative charge of another amino acid.

Covalent:

- Disulfide bonds: Disulfide bonds which occurs between two cysteine residues of aminoacids there occurs reactive sulphydril groups which forms the the disulphide bond very stong bond and it requires a lot of energy to break these bond. This disulphide is said to increase with increase in age which causes increased cross-linking b/w amino acids thereby enhancing stability of proteins.

NOTE: Stability of protein refers to delicate balance between non-covalent interactions and thermodynamic forces (Jelesarov Ilian and Andrey Karshikoff, 2009).

Thus the protein in body exists in two forms namely insoluble structural fibrous form and soluble globular form.

Globular and Fibrous Proteins

Globular Proteins	Fibrous Proteins
• Have complex tertiary and sometimes quaternary structures. • Folded into spherical (globular) shapes. • Usually soluble as hydrophobic side chains in centre of structure. • Roles in metabolic reactions. • E.g. Enzymes, Haemoglobin in blood.	• Little or no tertiary structure. • Long parallel elongated polypeptide chains. • Cross linkages at intervals forming long fibres or sheets. • Usually insoluble. • Many have structural roles. • E.g. Keratin in hair and the outer layer of skin, Collagen (a connective tissue).

Most of the proteins present in slaughter house by products are of insoluble structural fibrous nature this insoluble fibrous protein should be converted to the soluble form thereby we can precipitate the protein and we can extract it out. There are number of electrophoretic and chromatographic techniques for protein purification and extraction but these methods can handle only small volume and also it is costly but in case of protein extraction from slaughterhouse waste it needs to handle large volume so methods which can handle large volume and cost effective should be selected.

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