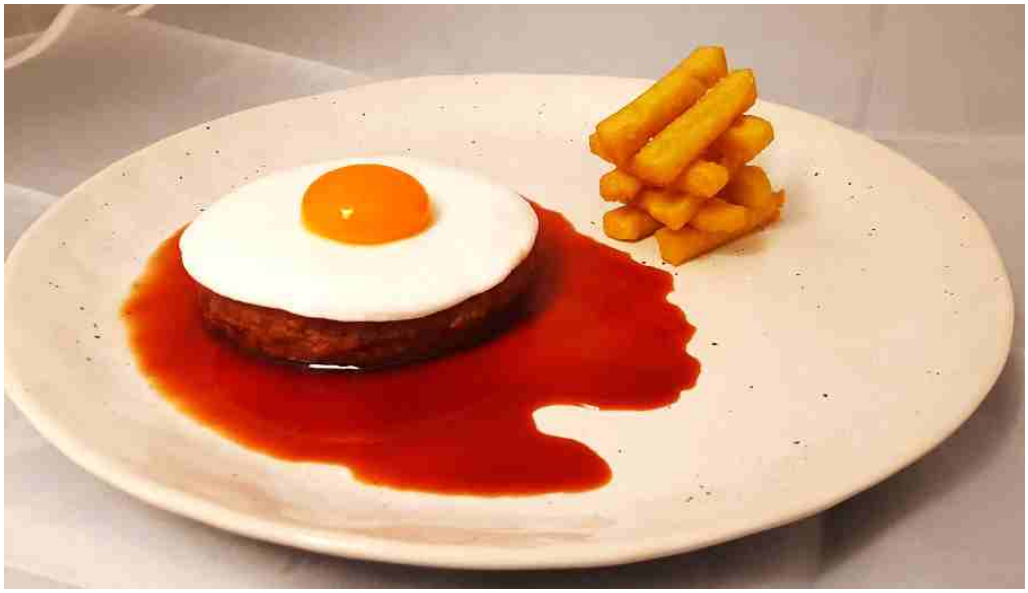
The 8th International Contest for Note by Note Cooking

Playing with Pectins

Note by Note "Bitoque"



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2. Introduction

Pectins are very complex polysaccharides found in the cell walls of all land plants. The main sources for extraction are apples, citrus fruits (lemon, lime and orange) and sugar beet. There are two types of pectins with different functionalities and gelling mechanisms, high methoxylation (HM) pectins (degree of esterification higher than 50%) and low methoxylation (LM) pectins (degree of esterification lower than 50%), which can undergo a transformation to get another type - amidated pectins with low degree of methoxylation.

HM pectin can form gels in aqueous solutions with high soluble solids content and low pH. LM pectin can form gels in the presence of divalent salts, being the most usual the Ca^{2+} ion, in aqueous solutions with low soluble solids content and a wider pH range (Kastner et al., 2012; MasterClass, 2019).

***Table** 1– Characteristics and gelling conditions of HM and LM pectins (adapted from Brejnholt, 2009)*

	HM Pectin	Pectin LM	Amidated LM Pectin
Degree of esterification (DE)	> 50%	< 50%	< 50%
Soluble solids content	65 - 85%	10 - 70%	5 - 65%
pH	2,0 - 3,8	2,5 - 6,0	2,5 - 6,0
Thermoreversible	No	Depends on the calcium content	Depends on the calcium content
Texture below pH 3.5	Firm	Easier to spread, with increased firmness when the pH decreases	Semi-firm, similar to HM, but stiffer
Texture above pH 3.5	Does not form gel, but allows to increase viscosity	Spreadable and slightly soft	Spreadable similar to LM

Pectins can have several applications, acting as gelling agents, thickeners, and emulsifiers, although the most studied is their application as gelling agents.

The “Note by Note” Cuisine, proposed by Hervé This, consists in using pure compounds or fractions of food products, without directly using meat, fish, vegetable or

fruit tissues in order to create new dishes. The compounds used can be extracted from natural products or synthesized (This, 2013).

Many of the pure compounds are already in daily use in kitchens around the world – among which are water, sucrose, sodium chloride – although most people are unaware of this fact. The food industry also uses them, having a much greater diversity of these pure compounds at their disposal than the average consumer at home. When reading the ingredients list of commercial products, some of these compounds, commonly known as food additives, are referred by their common name and/or with the designation "E" plus a three-digit number - which appears in the list of food additives.

3. Goal

The main objective of this work was the production of a Note by Note "*Bitoque"* (traditional Portuguese dish, consisting of a steak with a wine sauce, French fries and a sunny side up egg), using pectins in most of its components, and exploring their various potentialities to get different textures in a savory dish.

Other goals were: *i)* to explore Note by Note cooking to mimic a traditional dish; *ii)* to use Note by Note cooking as tool to develop plant-based versions of products or recipes; *iii)* to get knowledge and practice in producing extracts and dyes from natural products that are compatible with Note by Note cooking; *iv)* to acquire knowledge about analytical methods that can be used to optimize results and improve sensory characteristics.

4. Materials and Methods

4.1. Extracts and dyes production

One of the methodologies used to produce extracts was distillation at reduced pressure, for which a KNF (United States of America) RC 600 rotary evaporator with a KNF SC 920G vacuum pump and a KNF C900 Chiller were used.

Flavoring extracts of onion, mushroom, cheese, onion, beet and vegetable *demi-glace* were produced. The binomial temperature / pressure used for the extractions was 60 °C / 90 millibar. To prevent foaming, some oil was added and/or the ingredients were preheated in *sous-vide* at 60-90 °C – with the objective of denaturing proteins, which can act as foaming and stabilizing agents or enzymes that end up altering the organoleptic properties; and also, to hydrolyze some carbohydrates. At last resource, the excess solids were removed by vacuum filtration or centrifugation (24,500 *g* for 10 minutes) to prevent the extract from becoming too viscous and sticking to the walls of the distillation flask.

To obtain the yellow and red dyes, carrots and red peppers were used. Liposoluble carotenes were extracted using neutral oil and ultra-sounds bath.

The preparation method for all the extracts and dyes is presented in **Appendix**.

4.2. Note by Note "*Bitoque"*

The Note by Note "*Bitoque"* (**Figure 1**) consists of 4 elements: a Note by Note "hamburger", to which a separately prepared texturized coconut fat was added, some Note by Note "French fries", a Note by Note "sunny side up egg" (yolk and egg white preparations) and, finally, a Note by Note "vegetable *demi-glace* sauce". The main goal was to mimic the texture of the original elements and some analytical methods were used to evaluate the best options to achieve this. In some of the elements the intention was to replicate the flavors found in the traditional *Bitoque*, however, other were used as a vehicle to grant unexpected flavors.

Figure 1- Note by Note "Bitoque"

4.2.1. Note by Note "Hamburger"

The Note by Note "hamburger" (**Figure 2**) consists of two elements, mock meat and fat. For the mock meat, several tests were performed until the product with the desired characteristics was reached, which resembled in texture and appearance the real meat. The cooking behavior is also identical to that of meat. The preparation method, original and developed in the context of this work, can be seen in **Table 2**, and was inspired and adapted from Thompson (2019).

Figure 2 – Note by Note "hamburger"

Table 2– *Preparation method for Note by Note "hamburger"*

Ingredients	**Procedure**
• 550 g soy protein (hydrated and squeezed) • 160 g gluten flour • 200 g onion extract (*Appendix, recipe 3*) • 20 g hydrolyzed brewer's yeast • 5 g liquid smoke • 2 g artificial beef bouillon flavoring[1] • 15 g [1.5%] Gelburguer	1. Lightly whisk the texturized soy protein. 2. Pour in the gluten and continue whisking. 3. Separately, mix the remaining ingredients: onion extract, brewer's yeast, liquid smoke, beef bouillon flavoring, beet dye, salt, dextrose, glutamate and essential oils. 4. Add the two mixtures and continue whisking until combined (about 5 minutes). 5. Incorporate the texturized coconut fat, taking care not to break the structure. 6. Knead the mixture lightly, always stretching in the

1 We have used the one from SOSA which is a natural extract, therefore, not vegan.

(SOSA) • 10 g beet dye (SOSA) • 4 g refined salt • 3 g dextrose (SOSA) • 1 g monosodium glutamate • QB of essential oils of garlic, black pepper and oregano • 100 g texturized coconut fat [*preparation below*]	same direction. 7. Shape as desired and seal in vacuum bags. 8. Cook (pasteurize) in the thermostatic bath at 65 °C for 30 minutes. 9. Cool in ice water and store in the refrigerator until serving. 10. To finish the "hamburgers": reheat them in the steamer or using microwave, remove them from the bags, season with salt to taste, transfer to a preheated frying pan with some olive oil and grill until lightly browned.

Note by Note mock meat fat was designed to resemble the fat found in meat that remains partially visible even after it is cooked. In the original methodology developed, a thermo irreversible pectin (pectin *325 NH 95*) was used to resist cooking, and an unstable emulsion was produced, leading to some of the fat separating from the matrix during the cooking process. The mode of preparation can be seen in **Table 3**.

***Table** 3– Preparation method for Note by Note mock meat fat (texturized coconut fat)*

Ingredients	**Procedure**
• 100 g deionized water • 20 g inulin (hot) (SOSA) • 6 g [2%] pectin *325 NH 95* (SOSA) • 1.2 g [0.4%] xanthan gum (SOSA) • 180 g coconut fat (deodorized) • 2 g beta-carotene oil (*Appendix, recipe 1*) • 0.8 g artificial roasted meat flavoring[2] • 500 g water solution with 1% calcium chloride (SOSA)	1. Prepare a solution with water, inulin, pectin, and xanthan, bring it to a boil and then allow it to cool. 2. Meanwhile, melt the coconut fat in the microwave without letting it get too hot and incorporate the carotene oil and roast beef flavoring. 3. With a hand blender, make an emulsion by incorporating the oils into the liquid mixture keeping the container in an ice water bath. 4. Store the emulsion in the freezer, leaving it overnight. 5. Using a food processor, break the frozen emulsion into small granules. 6. Let the texturized fat rest for about 3 hours in the calcium chloride bath to gel the pectin. 7. Wash with abundant water, drain well, and keep refrigerated until the moment of application.

2 *Ibidem.*

4.2.2. Note by Note "French Fries"

The intention was to obtain a product visually identical to French fries, having a crispy outside layer and an interior similar in texture and flavor to cheese (**Figure 3**). In the original process developed, sour tapioca starch was used. The final product looks like French fries and has a slight cheesy flavor. The preparation method is summarized in **Table 4**.

Figure 3 – Note by Note "French fries"

Table 4– *Preparation method for Note by Note "French fries"*

Ingredients	**Procedure**
• 7.5 g [1.5%] methylcellulose (*Metilgel,* SOSA) • 140 g mineral water • 10 g [2%] pectin *Acid Free* (SOSA) • 200 g vegan blue cheese extract (*Appendix, recipe 5*) • 6 g tapioca maltodextrin (*Maltosec,* SOSA) • 6 g inulin (hot) (SOSA) • 10 g beta-carotene oil (Appendix*, recipe 1*) • QB of essential oils of white pepper, nutmeg and rosemary • 55 g sour (fermented)	1. Hydrate the methylcellulose (*Metilgel*) mixing it in hot water. Let the mixture cool in a water and ice bath with constant stirring. 2. Dissolve the pectin in the cold extract, using a hand blender, and take to the vacuum machine to remove excess air. 3. Mix the tapioca maltodextrin (*Maltosec*) and the inulin, then incorporate the carotene and the essential oils. 4. In a mixer, combine the methylcellulose and pectin solutions and gradually add the tapioca maltodextrin (*Maltosec*) and inulin mixture and the remaining dry ingredients. 5. Dispense into rectangular silicone molds, smoothing the surface with a spatula, and cover with a silicone mat or film. 6. Place in a water bath in the oven, preheated to 85ºC, for about 30 minutes. 7. Allow to cool, unmold, and cut into sticks about 8-10 mm long. 8. Before serving, fry the "potatoes" in hot oil (160-180°C)

tapioca starch • 55 g potato starch • 6 g potato protein (*Potato Whip,* SOSA) • 3.5 g refined salt • 1 g dextrose (SOSA)	until golden brown and crispy on the outside. 9. Drain, dry on plenty of kitchen paper, and serve immediately.

4.2.3. Note by Note "Sunny Side Up Egg"

The Note by Note "sunny side up egg" (**Figure 4**) consists of Note by Note "egg white" and "yolk", resembling visually a sunny side up egg. The procedure was inspired by a *Modernist Cuisine* recipe, however the methodology used was developed to use pectin instead of sodium alginate (Adrià et al., 2006; Myhrvold et al., 2011).

Figure 4 – Note by Note "sunny side up egg"

The Note by Note "egg yolk" consists of an encapsulated emulsion, whose color was optimized using colorimetric methods to be analogous to that of an egg yolk, and which behaves like a fried egg yolk. Upon breaking the outer film, the contents are released, looking like a real egg yolk, but it is flavored with truffle oil. The technique used to prepare it, is a pectin based reverse spherification. The emulsion, with added calcium, is introduced into a pectin bath and then the obtained spherification is further placed in a calcium chloride bath in order to reinforce the formed film. Texture analyses was used to find the concentrations and bath times required to achieve a film with characteristics similar to the real egg yolk. The formulation used and the method of preparation are shown in **Table 5**.

***Table 5**– Preparation method for Note by Note "egg yolk"*

Ingredients	Procedure
• 10 g maltodextrin 12DE (SOSA) • 1.5 g dextrose (SOSA) • 10 g [5%] calcium gluconolactate (SOSA) • 0.8 g [0.4%] soy lecithin (SOSA) • 1.2 g [0.6%] xanthan (SOSA) • 1.5 g refined salt • 120 g mineral water • 22 g grapeseed oil • 3 g white truffle flavored oil • 25 g beta-carotene oil (*Appendix, recipe 1*) • 5 g of xanthophyll oil (*Appendix, recipe 2*) • QB of essential oil of white pepper • 250 g water solution with 2% pectin *325 NH 95* (SOSA) • 500 g water solution with 1% calcium chloride (SOSA) • QB of vegetable oil (sunflower, corn, rapeseed, etc.) to preserve	1. Dissolve the solid ingredients (maltodextrin, dextrose, gluconolactate, lecithin, xanthan, and salt) in water. 2. With a hand blender, make an emulsion by incorporating the oils into the aqueous mixture. 3. Take to the vacuum machine to remove the air and let rest for about 1 hour to hydrate. 4. With a 15 ml semi-spherical spoon, drop the yolks into the pectin solution and leave in the bath for 6 minutes to form the gel layer. 5. Rinse the spheres in plenty of water and transfer them to the calcium chloride solution, leave for 1 minute to strengthen the gel structure. 6. Rinse again in water and store the spheres in vegetable oil in the refrigerator.

The texture and color of the Note by Note "egg yolk" were evaluated by texture analyses and colorimetry. The aim was to evaluate the concentration of pectin and the time in the pectin bath which allowed to get the texture of the egg yolk. For the color, the objective was to approach the color of the egg yolk. The results are shown on **Figure 5**, **Figure 6** and **Figure 7**.

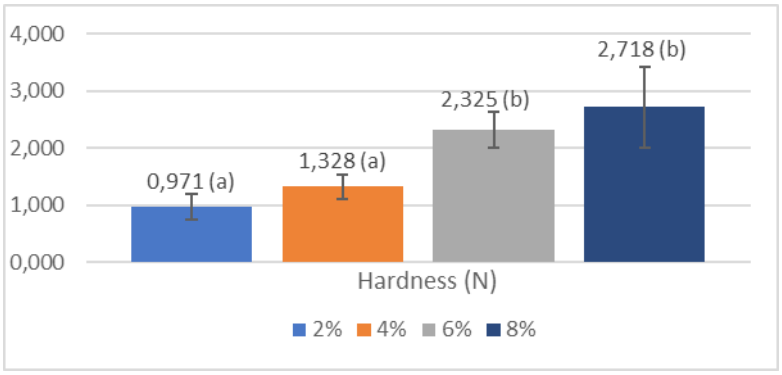

Figure 5 – Comparison of hardness of spherifications using different concentrations of pectin 325 NH 95

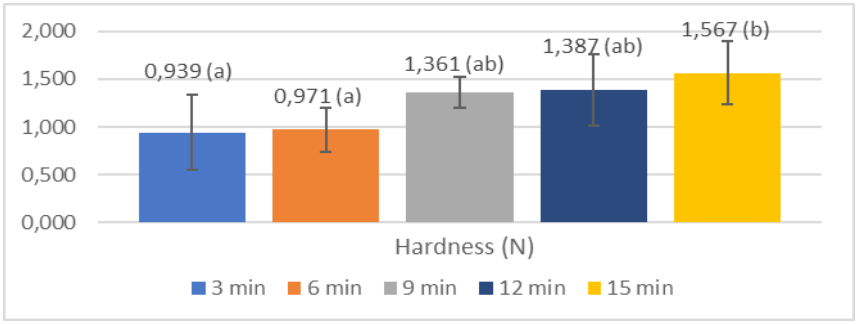

Figure 6 – Comparison of the hardness of spherifications resting different times in the pectin solution (pectin 325 NH 95)

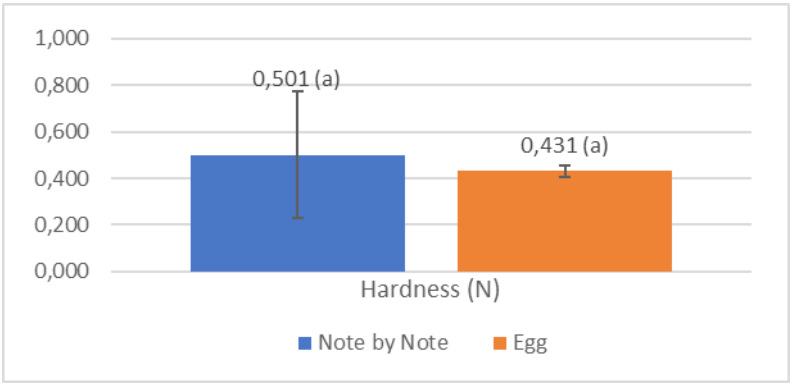

Figure 7 – Comparation of hardness of the Note by Note "yolk" and the real egg yolk

The texture of the Note by Note "egg white" is achieved by a mixture of two hydrocolloids, pectin and methylcellulose. Together they make possible to mimic not only the texture of egg white, but also to make it behave like real egg white when cooking. The methylcellulose solidifies when heated, and the role of the pectin, which is hydrated during heating, is to maintain the desired texture when the "egg white" starts to

cool down and the process of gelification starts. The formulations and the mode of preparation can be seen in **Table 6**.

***Table 6**– Preparation method for Note by Note "egg white"*

Ingredients	Procedure
• 4.5 g [1.5%] methylcellulose (*Metilgel*, SOSA) • 100 g deionized water • 12 g [4%] pectin *Acid Free* (SOSA) • 200 g mushroom extract (*Appendix, recipe 4*) • 3 g refined salt • 1 g white food coloring (titanium dioxide) (SOSA) • QB of essential oil of white pepper • QB of gum arabic (SOSA) • QB of olive oil or cooking oil for greasing	1. Hot disperse the methylcellulose (*Metilgel*) in boiling water using a magnetic stirrer. 2. Put a water and ice bath on the top of the stir plate to cool down the solution and hydrate the hydrocolloid. 3. With a hand blender, cold disperse the pectin in the mushroom extract. 4. Take the preparation to the vacuum machine to remove the air or let it rest overnight. 5. Combine both bases previously prepared and add the remaining ingredients. If you choose to use essential oil, pre-dissolve it in 0.2% (liquid weight) of gum arabic. 6. Heat up a non-stick pan sprayed with olive oil. 7. Grill the egg whites (60 g/pax), over low heat, on both sides (1 to 2 minutes, each) to hydrate the pectin. 8. Serve while still hot putting on top the previously prepared "yolk".

The texture of the Note by Note "egg white" was evaluated by texture analyses. The aim was to evaluate which concentration of methylcellulose and pectin allow to achieve a texture similar to the cooked egg white. The results are show on **Figure 8** and **Figure 9**.

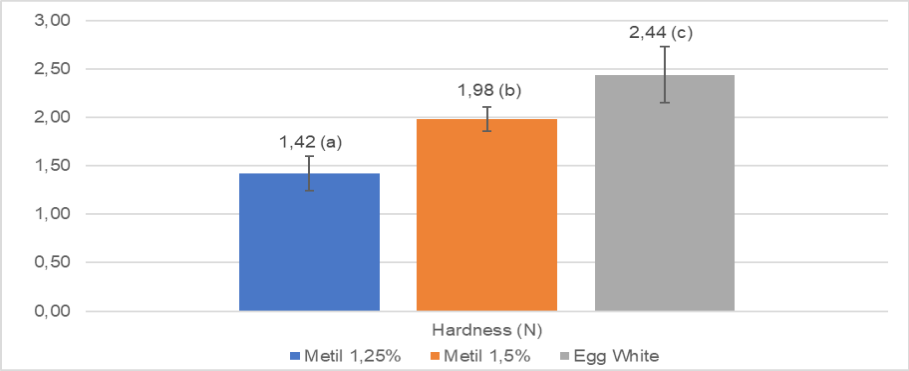

Figure 8 *– Comparison of the hardness of mixtures with different concentrations of methylcellulose and the real egg white*

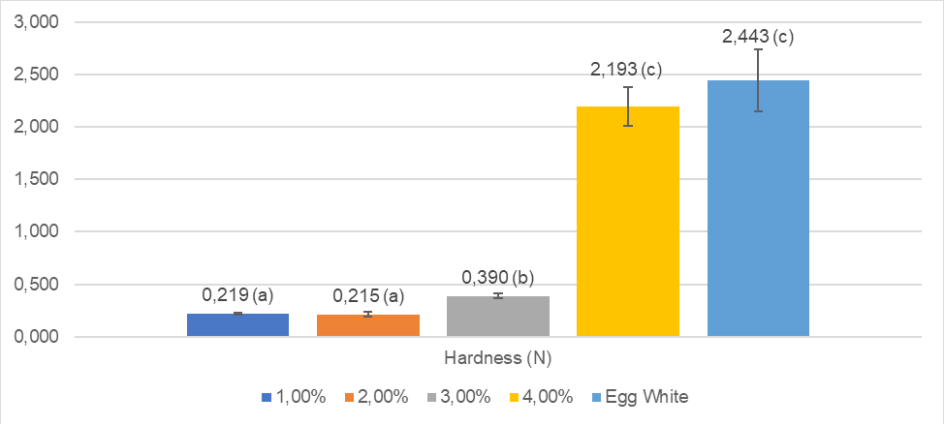

Figure 9 – Comparison of the hardness of the different concentrations of pectin Acid Free and the real egg white

4.2.4. Note by Note "Vegetable *Demi-glace* Sauce"

For the sauce (**Figure 10**), the extract obtained with the rotary evaporator from a vegetable *demi-glace* sauce was used as a base, which in terms of taste and aroma closely resembles a meat *demi-glace.* The method used to remove excess water in order to intensify the flavors was a concentration by centrifugation of the frozen mixture, a method widely used by Heston Blumenthal (2010). Jaune pectin was used to thicken the sauce. The preparation method, based on a version from ChefSteps (2016), can be seen in **Table 7.**

Figure 10 – Note by Note "vegetable demi-glace sauce"

***Table** 7 – Preparation method for Note by Note "vegetable demi-glace sauce"*

Ingredients	**Procedure**
• 340 g vegetable *demi-glace* extract (*Appendix, recipes 7 & 8*) • 40 g liquid caramel • 20 g hydrolyzed yeast • 10 g artificial meat flavoring[3] • 2 g cereal alcohol (vodka) • 1.2 g monosodium glutamate • 0.8 g red wine tannins • 1 g tartaric acid (SOSA) • 120 g beet extract (*Appendix, recipe 6*) • 80 g mushroom extract (*Appendix, recipe 4*) • 2 g port wine flavoring • 2 g brandy flavoring • 3 g of beet dye (SOSA) • 1 g caramel ammonia dye (E150c) • 6 g [1%; 2%[4]] pectin jaune (SOSA) • QB of essential oils of black pepper, coriander seeds and thyme	1. Heat the demi-glace extract with the caramel, hydrolyzed yeast, meat flavoring, grain alcohol, glutamate, tannins and tartaric acid until dissolved, taking care not to exceed 40-50 °C. 2. Meanwhile, mix the extracts and the other ingredients (flavorings, essential oils, colorants, and pectin), stirring well with a whipper. 3. Combine the two mixtures in a container and place in the freezer until frozen. 4. Crush the frozen stock into small pieces. 5. Centrifuge the preparation in a food centrifuge (without a waste basket[5]), taking care to stop the process when the container is full. 6. The process should be repeated until the concentrate obtained corresponds to approximately half of the initial volume (approximately 300 ml). 7. Rectify the salt and store refrigerated (8 °C, up to 1 week) or frozen (-18 °C, up to 1 year). 8. Reheat the sauce to 65 °C, moments before

3 *Ibidem.*

4 1% of the total weight of the preparation; 2% on the weight of the concentrate.

5 For this type of procedure, we use the Malina 2 centrifuge of the German brand Efbe Schott. Available at:
https://www.amazon.de/Efbe-Schott-2-Malina-juice-makers/dp/B0000D85NT

	serving.

5. Conclusion

An informal organoleptic evaluation of the Note by Note "*Bitoque"* made by the students, the advisor and some colleagues allowed us to conclude that the initial aims were achieved with success. The realistic and attractive aspect, the similarity of textures and the pleasant, and sometimes surprising, tastes were referred.

It was a long developing process as each of the referred elements underwent several changes during the optimization process to achieve the desired objectives for the final dish.

Figure 11 – Note by Note "hamburger" fibers

The results obtained for the Note by Note "hamburger" showed that it is possible to make a Note by Note product and a plant-based product, looking like the meat dish. The fact that the meat fibers and their color could be replicated to some extent in the final product allowed to get very close to the texture of the original product (**Figure 11**). The fat also worked as desired since, when cooking the meat, some of it melts and adds some juiciness and greasiness (**Figure 12**), leaving some fat intact, as for real meat fat.

Figure 12 – Note by Note "hamburger" after sous-vide cooking with visible texturized fat

Several versions of the Note by Note "French fries" were made using an oven, although they were good in terms of flavor, they fell short of the desired shape, i.e., the shape of traditional potato French fries. The last version (fried) allowed to overcome this obstacle, and the preparation became quite similar to French fries. When fried, they also take on a similar color, as well as having a crispy exterior and soft interior. Due to the use of tapioca starch, in addition to a cheese flavor, a slightly elastic texture on the inside reminiscent of melted cheese was achieved.

The texture analysis allowed to obtain a Note by Note "sunny side up egg" very similar to a real fried egg, both in relation to the texture of the yolk and the egg white. In terms of flavor, the addition of Himalayan black salt adds a touch of sulfur notes, reminiscent of the taste of a boiled egg. However, when this aroma disappears, it gives way to the remaining flavors of the yolk and egg whites with notes of truffles and mushrooms. As noted in the literature review by Brejnholt (2009) and SOSA (2020), the use of *325 NH 95* pectin to bath the yolk also allowed the outer film of the yolk to be thermoirreversible, so it was also possible for the yolk to be served warm. As far as the egg white is concerned, it is preferable to eat it warm, because it has a better consistency when the gelling is done by methylcellulose, than afterwards when it is due only to the pectin.

Finally, with regard to the sauce, it could have been a little thicker, which can be corrected by increasing the concentration of pectin jaune and/or checking the pH and correcting it, if it is less than 3.5, since at this value it no longer forms gel but increases

viscosity (Brejnholt, 2009). However, it turned out to be quite tasty, perfectly fulfilling its role in the dish prepared.

This work allowed us to acquire an enormous amount of knowledge. Note by Note products development also requires a different, and not always easy, approach and way of thinking that requires training. This project gave us great pleasure and motivated us to continue exploring these new approaches and techniques.

Acknowledgements: We want to thank Professor Paulina Mata, who contributed with her knowledge and advises for the success of this work.

6. References

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7. Appendix

1. Carrot Carotene Oil (Beta-Carotene)

Ingredients:	Procedure:
▪ 500 g carrots ▪ 200 g sunflower seed oil (or grapeseed oil)	1. Peel and chop the carrot coarsely. 2. Place 400 g of the carrot with the oil in a professional blender and grind to a puree. 3. Put the mixture into tubes for centrifugation (70 g/each). 4. Centrifuge for 15 minutes at 15000 rpm (24,500 *g*). 5. Remove the oil (supernatant) from the tubes and transfer to a container with a lid; Discard the pellet. 6. Keep refrigerated and in the dark until the moment of use.

2. Red Pepper Xanthophylls Oil (capsanthin and capsorubin)

Ingredients:	Procedure:
▪ 600 g red peppers ▪ 200 g sunflower seed oil (or grapeseed oil)	1. Wash the peppers and remove the stalk and seeds. 2. Separate 400 g of the pulp with skin from the peppers and leave in the dehydrator at 70 °C overnight. 3. Put the dehydrated peppers with the oil in a blender and grind to a puree. 4. Put the mixture into tubes for centrifugation (70 g/each). 5. Centrifuge for 15 minutes at 15000 rpm (24,500 *g*). 6. Remove the oil (supernatant) from the tubes and transfer to a container with a lid; Discard the pellet. 7. Keep refrigerated and in the dark until the moment of use.

3. Onion Extract

Ingredients:	Procedure:
▪ 600 g onions ▪ 150 g deionized water ▪ 10 g oil	1. Cut the onion into coarse pieces. 2. Put the onion in the blender with the water and grind to a puree. 3. Seal in a vacuum bag and cook in *sous-vide* at 90 °C for 30 minutes. 4. Set the rotary evaporator bath to 60 °C. 5. Remove from the bag and mix with the oil in an evaporating flask (1 L). 6. When the bath reaches the desired temperature, lower the flask and start distillation at 180-200 rpm and vacuum at 100 mBar, lowering progressively to 90 mBar. 7. Wait until the content of the flask with the initial mixture is almost dry or stop bubbling.

Extraction Conditions:
Temperature 60 °C, rotation 200 rpm, vacuum 90 mBar, condenser -5 °C to 5 °C.

4. Mushroom Extract

Ingredients:	Procedure:
▪ 1 kg deionized water, heated (90 °C) ▪ 75 g dehydrated *shiitake* mushrooms ▪ 300 g fresh *shiitake* mushrooms ▪ 10 g vegetable oil	1. Add the hot water and dried mushrooms to a container, cover and leave to infuse for about 30 minutes. 2. Place the fresh mushrooms in a professional blender with the previous infusion and grind to a puree. 3. Freeze the obtained mixture overnight. 4. Extract the liquid from the still frozen preparation using a food centrifuge[6], to obtain about 750 g of a mushroom stock. 5. Set the rotary evaporator bath to 60 °C. 6. Mix the extract with the oil in an evaporating flask (1 L). 7. When the bath reaches desired temperature, lower the flask and start distillation at 180-200 rpm and vacuum at 100 mBar, lowering progressively to 90 mBar. 8. Wait until the contents of the flask with the initial mixture are almost dry or stop bubbling.

Extraction Conditions:
Temperature 60 °C, rotation 200 rpm, vacuum 90 mBar, condenser -5 °C to 5 °C.

6 *Ibidem.*

5. Vegan Blue Cheese Extract

Ingredients:	Procedure:
▪ 750 g deionized water ▪ 750 g grated vegan blue cheese (or any other of your choice)	1. Boil the water and add the cheese. 2. Stir well to homogenize the mixture. 3. Set aside for about an hour. 4. Set the rotary evaporator bath to 60 °C. 5. Distribute the mixture into tubes for centrifugation (70 g/each). 6. Centrifuge for 10 minutes at 15,000 rpm (24,500 *g*). 7. Remove the supernatant from the tubes and transfer to an evaporating flask (1 L). 8. When the bath reaches the desired temperature, lower the flask and start distillation at 180-200 rpm and vacuum at 100 mBar, lowering progressively to 90 mBar. 9. Wait until the content of the flask with the initial mixture is almost dry or stop bubbling.

Extraction Conditions:
Temperature 60 °C, rotation 200 rpm, vacuum 90 mBar, condenser -5 °C to 5 °C.

6. Beet Extract

Ingredients:	Procedure:
▪ 750 g beet juice (1.2 kg) ▪ 10 g oil	1. Cut the beets into pieces. 2. Put the beets in the juice centrifuge. 3. Filter the beet juice using a vacuum filter or place it in a vacuum bag and cook in *sous-vide* at 90 °C for 30 minutes. 4. Set the rotary evaporator bath to 60 °C. 5. Mix the beet juice with the oil in an evaporating flask (1 L). 6. When the bath reaches the desired temperature, lower the flask and start distillation at 180-200 rpm and vacuum at 100 mBar, lowering progressively to 90 mBar. 7. Wait until the contents of the flask with the initial mixture are almost dry or stop bubbling.

Extraction Conditions:
Temperature 60 °C, rotation 200 rpm, vacuum 90 mBar, condenser -5 °C to 5 °C.

7. Vegetable *Demi-Glace*

Ingredients:	Procedure:
▪ 400 g cauliflower ▪ 120 g eggplant ▪ 300 g zucchini ▪ 300 g onion ▪ 250 g celeriac ▪ 200 g carrots ▪ 180 g leeks ▪ 120 g beets ▪ 120 g celery ▪ 80 g fennel ▪ 60 g garlic ▪ 100 g extra virgin olive oil ▪ 100 g red wine ▪ 30 g port wine ▪ 30 g madeira wine ▪ 2.5 kg of filtered water ▪ 1 can peeled tomatoes ▪ 50 g Chinese fermented bean paste ▪ 30 g dried kombu seaweed ▪ 30 g miso ▪ 20 g dehydrated *shiitake* mushrooms ▪ 15 g parsley stalks ▪ 2 g thyme ▪ 2 g coriander seed ▪ 2 g black pepper ▪ 1 g star anise ▪ 0.2 g bay leaf	1. Preheat the oven to 160 °C. 2. Mix the vegetables with the olive oil – this step is optional but prevents them from sticking to the tray – transfer to a convection oven and bake until they take on an even, golden color. Check the vegetables every 20 minutes or so, stir and turn as needed to prevent the edges from burning. 3. Transfer the mixture to a pressure cooker (with at least 6 L capacity) and deglaze the oven tray with the wines. 4. Incorporate the water and the deglazing juices, add all the other ingredients, close and pressure cook for about 45 minutes. 5. Remove from heat, let cool, remove the lid, and skim the fat and foam from the surface. 6. Strain through a *chinois*, squeezing well to extract as much of the broth as possible. 7. Then pass through a fine sieve or *étamine* to remove excess solids. 8. Keep refrigerated until the reduction step, which can be done in a wide-mouth pot or in the rotary evaporator – in the latter case, with the objective of obtaining an extract with the volatiles lost during the concentration process.

8. Vegetable *Demi-Glace* Extract

Ingredients:	Procedure:
▪ **1250 g vegetable *demi-glace***	1. Set the rotary evaporator bath to 60 °C. 2. Put the vegan demi-glace in an evaporating flask (2 L). 3. When the bath reaches the desired temperature, lower the flask and start distillation at 180-200 rpm and vacuum of 100 mBar, lowering progressively to 90 mBar. 4. Wait until the content of the flask with the initial mixture is almost dry or stops bubbling. 5. Remove the extract from the flask, check the yield, and keep refrigerated or freeze until use.

Extraction Conditions:
Temperature 60 °C, rotation 200 rpm, vacuum 90 mBar, condenser -5 °C to 5 °C.