



# FOOD CHEMISTRY

## DTC-321 Credit hours-3(2+1)



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**Enzyme catalyzed reactions involving  
hydrolysis and proteolysis**



Proteolysis => important role => **production of many foods.**

Occur => **proteolytic enzymes** present in

- food itself or
- microbial sources.

Enzymes => **two large subgroups**—

1. **Peptidases (exopeptidases)** --- cleave amino acids or dipeptide => step wise manner from terminal end .
2. **Proteinases (endopeptidases)** --- hydrolyze the linkages within the peptide chain.

**Types of proteolytic enzymes :**

Divided into **four** groups:

- ❖ the **acid** proteases,
- ❖ the **serine** proteases,
- ❖ the **sulfhydryl** proteases, and
- ❖ the **metal containing** proteases

**1. Acid proteases** : have pH optimum at low pH. e.g. **rennin (chymosin)** and **pepsin** .

☐ Formation of **casein curd** in **cheese** manufacture => with **chymosin** or **rennin**.

☐ Rennin => **fourth stomach** of the suckling calf.

☐ Also produced => **genetically engineered microorganism**.

**Coagulation of milk => rennin occurs in two stages:**

**1. enzymatic stage** => enzyme acts on  **$\kappa$ -casein** (hydrolysis of peptide bond between Phe105-Met106) → **insoluble para- $\kappa$  casein** and **soluble glyco macropeptide**.

**2. second stage** => **clotting** of the modified casein micelles by **calcium ions**.

Rennin => **free of other undesirable proteinases** => especially suitable for **cheesemaking**.

## 2. Serine proteases :

- Active sites => **serine** and **histidine** residue, e.g. **trypsin, chymotrypsin, plasmin & thrombin.**
- Produced <= **bacteria and fungi.**
- **Trypsin and Chymotrypsin** => **pancreatic enzymes** => **intestinal tract.**
- **Trypsin** => cleaves linkages of amino acid residues => **basic side chain** (arginyl or lysyl bonds).

### 3. Sulfhydryl proteases :

- **Sulfhydryl group** (–SH) => activity
- Plant origin e.g. **bromelain, ficin & papain**
- Active sites => **cysteine** and **histidine** => enzyme activity => catalyze **hydrolysis of amide, ester and peptide bonds.**
- **Haze** => combination of **polypeptide and tannin** molecules in beer => easily observed particles.
- **Papain, ficin, bromelain prevent** => haze => **reducing the polypeptide size.**

#### 4. Metal containing proteases :

##### ➤ Exopeptidases.

➤ Require a **metal** for activity

➤ **Inhibited** by **metal chelating compounds** e.g. **amino peptidases, dipeptidases and carboxypeptidases A & B**

➤ Most of them => contain **zinc**.

➤ **Aminopeptidases** remove amino acids => **free  $\alpha$ -amino end** of peptide chain

➤ **Carboxypeptidases** remove amino acids => end of peptide chains => that carry a **free  $\alpha$ -carboxyl group**..

# Application of proteolytic enzymes in foods

Used for protein hydrolysis to:

1. Provide enzymatically modified proteins e.g. Whey protein and egg protein
2. Improving functional properties => proteins
3. Solubilization => denatured proteins
4. Maintenance of protein solubility => in acid media
5. Increasing digestibility
6. Decomposition => proteins => possess undesirable properties