GASTRONOMIC APPLICATION OF ENZYMES

Naringinase

Introduction

The enzymes are ingredients that have been relatively unknown in the culinary field, although they have been used in the food industry for several years. By incorporating these ingredients into our restaurant, bar, or pastry shop, we open up the opportunity to achieve **unique textures that would be difficult to attain otherwise.**

In this dossier, we have endeavored to pr**ovide knowledge and insight into how to utilize enzymes and the possibilities they offer.**

We will explain what enzymes are and delve into each of them, ensuring you can grasp their nature and apply them to your own culinary creations.

Acknowledgments

This dossier recipe book has been created by the team of **Gastrocultura Mediterránea S.L.** in collaboration with the pastry team at **I+Desserts**. Together, they have developed Töufood products and crafted tried and true recipes.

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Enzymes

What are they?

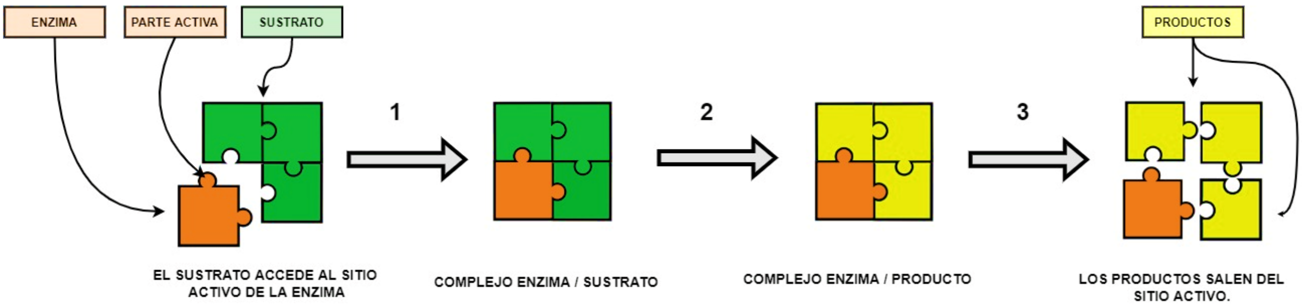
> *Enzymes are proteins that catalyze, or accelerate, biochemical reactions that naturally occur in all living organisms.*

Enzymes are **natural proteins** found in the majority of plant and animal foods we consume daily. When applied to food products, they can be used to **modify certain properties**. Most of these enzymes are generated through the fermentation of natural plant or animal-based products or are even directly extracted from fruits or vegetables.

Enzymes are commonly used to enhance and transform products on an industrial scale. However, until now, there have been very few methods and applications for the restaurant industry.

Unlike other texture modifiers, enzymes are **highly specific**. This means that each enzyme will only work with a particular type of fiber or molecule. The substance that reacts is called the substrate and is transformed into what are known as products.

As depicted in the image, enzymes will only function when **they fit with the specific substrate in question, meaning they will work only when the substrate is compatible.**



How are they used?

Several factors can influence the proper functioning and performance of enzymes, which should be taken into account when using them. This is primarily due to the enzyme's shape and how it fits with the substrate, meaning its specificity.

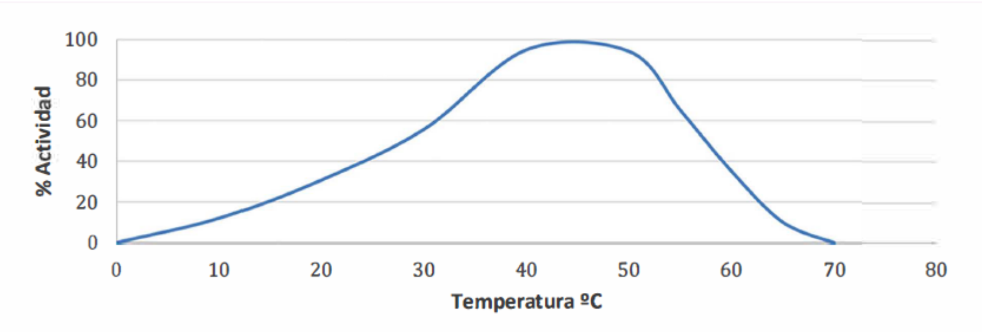
- **The substrate:** If the food does not contain the substrate that the enzyme requires, no reaction will occur. For example, if we apply pectinase to a food that lacks pectin, there will be no change.

- **Accessibility of the substrate:** The substrate must be accessible to the enzyme because if they do not come into contact or fit together, no changes can occur. The main barrier often encountered is the outer skin of vegetables, which is impermeable and does not allow the enzyme to penetrate. To address this, you may need to make cuts in the skin, pierce it, or peel it to enable the enzyme to penetrate.

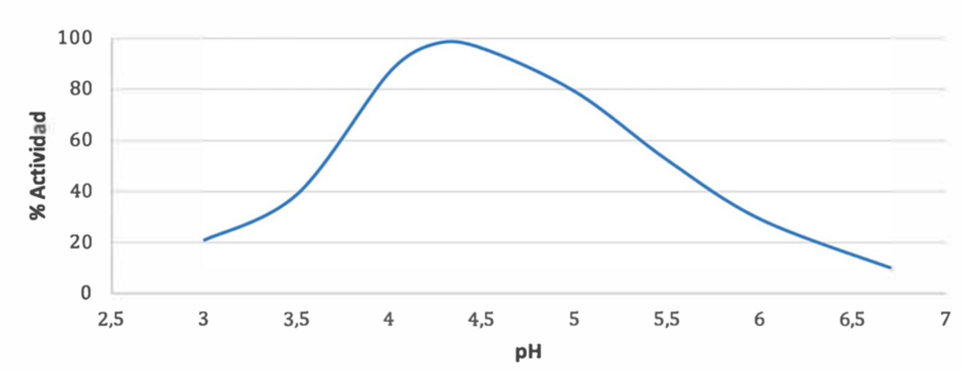
- **Proportion:** If there is a limited amount of substrate, adding a substantial amount of enzyme will not yield a greater effect. Conversely, if there is an abundance of substrate and only a small amount of enzyme, it will work, albeit at a slower rate.

• **Temperature:** Temperature is one of the most crucial factors to consider. Enzymes have a temperature curve that influences their activity, similar to the temperatures used for fermentation:

- → At 0°C or lower, the reaction stops because the product is frozen, and the two components cannot interact. As the temperature increases, this change becomes reversible.
- → Between 0°C and 60°C, the enzyme is active. In most enzymes, there is an optimal temperature range where their activity is at its peak. This range usually falls between 45°C and 60°C, depending on the specific enzyme.
- → At 70°C or higher, the enzyme is irreparably destroyed. High temperatures cause a change in the enzyme's structure and coagulation, making it impossible for the substrate to interact with the enzyme ever again.



•**Acidity:** Enzymes can also be destroyed when exposed to pH levels outside a certain range, rendering them inactive. In culinary applications, it's usually challenging to reach these extreme pH values because they are either extremely acidic or highly alkaline.



To activate the enzyme, it must be hydrated with water or a non-greasy liquid and brought into contact with the food substrate. There are three application methods depending on the desired outcome:

IMPREGNATION

By creating multiple holes or perforations in the product and adding the enzymatic solution, you achieve uniform degradation throughout the product.

INJECTION

This method achieves internal enzymatic degradation while keeping the exterior intact.

SKPRINKLE OR DIP

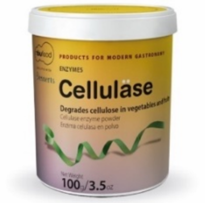
This approach causes the exterior to degrade while preserving the interior.

For optimal performance, it's recommended to peel or pierce the skin across its entire surface and perform impregnation with 2 or 3 cycles of vacuum at 90-95%. If desired, you can finish with a final sealing cycle.

Enzyme range

We have developed a line of Töufood Enzymes specifically designed for use in restaurants and haute cuisine. As of today, this project remains open, with ongoing research for the continuous expansion of the product range to encompass a much wider spectrum of applications.

Pectinase is the enzyme responsible for breaking down pectin in fruits and vegetables, making them tender and providing a cooked texture without actual cooking.



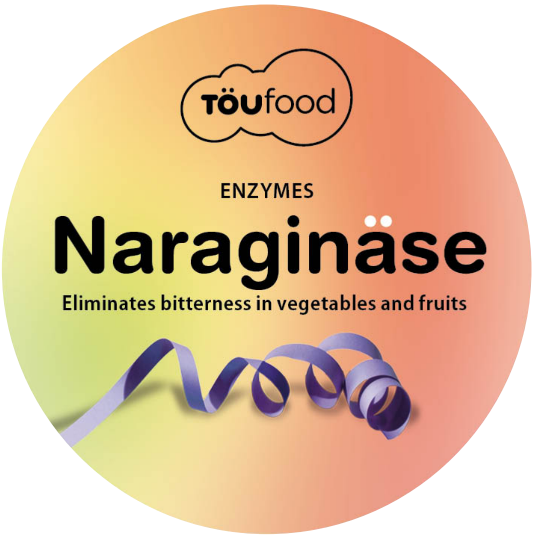
Cellulase is the enzyme responsible for breaking down cellulose in fruits and vegetables, thus breaking down the tough parts of vegetables.

Invertase is the enzyme responsible for converting sugar into inverted sugar, enhancing the sweetness of ingredients and imparting anti-freezing and humectant properties.

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

Glucosidase is the enzyme responsible for breaking down dextrins resulting from the application of amylase, significantly increasing the food's sweetness.

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



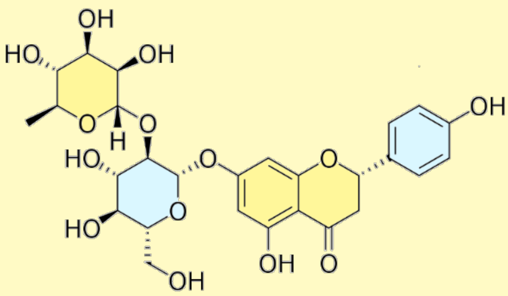
What is it?

La naringinase is the enzyme that degrades naringin, a bittering agent found in plant ingredients, whether they are fruits or vegetables. Depending on each vegetable, it may be more concentrated in the skin, the interior, or distributed throughout the entire piece.

Narinigin

Sanskrit ‘Naringa’ *(Nãriṅga)* means ‘orange’

Flavonoid present in the peel of some citrus fruits and other vegetables, and is the main contributor to their bitter taste. It has antioxidant and antimutagenic properties.

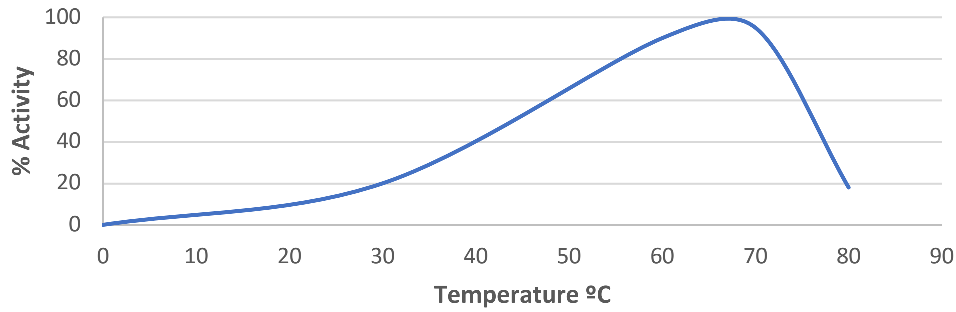


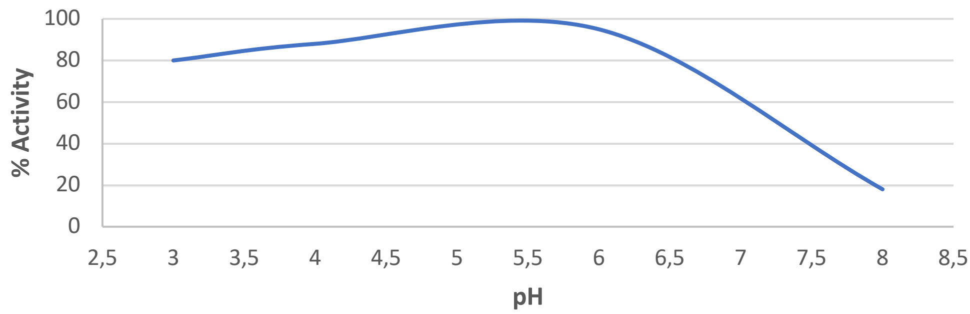
What does it do?

By using Naringinase, we break down the bitter components of vegetables, eliminating or significantly reducing this taste in the food. By minimizing bitterness, other secondary flavors, originally masked, emerge, allowing originally bitter fruits and vegetables to have subtle sweet, herbaceous, floral, or acidic flavors in their natural state.

When to use it?

As mentioned, temperature and pH affect the activity and, therefore, the performance of the enzymes. Below are graphs illustrating the naringinase activity for pH and temperature.





To ensure that the enzyme naringinase works effectively, it is advisable to know the amount of naringin present in the food to be treated. Since naringinase acts only on naringin, it will only work on products that contain it. There are several foods that may contain a small amount of naringin and allow the enzyme's action.

Here is a brief list of some foods that contain naringin:

Vegetables: 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 like condensed milk, and baked goods or pastries containing sugar. Jams, chocolate, and other sweets also contain significant amounts of sucrose. It can also be applied to pure sugar or sugar syrups.

Techniques and applications

As a result of our research, we have identified various techniques applied to these enzymes. Each technique yields a different texture and result, which we apply based on the desired consistency we aim to achieve.

When breaking down the molecules that impart a bitter taste, our perception changes, and we no longer sense it.

BITTERNESS REMOVAL

When naringin is enzymatically broken down, it transforms into another similar molecule, naringenin. Naringenin is a component that imparts no flavor, so, in conclusion, we eliminate the bitter flavors from these ingredients thanks to this enzyme. By removing this bitter taste, we obtain sweet and subtle flavors.

GASTRONOMIC APPLICATION OF ENZYMES

Recipes

Collaborating with:

Lemon albedo with chirimoya

For the albedo cream
50 g Sugar
150 g Lemon albedo
30 g Agua
25 g Zumo de yuzu
5 g Töufood Pectinäse
5 g Töufood Naringinäse

1. Colocar todos los ingredientes en una bolsa de vacío y envasar al 100%.
2. Dejar reposar un mínimo de 24 horas.
3. Pasar por un vaso triturador, hasta que quede homogénea.
4. Colocar en una manga pastelera y guardar para el servicio.

Para la chirimoya a la brasa
4 u Chirimoya

1. Cut the chirimoya into quarters.
2. Grill in the Josper, trying to maintain their shape.
3. Pit and peel carefully.

For the basil seeds
4 g Lemon basil seeds
5 g Water
20 g Simple syrup
15 g Coffee

1. Hydrate the seeds in water for two minutes.
2. Mix the coffee with the syrup.
3. Place the previously hydrated seeds in the coffee and syrup mixture.
4. Reserve for service.

Plating

1. On a plate, place a base of albedo cream and outline it with chirimoya slices.
2. Arrange basil seeds around the chirimoya slices.
3. Grate some yuzu on top and finish with a few basil sprouts.

Black lemon sorbet

For the black lemon peel
500 g Water (I)
15 g Töufood Cälx
200 g Water (II)
10 g Töufood Pectinäse
6 g Töufood Naringinäse
2 Lemon
400 g Simple syrup

1. Dilute Cälx in water (I) and set aside.
2. Dilute the enzymes in water (II) and set aside.
3. Prick the lemon peel with a pin and immerse it in the Cälx mixture for 3 hours, stirring every 15 minutes.
4. Drain the lemons and rinse thoroughly with cold water.
5. Vacuum-seal them with the enzymatic solution and let them act in the refrigerator for 12 hours.
6. When the lemons are degraded but still maintain their shape, remove them from the bag and simmer in a pot covered with syrup over low heat for an hour. Let it cool.
7. Cut the lemons in half horizontally and hollow them out with a spoon, scraping the walls well so that the skin remains whole and completely free of albedo.
8. Make 4 balls with aluminum foil, spray with cooking spray, place the skins on the aluminum balls to keep them in shape, and freeze.
9. Burn the surface of the peel with a torch and reserve in the freezer.

For the lemon caramel
100 g Lemon juice
100 g Sugar

1. Heat the sugar with the lemon juice and raise it to 109ºC.
2. Cool and reserve in a piping bag.

For the almond sablé
85 g Flour
100 g Almond flour
85 g Butter
100 g Brown sugar
5 g Speculoos spices

1. Work the softened butter with the sugar in a mixer with the paddle.
2. Add the flour and spices and work until obtaining a homogeneous dough.
3. Make small balls with the sablé, place them on a tray with a microperforated silicone mat.
4. Bake at 170ºC for 12 minutes.

For the basil oil
300 g Basil
300 g Sunflower oil

1. Process the basil and oil in a food processor at 70ºC for 7 minutes at maximum speed.
2. Place in a cloth filter and let it filter for 12 hours at room temperature.

For the black lemon powder
1 Dried persian black lemon (loomi)

1. Grind the lemon with a grinder and reserve the powder.

For the degraded lemon
1 kg Lemon
50 g Töufood Pectinäse
30 g Töufood Naringinäse

1. Cut the lemons into pieces and vacuum-seal with Pectinäse and Naringinäse.
2. Let it act in the refrigerator for 48 hours until the lemons are completely liquefied.
3. Remove from the bag, crush, and strain.
4. Reserve the pulp to make the sorbet.

Other
Greek yogurt

Plating

1. Pipe an oval disc of yogurt onto the center of the plate. In the center of the yogurt, pipe the lemon caramel, and on top, add the basil oil.
2. Place some almond sablé balls and sprinkle powdered loomi on top.
3. Put the lemon sorbet in a piping bag and fill the lemon peel with ice cream until the top, smoothing the surface.
4. Gently press the half lemon and place it horizontally on the yogurt. Serve.

Frozen orange

For the orange peel
4 Orange
1 L Water (I)
30 g Töufood Cälx
400 g Water (II)
20 g Töufood Pectinäse
12 g Töufood Naringinäse
800 g Simple syrup
800 g Butter

1. Dilute Cälx in water (I) and set aside.
2. Dilute the enzymes in water (II) and set aside.
3. Prick the orange peels with a pin and immerse them in the Cälx mixture for 3 hours, stirring every 15 minutes.
4. Drain the oranges and rinse thoroughly with cold water.
5. Vacuum-seal them with the enzymatic solution and let it act in the refrigerator for 12 hours.
6. When the oranges are degraded but still maintain their shape, take them out of the bag and simmer them in a pot covered with syrup over low heat for one hour. Let it cool.
7. Melt the butter and dip the oranges. Cook for 30 minutes, remove, and let it cool.
8. Cut a horizontal lid and hollow them out with a spoon, scraping the walls well, leaving the skin whole and completely free of pith.
9. Make 4 balls with aluminum foil, spray with grease, place the skins over the aluminum balls to keep them well open and freeze.

For the orange pulp
1 kg Orange
50 g Töufood Pectinäse
30 g Töufood Naringinäse

1. Cut the oranges into pieces and blend them.
2. Vacuum-seal with Pectinäse and Naringinäse.
3. Let it act in the refrigerator for 48 hours.
4. Blend again, strain, and reserve.

For the whole orange sorbet
64 g Töufood Trehalöse
6 g Sorbet stabilizer
300 g Water
60 g Sugar
70 g Töufood Glucöse 35
10 g Töufood Inülin
30 g Töufood Dextröse
80 g Töufood Maltödextrin
380 g Orange pulp (previous preparation)

1. Mix all dry ingredients, except dextrose and stabilizer.
2. Pour the dry ingredients over the water and heat it to 40ºC.
3. Add dextrose and stabilizer, raise to 65ºC.
4. Remove from heat and cool to 20ºC.
5. Combine with orange pulp and emulsify.
6. Mature for 6 hours in the refrigerator, churn, and reserve.

Plating

1. With a piping bag, fill the orange peel with the orange sorbet, giving it volume.
2. Place the lid on the sorbet and serve over crushed ice.

Orange segments sorbet

For the candided orange peel
2 Oranges
200 g Water
10 g Töufood Pectinäse
6 g Töufood Naringinäse
400 g Simple syrup
400 g Butter

1. Prick the orange peel with a pin, vacuum-seal them with the enzymatic solution, and let it sit in the refrigerator for 12 hours.
2. When the oranges are degraded but still maintain their shape, remove them from the bag and simmer in a pot covered with syrup at low heat for an hour. Let it cool.
3. Melt the butter and dip the oranges. Cook for 30 minutes, remove, and let it cool.
4. Cut into quarters and carefully remove the peel, being cautious not to break it.
5. Scrape the inner part to remove albedo and pulp, then cut the peel into rectangles.
6. Reserve.

For the degraded albedo
300 g Lemon albedo
100 g Orange albedo
20 g Töufood Pectinäse
12 g Töufood Naringinäse

1. Crush all the ingredients.
2. Vacuum-seal and let it sit in the refrigerator for 48 hours.
3. Crush again and reserve.

For the albedo sorbet
410 g Water
6 g Sorbet stabilizer
124 g Sugar
80 g Töufood Glucöse 35
10 g Töufood Inülin
90 g Töufood Maltödextrin
30 g Töufood Dextröse
250 g Degraded albedo (previous preparation)

1. Mix all dry ingredients, except dextrose and stabilizer.
2. Pour the dry ingredients over the water and heat it to 40ºC.
3. Add dextrose and stabilizer, raise to 65ºC.
4. Remove from heat and cool to 20ºC.
5. Combine with degraded albedo and emulsify.
6. Mature for 6 hours in the refrigerator, churn, and reserve.

For the degraded orange
1000 g Orange
50 g Töufood Pectinäse
30 g Töufood Naringinäse

1. Cut the oranges into quarters and crush them with the enzymes.
2. Let it sit for 48 hours in the refrigerator.
3. Crush the oranges again and reserve.

For the whole orange sorbet
300 g Water
64 g Töufood Trehalöse
60 g Sugar
70 g Töufood Glucöse 35
10 g Töufood Inülin
80 g Töufood Maltödextrin
30 g Töufood Dextröse
6 g Sorbet stabilizer
380 g Degraded orange (previous preparation)

1. Heat the water to 40ºC and add all dry ingredients, except dextrose and stabilizer.
2. Add dextrose and stabilizer, raise to 65ºC.
3. Remove from heat and cool to 20ºC.
4. Combine with orange pulp and emulsify.
5. Mature for 6 hours in the refrigerator, churn, and reserve.

Plating

1. Place the candied peel on the walls of the segment mold.
2. Fill with a thin layer of albedo sorbet and finish filling the mold with whole orange sorbet.
3. Freeze and unmold.

Orange sorbet

For the degraded orange puree
300 u Orange
100 g Water
5 g Töufood Naringinäse
5 g Töufood Pectinäse

1. In a container, prepare a solution by mixing water with pectinase and naringinase enzymes.
2. Clean the oranges thoroughly and, using a syringe, pierce the peel repeatedly over the entire surface.

For the whole orange ice cream
180 g Degraded orange puree (previous preparation)
130 g Sugar
160 g Water
25 g Töufood Dextröse
3 g Sorbet stabilizer

1. In a bowl, mix sugar, dextrose, and sorbet stabilizer; set aside.
2. In a saucepan, heat water to 40ºC.
3. Add the dry extracts gradually, stirring constantly with a whisk, and heat to 82ºC.
4. Remove from heat, pour the mixture into a sealed container, cover with film, and let it mature for 12 hours in the refrigerator.
5. Mix the sorbet with the whole orange puree using a hand blender, churn, and reserve in the freezer at 16ºC until serving.

For the orange molasses
500 g Sugar
150 g Water
300 g Orange peel
25 g Töufood Invertäse

1. Crush the orange zest with sugar and reserve at room temperature for 24 hours.
2. Add water and heat the mixture to 70ºC.
3. Reduce the temperature to 55ºC and add the invertase. Vacuum seal.
4. Maintain the mixture at 55ºC for 4 hours.
5. Reserve in the refrigerator for 24 hours.
6. Strain through a sieve and reserve.

Plating

1. On a plate, serve three small quenelles, overlapping them.
2. Finish with orange molasses, extra virgin olive oil, and Maldon salt.

Orange pâte de fruit

For the whole orange pulp
3 u Orange
20 g Töufood Pectinäse
20 g Töufood Naringinäse
100 g Water

1. In a bowl, prepare an enzymatic solution by mixing the enzymes with water.
2. On the other hand, quarter the oranges and place them in a vacuum bag.
3. Add the enzymatic solution to the vacuum bag with the oranges and vacuum-seal. Reserve in the refrigerator for 24 hours.
4. After the time has elapsed, in a food processor, puree the oranges until obtaining a homogeneous pulp. Reserve in the refrigerator.

For the orange pâte de fruit
160 g Whole orange pulp (previous preparation)
50 g Water
20 g Sugar
5,5 g Töufood Pëctin LM Nappage
50 g Töufood Glucöse Syrup
230 g Sugar
6 g Töufood Citrïc

1. Divide the sugar into 3 parts. In one of these parts, incorporate the pectin.
2. In a saucepan, mix the whole orange pulp with water and bring to a boil.
3. Once it starts boiling, add the part of sugar and pectin initially, and with the help of a whisk, dissolve well and bring to a boil again. Repeat the process with the remaining two parts of sugar.
4. Add the liquid glucose, stirring the mixture well to integrate the products. Bring to a boil again until reaching a temperature of 103ºC.
5. Remove from heat, add citric acid, dissolving it in the mixture. Next, pour the mixture into a mold with orange wedge shapes and, using a spatula, remove the excess.
6. Reserve in the refrigerator, and unmold once the paste has crystallized.

Lemon curd

For the degraded lemon
3 u Lemon
150 g Water
10 g Töufood Pectinäse
25 g Töufood Naringinäse

1. In a container, prepare a solution by mixing water with Töufood Pectinase and Töufood Naringinase enzymes.
2. On the other hand, clean the lemons well and, with the help of a syringe, puncture the peel several times all over the lemon's surface.
3. In a vacuum bag, introduce the enzymatic solution along with the punctured lemons, and vacuum-seal. Reserve in the refrigerator for 24 hours.

For the lemon curd
3 u Degraded lemon (previous preparation)
30 g Sugar
90 g Butter

1. In a food processor, place the degraded lemons and blend well. Pass through a strainer and reserve the resulting product.
2. Again, introduce the blended lemon along with the butter and sugar into the food processor and blend for 15 minutes until obtaining a fine texture. Reserve in the refrigerator.

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