FOOD CHEMISTRY
DTC-321 Credit hours-3(2+1)

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Texturized proteins

❖Texturization (plant proteins) => development => physical structure => sensation of meat =>"texture" (visible fibres), chewiness, elasticity, tenderness and juiciness.

❖meat => texture => muscle fibres & connective tissue.

❖plant proteins => globular structure.

❖Texturization => globular proteins => fiber-like structure .

❖ Suitable processes => protein chewiness & good water holding property, cooking strength & meat-like structure => retain these properties even during subsequent hydration and heat treatment.

❖ texturized proteins => used as meat analogues, meat substitutes & extenders

❖ Commercial products => exclusively from **soy protein.**

Process of Texturization

Two categories:

❖1. **assemble** => heterogeneous structure with protein fibres (by "**spinning**" process) within a matrix of binding material.

❖2. soy material => **convert** => into a hydratable, laminar, chewy mass <= without true fibres.

Two different processes :

❖1. Steam texturization.

❖2. Thermoplastic extrusion

❖During texturization => globular proteins are unfolded (<= breaking of intra-molecular binding forces) => stabilized through interactions within the neighbouring chains.

Spin Process/Fiber Spinning

- starting material => protein isolate => contain 90 % or more protein
- molecular weight of proteins => 10-50 kdal.
- Proteins < 10 kdal => weak fiber builders
- Proteins > 50 kdal => disadvantageous (their viscosity & tendency to gel in alkaline pH range).

Major steps :

- **Dope** [High (10-40%) protein concentration] => **solublized** by addition of **alkali (pH to 10)** => **aged** (continuous stirring) => complete **dissociation** of the protein(sub units) & extensive **unfolding** of polypeptide chain => **high viscosity** => **pressed** through a **die-plate** (a thousand or more holes) with diameter 50-150 μm => **streaming orientation** of unfolded protein molecules => **extend and align** them in a parallel manner => **liquid filaments** from the die => **coagulation bath** (acetic, citric, phosphoric, lactic, or hydrochloric) and usually 10 % NaCl at **pH 2-3** => proteins **coagulated** (iso-electric pH and by salting-out effect) => **elongated**, **parallel** protein molecules of each filament **interacts with each other** (hydrogen, ionic and disulfide bond) => form **hydrated protein fiber =>** removed on **rollers**=> stretched = better alignment=> **associate closely** => form more intermolecular bonds => increases **mechanical strength and chewiness** => **compressed** between rollers => promote adhesion and toughness => bundles=> **neutralizing bath** (NaHCO3 and NaCl) at **pH 5.5 to 6.0** => **bath** (a binder and other additives such as aroma compounds and lipids) to improve the thermal stability and aroma => **heated, cut, assembled** & **compressed**=> **fibers** and **texture resembles meat**.

Extrusion Method/Thermoplastic Extrusion

- Major technique => for texturization of vegetable proteins => leads => formation of dry, fibrous, porous granules / chunks => possess chewy texture <= rehydration.

- starting material => need not be protein isolates.

- Cheap protein concentrates / flours (45-70% protein) => use

- small amounts of starch / amylose / 3% NaCl / CaCl2 (addition) => improves **final texture**

- lipid content >5-10% is **detrimental**.

The major steps involved are :

Starting material => moisture content (30-40%) => incorporate additives =>Protein mixture => fed to **extruder** => exposed to a **high pressure**(10,000 to 20,000 kPa) 20-150 s => mixture => elevated to a **temperature** of 150-200oC => **transformed** => a plastic viscous state=> in which solids are dispersed => partial unfolding of the globular proteins => Hydration => stretching and rearrangement of the protein strands => thermal **coagulation** of proteins may occur => extruded through a small diameter orifice => normal pressure environment => results in formation of expanding steam bubbles by flash evaporation of internal water => leaving **vacuoles** in the protein chunks=> cooling => highly expanded dry structure of protein polysaccharide matrix => **may** absorb 2 to 4 times of water => giving a fibrous, spongy structure & chewiness like **meat**=> stable even under sterilization conditions