TÖUfood

GASTRONOMIC APPLICATION OF ENZYMES

Invertase

GASTRO CULTURA MEDITERRÁNEA

Collaborating with:

iDesserts

Introduction

Enzymes are hitherto unknown ingredients in restaurants, although they have been used in the food industry for years. By using these ingredients in our restaurant, bar or pastry shop, we will have the opportunity to **achieve textures that could not be achieved otherwise**.

We have developed this dossier with the aim of **providing knowledge and making known how to use them and the options they can offer us.**

That is why we will explain what enzymes are, and we will delve into each one of them so that you can understand them and apply them in your own gastronomic recipes.

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Enzymes

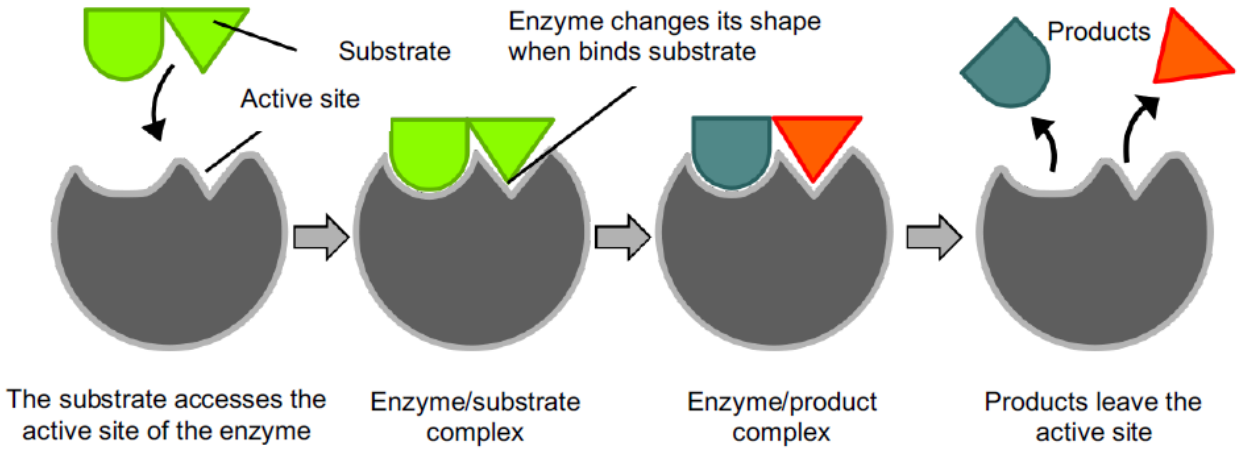
What are they?

> *Enzymes are proteins that catalyze (speed up) biochemical reactions that occur naturally in all living organisms.*

Enzymes are **natural origin proteins** present in most plant or animal foods that we consume on a daily basis, and which, applied to food products, can be used to **modify some of their properties**.
They are commonly used to improve and transform products on an industrial scale, but until now very few restoration methods and applications have been developed.

Enzymes, unlike other texturizers, are **very specific**. This means that each enzyme will only work with one type of fiber or molecule. This compound that reacts is called substrate, and is transformed into the so-called products.

As you can see in the image, for enzymes to work they **have to fit the substrate in question, so they will only work when the substrate is compatible**.



Origin

Enzymes are of **natural origin**. Most have been generated through the fermentation of natural products of plant or animal origin, or even extracted directly from fruits or vegetables.

How are they used?

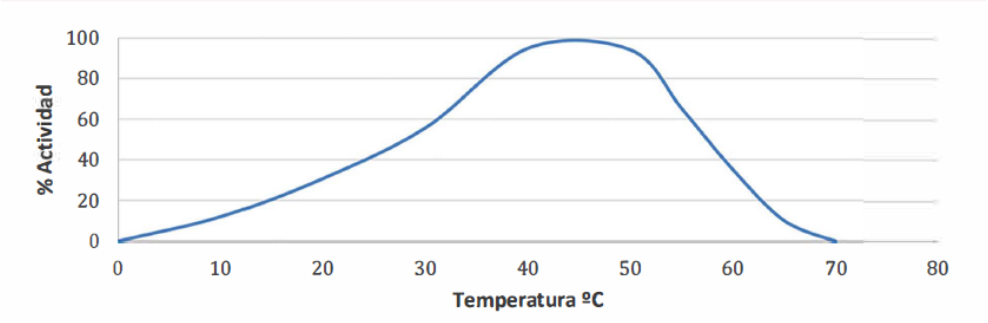
There are different parameters that can affect the proper functioning and performance of enzymes, and that we will take into account when using them. This occurs due to the shape of the enzyme and the way the substrate fits with it, that is, due to its specificity.

- **The product:** If the food does not contain the substrate that the enzyme needs, there will be no reaction. So, if we apply pectinase to a food that does not contain pectin, it will not undergo any change.

- **Substrate accessibility:** The substrate must be accessible for the enzyme, since, if they do not meet and do not fit, no change can occur. The main barrier that we find is the external skin of the vegetables since the impermeability of the skin does not allow the enzyme to penetrate. We will have to make some cuts in the skin, puncture it or peel it so that the enzyme can penetrate.

- **Proportion:** If there is little substrate, even if we add a lot of enzymes, we will not achieve more effect. If, on the other hand, we have a lot of substrate and little enzyme, it will work, although slowly.

- **Temperature:** It is one of the most important factors to take into account. The enzyme has a temperature curve on which its activity depends, much like the temperatures used for fermentation:
  - → At 0º C or less, the reaction stops because, as the product is frozen, so the two parts cannot fit together. As the temperature rises, this change is recoverable.
  - → From 0 to 60°C the enzyme is active. In general, most enzymes have an optimum temperature where their activity is maximum. It is usually between 45°C and 60°C, depending on the enzyme.
  - → At 70°C, or more, the enzyme is irreparably destroyed, since by heat the shape of the enzyme is modified and coagulates, so that the substrate can no longer fit with the enzyme anymore.

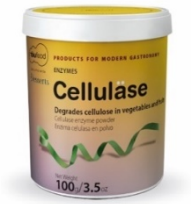


- **Acidity:** Enzymes are also destroyed if they leave a certain pH range and become inactive, although in the kitchen it is very difficult to reach these extreme values since they are either too acidic or too alkaline.

Enzyme range

We have developed a line of Töufood Enzymes intended for use in restaurants and haute cuisine. This project is still open today and with research in constant development in order to expand the range with a much broader spectrum of applications.

Pectinase is the enzyme responsible for degrading pectin in fruits and vegetables, softening them and giving them a cooked texture, but without cooking.



Cellulase is the enzyme responsible for breaking down cellulose in fruits and vegetables, thus breaking down the hard parts of vegetables.

Invertase is the enzyme responsible for transforming sugar into inverted sugar, enhancing the sweetness of the ingredients and providing them with antifreeze and moisturizing properties.

Amylase is the enzyme responsible for breaking down starch in fruits and vegetables, giving starches creamy textures and adding sweetness.

Glucosidase is the enzyme responsible for degrading the dextrins resulting from the application of amylase. It greatly increases the degree of sweetness of the food.

Lipase is the enzyme responsible for breaking down fats and triglycerides, modifying their aromatic profile and enhancing mature flavors.

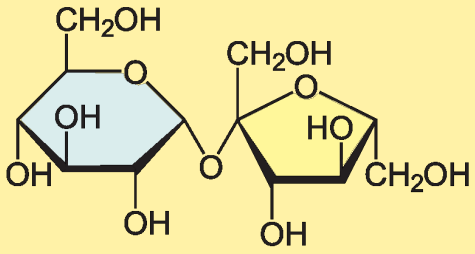
What is it?

Invertase, also known as sucrase, is the enzyme that splits sucrose, or table sugar, into its two simple sugars, glucose and fructose. The name invertase refers to the product resulting from its hydrolysis, known as "invert sugar", due to its optical properties.

Saccharose

Sanskrit ‘Sarkara’ *(śarkarã)* means ‘sugar’

Disaccharide made up of glucose and fructose. It is the most widely used sweetener for what is usually called simply sugar and is generally extracted from sugar cane, beetroot or corn. Apart from being a sweetener, it has other functions such as preservative or structural.



What does it do?

It has many applications in gastronomy, since it allows the generation of invert sugar, which has anti-crystallizing properties, and since the mixture of glucose and fructose is sweeter than sucrose, it allows the treated product to be sweetened without adding any sweetener.

How is it used?

To activate the enzyme, it must be hydrated with water or a non-greasy liquid and placed in contact with the sucrose in the food. There are two application methods depending on the result we want:

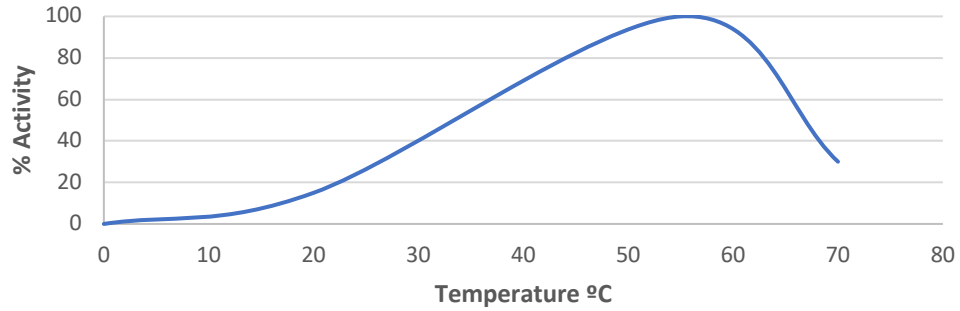
- **Impregnación**: Realizando previamente múltiples agujeros al producto, y agregando la solución enzimática, conseguimos una degradación homogénea en todo el producto.

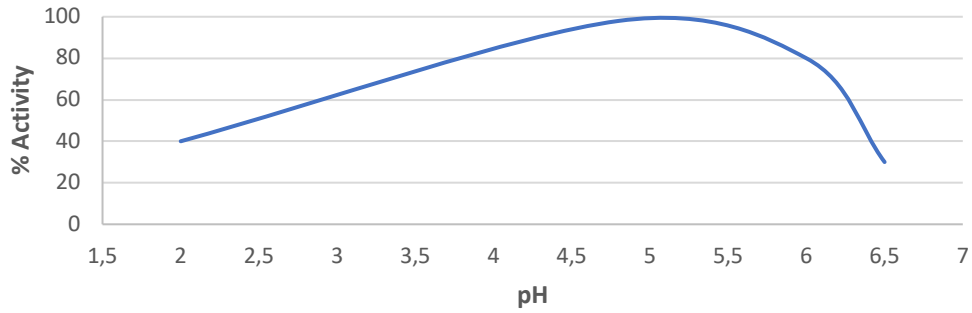
- **Espolvorear o sumergir:** Se aplica de forma directa (en polvo) sobre el producto que se desee degradar, obteniendo un mayor rendimiento con el producto triturado previamente.

To obtain maximum performance, it is recommended to peel or puncture the skin over its entire surface and impregnate with 2 or 3 cycles of 90-95% vacuum, and if desired, carry out a final cycle with sealing.

Factors that affect its performance

As mentioned in the introduction, temperature and pH affect the activity and therefore the performance of Invertase. Invertase activity graphs for pH and temperature are shown below:





Another factor that must be taken into account for the enzyme to work is the amount of sucrose contained in the food to be treated: since pectinase only acts on pectin, it will only work with products that contain it.

In general, many vegetables contain sucrose, but it is usually not enough for the use of the enzyme to produce noticeable results. Depending on the proportion of sucrose, and where it is, we will obtain one result or another.

Below is a brief list of some fruits and vegetables that contain sucrose.

Vegetables rich in sucrose: Sugar cane - Beetroot - Sweet corn - Strawberry - Fig - Mango - Pineapple - Peach - Apricot - Date - Carrot - Tomato - Peas

Another option is the use of the enzyme with sugary products, such as commercial soft drinks, sweetened dairy products such as condensed milk, and sweetened pastries or pastries. Jams, chocolate, and other sweets also contain large amounts of sucrose. It can also be applied to pure sugar or sugar syrups.

Applications

As a result of our research, different techniques applied to this enzyme have been determined. Each technique will provide us with a **change in texture and a different result** that we will apply according to the consistency we want to achieve.

SUGAR INVERSION

LIQUIFY

SWEETENER

Sugar inversion

> *By breaking sucrose into glucose and fructose, invert sugar is obtained, which has very different functions from grain sugar.*

Invert sugar has very different functionalities and properties from table sugar syrups. That is why by inverting a syrup (which can be flavored with different ingredients), we can use it in different preparations to, for example, maintain the moisture in doughs to have fluffy biscuits and other doughs for much longer. Invert sugar also speeds up fermentation in the dough, which is why it is also widely used in bakeries.

ROSE

By previously macerating the sugar with fresh rose petals, we will obtain a sweet product with a honey texture and all the flavor of rose. You can also add a small amount of rose water to deepen the flavor.

PISTACHIO

To obtain dried fruit honey, it is necessary to extract all its essence in sugar. For that, you have to grind well until you have a homogeneous texture where the enzymes can work to turn it into an inverted sugar, in this case, pistachio.

PINECONE

By macerating green pine cones in a syrup, we manage to retain part of its deep resin and forest flavor, with a notable sweetness that we will pronounce while blending and inverting the sugar present. The result is a pine honey with all the properties of an inverted sugar.

Sweetener

> *Glucose and fructose alone, by their nature, are noticeably sweeter than when they are together.*

When the sugar molecule is broken into its components, we are able to increase the sweetening capacity by 30% compared to normal sugar, achieving a higher level of sweetness without using so much sugar. It also allows you to sweeten fruits that are not yet at their optimum point of ripeness.

PINEAPPLE

Pineapple is a fruit that is already sweet in itself. If the invertase enzyme is applied to a piece that does not have the desired sweetness, it will increase, giving a sensation of pineapple in syrup, but without adding any sugar or sweetener.

Liquify

> *When invertase is applied to a sugar-based preparation, such as candy or fondant, it will lose its structure over time.*

The invertase enzyme, by breaking down the sugar into glucose and fructose, causes the structure and crystallization capacity to be lost. This phenomenon is what gives body to meringues, caramels or fondants, so that, as time passes, they will become liquid.

FILLED CHOCOLATE

When an invertase enzyme is added to a candy and coated with chocolate, the reaction occurs on the inside while the chocolate coating retains the filling as it liquefies. The final result will be a chocolate with a liquid-creamy interior and a more pronounced sweetness.

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Recipes

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Raspberry and rose kakigori

Fort he rose molasses
500g Sugar
150 g Water
50 g Rose petals
25 g Töufood Invertäse

1. In a food processor, lightly crush the rose petals with the sugar, and in an airtight container, reserve the mixture at room temperature for 24 hours.
2. In a saucepan, add the water along with the sugar and the rose petals and heat the mixture at 70ºC until the sugar dissolves. Lower the temperature to 55°C, and add the invertase enzyme. Vacuum pack.
3. Allow the enzyme to act, keeping the mixture for 4 hours at 55ºC. Reserve in the fridge for 24 hours.
4. Finally, heat the mixture to facilitate its extraction and strain through a "superbag" or cheesecloth, extracting the molasses from the solid part.

For the raspberry water
1 Kg Frozen raspberry
100 g Sugar

1. Arrange the raspberries in a bowl with the sugar, film and make some holes in the surface of the film.
2. Microwave on full power for 15 minutes.
3. Once the raspberry has released all its water, pour it over a strainer and leave it straining, without pressing, for 1 hour.
4. Recover the water released by the raspberries and reserve.

For the rose and raspberry kakigori
450 g Raspberry water (preparation above)
6 g Rose water

1. Mix the raspberry water with the rose water, place in a paco jet glass (or a 1L plastic glass) and freeze.
2. Once frozen, unmold and reserve in the freezer.

For the lychee jelly
250 g Lychee water
4 g Töufood Fishgël

1. In a container with very cold water, hydrate the gelatin leaves.
2. In a saucepan, heat a small part of the lychee pulp and off the heat, add the gelatin leaves.
3. Combine the mixture with the rest of the lychee water and curdle the mixture in an airtight container. Reserve in the fridge.

For the almond milk
250 g Raw Marcona almonds
250 g Mineral water

1. Cold hydrate the almonds in a container with water for 24 hours.
2. Crush the almonds with the water in a food processor and strain the result through a cheesecloth.
3. Refrigerate almond milk in an airtight container.

Plating

1. In an ice cream container, place the almond milk at the base, on the surface, break the lychee jelly unevenly. Reserve in the fridge.
2. At the moment of the pass, grate the raspberry and rose kakigori on top, and finish with the rose molasses.

Guava and panela chocolate

For the guava mou caramel
190g sugar
125g Cream
20 g Töufood Glucose Syrup
80 g Guava reduction
40g butter
50 g Milk chocolate
10 g Töufood Invertäse

1. Boil the cream with 80 g of sugar, the liquid glucose and the salt.
2. With the other 80 grams of sugar, make a lightly toasted caramel and add the hot cream.
3. Heat the mixture up to 105ºC and add the butter.
4. Emulsify and continue heating until reaching 115ºC.
5. Pour over chocolate and emulsify. Once the temperature has dropped, add the guava and before it begins to crystallize, add the invertase enzyme.
6. Place in a rectangular mold, film to contact and cool in the fridge.

For the chocolate coating
200 g Dark chocolate 70%

1. Melt the chocolate in a bain-marie.
2. Temper the chocolate.
3. Unmold the mou caramel and encapsulate, creating a thin layer with the chocolate.
4. Let cool.

Plating

1. Let the inside of the chocolate liquefy for 2 days at room temperature.
2. Decorate with gold coloring.

Pineapple in syrup

For the pineapple slices
1 u Ripe pineapple

1. Peel the pineapple and clean any impurities.
2. Cut slices of approximately half a centimeter.
3. With two cookie cutters, cut the outline and remove the heart.
4. Reserve.

For the rum “syrup”
200g Water
10 g Töufood Invertäse
50 g Rum
Mint
Star anise
Juniper berries

1. In a saucepan, mix the water with the rum and the aromatics, and boil until the alcohol evaporates. Let's cool.
2. With the help of a strainer, separate the liquid from the aromatics and reserve them.
3. With a blender, mix the infusion with the enzyme.

For the pineapple in syrup
4 pineapple slices (preparation above)
250 g "Rum syrup" (preparation above

1. In a glass jar, introduce the pineapple with the "syrup" to the rum.
2. Let rest for a day in the fridge.

Plating

1. Drain the pineapple slices and serve whole or sliced.

Cookie, spun candy

For the mou caramel
190g sugar
165g Cream
20 g Töufood Glucose Syrup
0.4 g Töufood Bicärb
1 g Salt
40 g Butter
50 g Milk chocolate
5 g Töufood Invertäse

1. Boil the cream with 80 g of sugar, liquid glucose, bicarbonate and salt.
2. With the other 80 g of sugar, make a lightly toasted caramel and add the hot cream.
3. Heat the mixture up to 105ºC and add the butter.
4. Emulsify and continue heating until reaching 115ºC.
5. Pour over the chocolate, and emulsify. When the mixture reaches 70ºC, add the invertase enzyme and continue emulsifying.
6. Introduce the mixture into a circular mold and let it crystallize in the fridge. Once crystallized, unmold and reserve.

For the sablé biscuit
500 g Plain flour
300g Butter
160 g Icing sugar
2 u Egg

1. Cut the butter into small squares. Put the butter with the flour in the food processor bowl with whisks.
2. Put the shovel and start working at medium speed.
3. Add the caster sugar and salt and continue working until you obtain a homogeneous mass
4. Add the egg and finish incorporating the elements well. Stretch between two parchment paper with 2mm guides.
5. Put in the fridge for 24 hours.
6. Cut the dough into 7 cm rings and form the cookies.
7. Put to cook in the oven at 170°C for 10min.

For the chocolate dipped caramel cookies
chocolate 70%
8 u Sablé biscuit (preparation above)
4 u Mou caramel (preparation above)

1. In a bowl, prepare a chocolate bath, melting it in the microwave.
2. Place the mou caramels between the sablé and introduce into the chocolate bath, place Maldon salt on the surface, and allow the chocolate to crystallize at room temperature.
3. Reserve the dipped cookies at room temperature for 48 hours, and after this time, check the enzymatic liquefaction of the caramel.

Pistachio baklava

For the pistachio molasses
500g sugar
150g Water
300 g Pistachio
25 g Töufood Invertäse

1. In a food processor, lightly crush the pistachios with the sugar, and in an airtight container, reserve the mixture at room temperature for 24 hours.
2. In a saucepan, add the water along with the sugar and pistachios and heat the mixture to 70ºC until the sugar dissolves. Lower the temperature to 55°C, and add the invertase enzyme. Vacuum packing.
3. Let the enzyme act, maintaining the mixture for 4 hours at 55ºC. Reserve in the fridge for 24 hours.
4. Finally, heat the mixture to facilitate its extraction and strain through a "superbag" or cheesecloth, extracting the molasses from the solid part.

For the crunchy filo pastry
2 u Sheets of filo pastry
50 g Clarified butter
Powdered sugar

1. Preheat the oven to 160ºC.
2. On a baking tray lined with parchment paper, place a well-stretched sheet of phyllo dough, and with the help of a brush, paint with clarified butter.
3. Place the other sheet on top and bake for 10-12 minutes, until the phyllo dough is golden brown.
4. Once golden, remove from the oven, let cool and sprinkle icing sugar on the surface.

For the sorbet base
150g Water
40 g Töufood Invërt Sugar
190 g Töufood Glucose Syrup
8 g Töufood Skimmed Milk
5 g Strawberry stabilizer
230 g Sugar

1. Mix the sugar, powdered milk and stabilizer in a bowl.
2. Heat the water with the liquids and heat to 40ºC.
3. Add the dry ingredients in the form of rain and continue heating until reaching 82ºC.
4. Remove from the heat, film the skin and mature for 12 hours in the fridge.

For the raspberry sorbet
400 g Raspberry pulp
70 g Sorbet base (preparation above)

1. In a container, put the sorbet base and the raspberry pulp and, with the help of a blender, blend.
2. Let rest in an airtight container, for 1 hour in the fridge.
3. Churn and reserve in the freezer at -16ºC.

Plating

1. At the bottom of the plate, spatulate a quenelle of raspberry sorbet.
2. On one side of the spatulated quenelle, accompany with the pistachio molasses.
3. Break the filo pastry into irregular pieces with your hands, and place on top of the sorbet and molasses, giving height to the preparation.

Pinecone marshmallow

For the pinecone molasses
500g Sugar
150g Water
300 g Green pinecones
25 g Töufood Invertäse

1. In a vacuum bag, pack the green pinecones with the sugar. Reserve at room temperature for 12 h.
2. Open the vacuum bag, add the water with the sugar and the green pinecones, place in a water bath at 70ºC until the sugar dissolves. Lower the temperature to 55ºC. Again, remove the bag from the bath and add the invertase enzyme.
3. Let the enzyme act, maintaining the mixture for 4 hours at 55ºC. Reserve in the fridge for 24 hours.
4. Finally, heat the mixture to facilitate its extraction and strain through a "superbag" or cheesecloth, extracting the molasses from the solid part.

For the pine marshmallow
110 g Sugar
35g Water
35 g Töufood Invërt Sugar (I)
50 g Töufood Invërt Sugar (II)
30g water
4 g Töufood Fishgel
50g lemon juice
Pine molasses (preparation above)

1. Place the sugar, 35 lemon juice and 35 inverted sugar in a saucepan over low heat, while we continue with the preparation.
2. Meanwhile, break the gelatin sheets and hydrate in 35 g of water. When it is hydrated, melt it at 60 degrees, add the 50 g of inverted sugar and put it in the Kitchen Aid to assemble.
3. When the syrup reaches 120 degrees, remove from the heat to remove the bubbles and pour over the cloud in the form of a thread.
4. When the cloud is well assembled and the temperature has dropped, add the last 50 grams of lemon juice and let it rise.
5. Place in a sleeve with a smooth number 4 spout to pour.
6. In a 7 cm ring, fill to cover 1 cm of the ring and chill in the fridge for 1 hour.
7. Once the marshmallow is set, add the green pinecone molasses in the center, without touching the perimeter of the marshmallow. Top with more marshmallow, seal with the honeycomb seal, and chill again.

Plating

1. At the time of service, introduce pine molasses into three holes formed by the honeycomb seal, plate and serve.

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