



# Amfep Fact Sheet on Transglutaminase

## Background

Transglutaminase is an enzyme that is commonly found in nature (blood and liver of mammals, muscles of fish, micro-organisms) and also produced by microbial fermentation. It is used in the food industry for cross-linking of proteins in various processes.

The enzyme catalyzes acyl-transfer reactions between the gamma-carboxamide groups of protein bound glutamine and primary amines. If the epsilon-amino group of lysine acts as the primary amine epsilon-(gamma-Glu)-Lys bonds are formed, which result in an intra- and intermolecular cross linking of proteins.

Depending on the food in question the addition of transglutaminase to the raw material followed by the food processing steps gives rise to the formation of a framework of additional iso-peptide bonds which determines the functional properties of the food, such as gelation capability, viscosity or water binding capacity.

Transglutaminase is active within a wide pH range (pH 5-8). The enzyme is stable up to a temperature of 40° C. Above 75° C the enzyme loses its activity within a few minutes if used at usual dosages.

Examples of food applications making use of these characteristics are given below:

### **1. Transglutaminase used in cooked meat and fish products:**

Transglutaminase is used to improve the texture and consistency of cooked meat products such as sausages and hams. Transglutaminase catalyzes the intermolecular linkage between glutamine and lysine residues in the proteins of the raw meat by creating a complex network. At the end of the process the enzyme activity is destroyed by heat treatment (cooking).

### **2. Transglutaminase used for preparation of recombined meat part products:**

There are numerous ways to prepare recombined meat part products, with one of them involving transglutaminase. Transglutaminase, in raw meat products, provides an enzymatic way of creating uniform shapes and sizes due to the enzyme being able to catalyze the cross-linking between glutamine and lysine residues in liquefied proteins. Transglutaminase produces an

effect on soluble proteins only changing their character in such a manner that a gel is produced. Together with transglutaminase, those proteins (i.e., caseinate) are added to meat applications as an ingredient.

Transglutaminase does not enable cross-linking of meat proteins without the soluble phase (gel) being present, because the chance of relevant pairs of side-chains being available is virtually zero. The protein gels combine pieces of meat together, while transglutaminase alone is not a part of the gel matrix. The catalytic reaction of the enzyme with gelled proteins is always stopped by the depletion of substrate protein during processing. The enzyme may therefore be found in its native form in the finished product, as it cannot be removed, but it is not functional due to lack of substrates.

### **3. Transglutaminase used in yoghurt:**

Yoghurt is a protein matrix composed of casein micelle chains and clusters with minute particles of fat embedded in the casein. Transglutaminase reacts on the casein thereby improving the texture and rheological stability of yoghurt. After transglutaminase treatment, the enzyme activity is destroyed by pasteurization or due to the low pH caused by lactobacillus fermentation. Thus transglutaminase is not functional in the final food.

### **4. Transglutaminase used in the field of baking:**

The enzyme acts on the gluten structure of wheat strengthening it by cross-linking. The enzyme is destroyed by heat (baking process) and has no function in the finished breads.

## **Regulatory Status**

Transglutaminase is currently marketed in several EU countries as a processing aid mainly for the use in processed meat such as sausages and hams.

France, Germany and the United Kingdom have reviewed the documentation for the use of transglutaminase in processed meat and determined it to be a processing aid.

In the USA, transglutaminase is GRAS and the USDA has authorised its use in meat dairy, bread, and fish products.

\* \* \* \* \*

**amfep.org**

bd Saint-Michel 77-79, 1040 Brussels, + 32 2 740 29 62, amfep@agep.eu