Protein-glutaminase from *Chryseobacterium proteolyticum* isolated from soil and its applications

Shotaro Yamaguchi  
Food & Industrial Enzyme Division, Gifu R & D Center, Amano Enzyme Inc., 4-179-35, Sue-cho, Kakamigahara, Gifu 509-0108 JAPAN,  
E-mail: syamaguc@amano-enzyme.ne.jp

Protein functionalities, that is, solubility, viscosity, emulsion-, foaming-, gelling properties etc., are important in food system to give the textural and sensory properties to the food. Enzymatic modification of proteins is a promising method to improve protein functionality, being superior to chemical modification because of its specificity of reaction, safety and environmental friendliness. Limited proteolysis has been widely used for this purpose. Recent development of microbial transglutaminase (protein cross-linking enzyme) gave significant impact to the food protein industry.


Protein-bound Gln + H₂O → Protein-bound Glu + NH₃

The enzyme is an extracellular protein with an molecular weight of 20 kDa and pl 10. It is synthesized as a prepro-protein of 305 amino acid residues and secreted as a mature form of 185 amino acid residues. The amino-acid sequence has no obvious homology to any published sequences, suggesting it is a novel protein. It is active against proteins and long peptides rather than short peptides and free glutamine, and does not deamidate asparaginyl residues in peptides, and other amide compounds. Analyses of deamidated β-lactoglobulin and α-lactalbumin indicate deamidation by the enzyme causes alteration of tertiary or local structure of protein, not secondary structure. Specificity to target glutaminyl residue in proteins seems to be related with protein higher structure.

More than 95% of glutaminyl residues are deamidated in some food proteins, such as milk casein and wheat gluten, by this enzyme. Deamidated proteins have a decreased isoelectric point due to increased negatively-charged carboxyl groups, resulting in a protein with good solubility at more acidic pH of many food systems. Protein deamidation also causes the alteration of its higher structure due to a newly formed negative charge. This unfolding leads to exposure of hydrophobic region, resulting in a protein with an improved amphiphilic character that would be used as an emulsifier or foaming agent. In addition to improvement of protein functionality, protein-glutaminase can be used for many applications in food industry, including dough softening in the baking industry, enhancement of umami taste (glutamic acid) in hydrolyzed vegetable protein, and increase of protein digestibility.