

Activa (Transglutaminase: TG)

FAQ (frequently asked question)

Ajinomoto Foods Deutschland GmbH

Basic properties

Q1: What is TG, and its nature, composition?

TG is an enzyme and composed of simple amino acid chain (no glyco-, phosphate-, acyl- moieties attached). TG is produced by the fermentation of non-GMO microorganisms, and the key functional ingredient in Activa.

Q2: What is the mode of action (functionality)?

TG catalyses the cross-link of side chains in Glutamine and Lysine residues in protein, yielding ϵ -(γ -glutamyl)-lysine bond. This bond forms inter- and intra-molecularly, and is stable against physical stresses.

Q3: Is TG found naturally in food?

Yes, there are many scientific reports showing TG exists in living organisms, beef, pork, poultry, fish, shellfish and vegetables, which human being has been consuming for long periods.

Q4: How do you measure the TG activity?

Hydroxamate method is used on Activa. Also sensitivity method with radioactive substances is known. Simple meat-binding method is used in production sites. For activity check in product, refer to Q40 & Q41.

Q5: What is optimal temperature for right function of Ajinomoto TG?

Since TG is an enzyme, its activity depends on the structure. TG is active in between 1 to 60 C, and the optimal temperature is 55 C, and high temperature leads to the breakdown (inactivation).

Q6: What is optimal pH for right function of Ajinomoto TG?

Since TG is an enzyme, its activity depends on the environmental pH. TG is active in between pH 4 and 10. The optimal pH is around 7 to 8.

Q7: What kind of TG preparations are there and how they are used?

Activa WM for texture improvement of emulsified products such as sausage and surimi. Activa EB for binding or restructuring of meat and fish. Activa MP for texture improvement of yogurt.

Q8: What is the technical function of caseinate of Activa EB? Why do they need to be included in the preparation?

Caseinate is protein and increases total protein contents in the final products. Thus, it gives stickiness by its nature and enhances the binding by TG.

Q9: What is the technical function of gelatin of Activa SB? Why do they need to be included in the preparation?

Gelatin is protein and increases total protein contents in the final products. Thus, it gives stickiness by its nature and enhances the binding by TG.

Q10: What is the technical function of lactose in Activa MP? Why do they need to be included in the preparation?

Lactose improves the solubility of Activa preparation in cold milk. Yeast extract in Activa YG help TG in low temperature pasteurized milk.

Q11: What is the technical function of yeast extract in Activa MP? Why do they need to be included in the preparation?

Yeast extract helps TG activity on low temperature pasteurized milk. Yeast extract does not affect in the product.

Q12: Are there other similar enzymes available?

No similar enzymes are known, to our best knowledge. Ajinomoto holds the patent rights on our TG product. Fibrimex similarly binds meat, but its key ingredient is claimed to be fibrin, not enzyme.

Q13: Are there any competitors to Ajinomoto TG?

Yes. Fibrimex (Harimex), texturizing and thickening agents as hydrocolloids are competitors. In case of Fibrin, its key components are fibrinogen and thrombin.

Legislative issues

Q14: What are the benefits of TG from legal viewpoint?

TG is a food enzyme (processing aid) and need no labeling on the product. On the other hand, Fibrimex is food additive. Other texturizing and thickening agents may also need the labeling.

Q15: Is there any legislation that covers TG in EU?

There is no harmonized law to cover food enzymes (including TG) in EU. Currently, food enzymes are regarded as processing aid under Framework Directive (89/107/EEC). Only France & Denmark have own enzyme laws.

Q16: How is TG positioned in France?

In France, TG is also registered as Processing aid. Each application needs approval and the key for authority approval is inactivation. So far, TG can be used heated meat, bakery, and pasteurized dairy products.

Q17: How is TG positioned in Denmark?

Authorization of enzymes in Denmark is different from the French system. So far, no approval was obtained for TG. However, TG is allowed to use only for exported production in Denmark.

Q18: How is TG declared on the label (Directive 2000/13/EC)?

Production process (mostly, heating) inactivates the enzyme or depletes the substrates, thus, TG in Activa has no technological effect on the final products = processing aid (89/107/EEC) and labeling is unnecessary. Also please refer to Q19 – Q25.

Q19: How is Activa WM declared on the label?

Activa WM contains maltodextrin as protection of TG. And since no specifically concerned substances are included, labeling is not necessary. Refer to Q18, Q24, & Q25.

Q20: How is Activa EB declared on the label?

Activa EB contains sodium caseinate, milk derivatives, as an ingredient. The rest are for either TG protection or activity modifier. For labeling, please refer to discussions in Q18, Q19, Q24, & Q25.

Q21: How is Activa SB declared on the label?

Activa SB contains fish gelatin, fish derivative, as an ingredient. The rest are for either TG protection or activity modification. For labeling, please refer to discussions in Q18, Q19, Q24, & Q25.

Q22: How is Activa MP declared on the label?

Activa MP contains lactose, milk derivative, as an ingredient. The rest are for either TG protection or activity modification. For labeling, please refer to discussions in Q18, Q19, Q24, & Q25.

Q23: How is Activa YG declared on the label?

Activa YG contains lactose, milk derivative, as an ingredient. The rest are for either TG protection or activity modification. For labeling, please refer to discussions in Q18, Q19, Q24, & Q25.

Q24: How is Activa declared on the label from GMO labeling viewpoint (Regulations 1829/2003 and 1830/2003)?

TG producing microorganism is non-GMO. The raw materials used for TG fermentation is non-GMO. However, since TG is fermented product, TG is out of scope of this Regulation.

Q25: How is Activa declared on the label from allergen labeling viewpoint (Directive 87/2003)?

Since TG itself is fermented product, TG itself is out of scope of this Directive. However, caseinate and lactose (milk derivatives) in Activa EB and MP, and YG, and fish gelatin (fish derivative) in Activa SB, respectively, are used, the customers of Activa preparations need to label in their final products. In case of fish gelatin, this substance may be listed in the exemption list for allergen. Then, customers of Activa SB need not to label.

Safety issue

Q26: Can I consume safely TG in cooked food?

Yes. TG is protein and heated protein can be consumed as a source of amino acids, like steak. All the ingredients in Activa preparations are food grade.

Q27: Can I consume safely TG in raw uncooked food?

Yes. All the ingredients in Activa preparations are food grade. Our toxicological studies showed no adverse results with the recommended dosages.

Q28: What if the end consumer does not cook well the product, or eat as such?

We have carried out toxicological studies even with active enzyme. The results indicated no adverse result with the recommended dosages.

Q29: Is it widely used in Europe?

Yes, we have customers mostly all over Europe. Technologies of TG are applied in meat and fish (processed products, such as portion-controlled products, and restructured products) and dairy (yogurt and cheese).

Q30: Can Activa cause a sensitive reaction?

Longer, repeated exposure to Activa preparation may cause sensitive reactions in the body, like other protein powders. Please wear protective gloves, goggles (or mask), and wear to avoid direct contact.

Q31: Would such a reaction cause a rash/chest problem?

Symptoms of the above-said reactions vary individually. A rash/chest problem may be seen in some, and not in others. Some experiences running-nose or cough. However, there are not enough data to draw conclusion.

Q32: When Activa is made up into a slurry/solution, are any active substances that could cause sensitivity given off?

No. Activa contains food grade ingredients, and thus, it is unlikely addition of water give rise to any harmful substances.

Application

Q33: For which type of products is acceptable for TG?

TG catalyses the cross-link between Glutamine and Lysine residues in proteins. Thus, any protein-rich materials can be acceptable for TG application.

Q34: How does TG function in meat protein?

TG catalyses the cross-link between Glutamine and Lysine residues in meat myosin. According to our study, meat actin is not a good substrate, even after heating. For specific application, contact us*.

Q35: How does TG function in fish protein?

TG catalyses the cross-link between Glutamine and Lysine residues in fish myosin. According to our study, fish actin is not a good substrate, even after heating. For specific application, contact us*.

Q36: How does TG function to soy proteins?

TG catalyses the cross-link between Glutamine and Lysine residues in globulins. According to our study, whey proteins can be substrates after denaturation. For specific application, contact us*.

Q37: How does TG function to milk proteins?

TG catalyses the cross-link between Glutamine and Lysine residues in casein. According to our study, whey proteins can be substrates after denaturation. For specific application, contact us*.

Q38: How stable is final product after heat treatment and after freezing?

The enzymatic product, ϵ -(γ -glutamyl)-lysine bond, is covalent bond and thus, the final end product is stable against heating and mechanical stress some extent. One can freeze the final products, however, the ϵ -(γ -glutamyl)-lysine bond does not increase freeze-tolerance (no effect to freeze denaturation).

Q39: How is minimum temperature for inactivation of TG?

The minimum temperature in product center for TG inactivation is 70-75 C for several minutes.

Q40: How is TG detectable in the final product?

In cooked products, normal activity detection is impossible. However, after complete degradation by proteases and peptidases, one can measure ϵ -(γ -glutamyl)-lysine bond.

Q41: How is TG detectable in the fresh end product?

Theoretically yes, with high-tech instruments and pre-treatment, one can detect the enzymatic activity. But, differentiation of our TG from endogenous TGs in living organisms is difficult.

Q42: Is it possible to combine TG with other additives (antioxidant, sodium lactate, spices,..)?

TG worked well with such additives as sodium lactate, spices and other salts. But we have not checked the effect of all additives. In case if pH is affected by additive, TG does not work well at too low or high pH.

Q43: Is it possible to combine different kinds of meat? (for instance, roll production)

Yes. Based on our experiences, it is possible to combine different kinds of meat. However, chicken breast results in poor binding. Thus, when chicken breast is mixed, please try to increase TG dosages.

Q44: Is possible to use TG without phosphates and salt?

Yes, TG works on meat without phosphates and salt. But phosphates/salt solubilise muscle proteins, thus, combination of TG with phosphates/salt results in better effect.

Q45: Is it possible to use TG for PSE and DFD meat?

Yes, for PSE, but we noticed the effect of TG was lower as compared to normal meat. We have no experiences with DFD.

Q46: Is it possible to use TG for MDM?

Yes, we noticed TG worked on MDM either to give sausages or mince meat-like products.

Q47: How is optimal composition of meat (ratio on fat, muscle) for right function of TG?

Optimal compositions vary product by product (sausage, steak) and material by material (meat or fish). TG generally works better on muscle protein than fat. Also too much fat inhibits the TG activity.

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Remark: The information contained in this FAQ is believed to be true and correct, as of the issue date. But the accuracy and completeness of the legislative information are always dependent on the EU legislations. This may be subject to change accordingly to the discussion in European Commission. In case if you have any questions, please contact us (see a few lines above).

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K. Seguro, 2.11.2004