Student Name: Eléonore Boisseau
Student ID: D21127078

Advanced Molecular Gastronomy Report

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International Contest for Note-by-Note Cooking

Course: Advanced Molecular Gastronomy
Course code: TFCS9025: 2021/2022
Lecturer: Roisin Burke
Deadline: 9th May 2022

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Introduction

As Hervé This puts it “cooking is both a technical and an artistic activity” (This, 2016). Through this vision of cooking and his scientific approach to the subject due to his background, This first development molecular gastronomy and molecular cooking through number of his writings back in the 80s to now. The concept of molecular gastronomy is to use the technology and tools from a laboratory and apply it to food, to develop new textures, shapes, flavors, and through all that: molecular gastronomy dishes. This futuristic take on French gastronomy quickly became popular and stirred up curiosity in the gastronomy world. This method is now known world-wide and used every day in restaurants (Burke & Danaher, 2016; This, 2016). Thierry Marx for example, known to be one of the Master of Molecular cooking, sees it as the future of cooking, linking ecology and innovation as it is the only way to go or else there will be no future (De Bei, 2021). While researching molecular gastronomy as well as other topics such as paraethylphenol compounds and how it could improve the flavor of wine that Hervé This first started the concept of Note-by-note cooking with his dear friend and colleague Nicholas Kurti. Note-by-note cooking is an application of molecular cooking, where dishes are made only using or mostly using pure compounds (Burke & Danaher, 2016). Note-by-note cooking was shown by Hervé This to be the future of food as it brings it down to mathematical calculation. It could potentially revolutionize the approach we have to food and how we deal with problems around food and recipes by applying an equation. He estimated the number of potential recipes to be created to be of 10^{30} possibilities (Burke & Danaher, 2016).

To challenge students, scientists and chef’s creativity, the Note-by-Note contest was created in 2012. Each year a specific theme is given, and participants must respect the theme and create a note-by-note recipe. This year’s theme is “Savoury dice and fibers (no Rubik’s cube)”. The two main challenges are then to make something savory, but which is also a good source of fibers. In the previous years, most of the dishes presented were sweet as using technique from French patisserie is an easy entry to note-by-note. For example, it is common to work with glucose syrup in French patisserie, which is a pure compound. The same goes for isomalt, vanillin, baking soda, etc. Applying note-by-note to savoury cuisine may seem more of a challenge at first. Regarding fibers, they have been one of the big topics in nutrition in the past years, especially since the discovery of the role of the gut microbiota and how fibers help keep it healthy. A review done in 2018 and published in Cell Press concluded that dietary fibers is a crucial compound to preserve gut ecology. They also mentioned that novel fibers, such as the

ones that can be used as pure compounds in note-by-note cooking, could be the next-generation prebiotics and help reintroduce essential microbes in our gut microbiotas through their consumptions (Makki et al., 2018).

In this report will be presented my take on the 10th edition of the international contest for Note-by-Note cooking. I will cover the creative process and scientific thinking that was applied and evolved throughout the process, clearly state my final material and method, and finally discuss the results that were obtained.

Aim of the Assignment

The aim of this assignment was to challenge one's knowledge in food science and chemistry as well as their creativity to achieve a note-by-note savory dice containing fibers. The goal was to be as close as possible to pure note-by-note cooking by using most pure compounds or ingredients close to being pure compounds. Finally, it had to taste good and be an original dish as the final goal is to enroll in the Note-by-note competition and surprise the judges.

My personal aim for this assignment was to create a plate called "an ocean breeze". The idea behind it is to have a lemon-ginger meringue cube representing a rock next to the ocean, with the foam from the ocean represented by a lobster cream, and vibrant coral tuiles representing the coral from the water. A sketch was done to show the aim, as shown on figure 1.

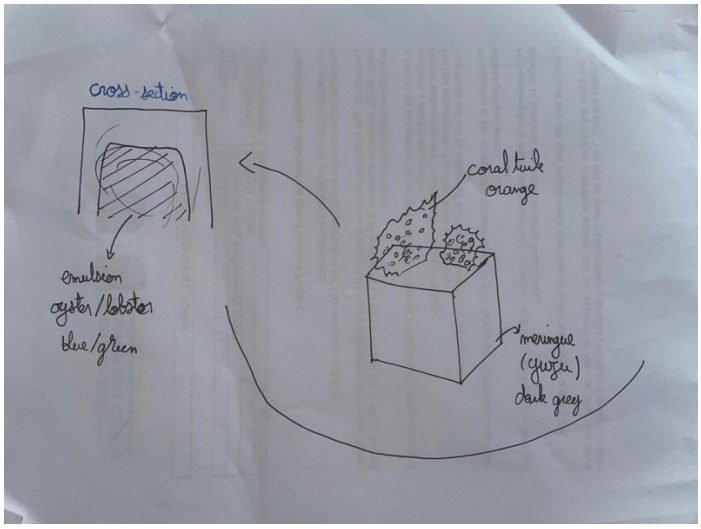


Figure 1 Scheme showing the aim of the plate for the note-by-note project "an ocean breeze". Made by Eleonore Boisseau

Final Material and Methods

Material

- 1 Oven

Electrolux SkyLine Premium Electric Combi Oven 10GN1/1.

More details here: https://www.electroluxprofessional.com/pd/cook-chill/skyline-premium-ovens/skyline-premium-ovens-electric/skyline-premium-ovens-10gn-1-1-electric/skyline-premium-electric-combi-oven-10gn1-1-217822/

Figure 2 Oven used. Source: personal photo.

- 1 Scale
  Dunnes Stores Digital Kitchen Scale, Style #7837422. Graduation of 1g. Can weigh up to 5 kg. More details here : https://www.dunnesstores.com/p/digital-kitchen-scales/7837422.

- 1 Micro scale
  Lidl Digital spoon scale. Graduation of 0,1g. Can weigh up to 0,3 kg. More details here : https://digitalprobox.com/lidl-digital-spoon-scale-to-measure-up-to-300-grams/.

Figure 3 Scale Used. Source: https://www.dunnesstores.com/p/digital-kitchen-scales/7837422.

Figure 4 Microscale used. Source: https://digitalprobox.com/lidl-digital-spoon-scale-to-measure-up-to-300-grams/.

- 1 Immersion hand blender
  From L. Tellier. Variable speed drive - RPM: 22 000 RPM (free speed / no-load speed) – 13 000 RPM (load speed). More details here: https://espacepro.louistellier.fr/Catalogue2020EN.pdf

- 1 Electric whisk
  Planetary mixer, 5L, electronic with hub. COD 600193. More details here: https://www.electroluxprofessional.com/pd/food-preparation/planetary-mixers/5-litres/be5-5-liters/planetary-mixers-planetary-mixer-5-lt.-electronic-with-hub-600193/

Figure 5 Electric whisk used. Source: https://www.electroluxprofessional.com/pd/food-preparation/planetary-mixers/5-litres/be5-5-liters/planetary-mixers-planetary-mixer-5-lt.-electronic-with-hub-600193/

- 1 Siphon (a.k.a. whipped cream dispenser)
  Maximum capacity: 0,5L. Brand ISI. Used with a fluted sleeve. Material: inox, aluminum, and plastic. More details here: https://www.laboutiquedeschefs.com/patisserie-boulangerie/ustensiles-de-patisserie/siphons/siphon-a-chantilly-gourmet-whip-professionnel-05-litre

- 5 Bowls
- 1 skillet
- 1 spatula
- 1 knife
- 1 metal cube cake mold (diameter=12cm)
  Vogue Square Mousse Rings 60x60x60mm Extra Deep. Code: CF165. Material: Stainless steel. More details here: https://www.nisbets.ie/vogue-square-mousse-rings-6x6cm-extra-deep/cf165

Figure 6 Siphon used. Source: https://www.laboutiquedeschefs.com/patisserie-boulangerie/ustensiles-de-patisserie/siphons/siphon-a-chantilly-gourmet-whip-professionnel-05-litre

Figure 7 Metal cube used. Source: personal photos

Ingredients

- White flour type 55 (20g)
- Water (530g)
- Albumin powder (60g)
  Supplier: Sosa. Ingredients: Albumin (eggs and derivatives). More details here: https://infusions4chefs.co.uk/sosa-albumin-powder-egg-white-500g/

Figure 8 Albumin powder used, from Sosa. Source: https://infusions4chefs.co.uk/sosa-albumin-powder-egg-white-500g/

- Inulin powder (15g)
  Plant fibers extracted from chicory root. Supplier: Sosa. Box of 600g. More details here: https://www.indispensables-sosa.com/en/product/hot-inulin

Figure 9 Inulin powder used from Sosa. Source: personal photo

- Salt (3,5g)
- Xanthan gum (0,2g)
- Water-soluble liquid flavors:
  - Lemon natural flavor (0,3g)

Item no. 100.400.190. Dosif. NATURAL AROMA *: 0.2 g / kg (0.2 g = 6 drops approx.)
More details here: https://www.redmondfinefoods.ie/modern-gastronomy-sosa/lemon-skin-natural-aroma-sosa-50g-100.400.190?returnurl=%2fmodern-gastronomy-sosa%2f

Table 1 Table containing photos taken of the lemon flavor used from Sosa. Source: personal photos.

- Ginger flavor (0,2g)
  More details here: https://infusions4chefs.co.uk/sosa-flavour-drop-ginger-50g/

Table 2 Ginger flavor used, from Sosa. Source: https://infusions4chefs.co.uk/sosa-flavour-drop-ginger-50g/

- Lobster flavor (0,4g)
  Item no. 100.400.225. Dosif. AROMA *: 2 g / kg (2 g = 70 drops approx.).
  More details here:
  https://www.redmondfinefoods.ie/modern-gastronomy-sosa/lobster-aroma-sosa-50g-100.400.225?returnurl=%2fmodern-gastronomy-sosa%2f

Table 3 Table of photos of the lobster flavor used. Source: personal photos.

- Coloring agents:
  - Orange powder (0,3g)
    Fat-soluble. Supplier: MSK. Colors: E102, E110.
    More details here: https://msk-ingredients.com/fat-soluble-colours/msk-7715-tangerine-fat-soluble-powder-colour-25g?limit=75

Table 4 Photo of the orange color use, from MSK. Source: personal photo

- Liquid blue (1g)
  Colour: blue E133. Water soluble. Recommended quantity: 4g/kg. Supplier: Il Punto Italiana
  More details here:
  https://www.meilleurduchef.com/en/shop/pastry/ingredients/burgundy-red-food-colouring/mfe-food-colouring-gel-blue.html

- Liquid red (1,2g)
  Colour: Red E129. Water soluble. Recommended quantity: 4g/kg. Supplier : Il Punto Italiana. More details here:
  https://www.meilleurduchef.com/en/shop/pastry/ingredients/burgundy-red-food-colouring/mfe-food-colouring-gel-blue.html

- Liquid green (1,2g)
  Colour: Red E102, E133. Water soluble. Recommended quantity: 4g/kg. Supplier : Il Punto Italiana. More details here:
  https://www.meilleurduchef.com/en/shop/pastry/ingredients/burgundy-red-food-colouring/mfe-food-colouring-gel-blue.html

- Peanut oil (560g)
- Powdered milk (100g)

Methods

1. For the meringue cube:
   a. In a bowl, measure:
      i. 30g of albumen,
      ii. 4g of inulin powder,
      iii. 170g of water,
      iv. 1g of salt,
      v. 0,3g of liquid lemon flavor
      vi. 0,2g of liquid ginger flavor
      vii. 1g of liquid blue coloring (water soluble)
      viii. 1,2g of liquid red coloring (water soluble)
      ix. 1,2g of liquid green coloring (water soluble)
   b. Using a head mixer, mix the mixture for 5 minutes, until completely smooth and no lumps are left.
   c. Whisk for 5 minutes on high speed, or until a peak shape form when the whisk is taken out of the mixer:
   d. Place a layer of aluminum foil under the metal cube and line it with parchment paper.
   e. Using a spatula, add in the meringue mixture Inside the metal cube.

f. Make a cube of (diameter=4cm) using aluminum foil. Line it with parchment paper and place it in the center of the meringue to prevent excessive shrinkage during cooking and to create a hollow center.

Figure 10 Picture showing the desired texture after whisking. Source: https://www.bakefromscratch.com/whip-good-make-perfect-french-meringue/

g. Cook it in the oven at 100C for 20 minutes. Check the meringue and help it keep its cube shape by pushing on the parts that rose from the cube.
h. Continue to cook it for 30 more minutes.

2. For the coral tuile:
    a. In a bowl, add:
        i. 160g of water
        ii. 60g of peanut oil
        iii. 20g of T55 flour
        iv. 0,3g of orange powder coloring agent (water soluble).
        v. 1g of salt.
    a. Heat peanut oil in a skillet on high heat until the oil attains 180C.
    b. Pour in 80g of the mixture in the oil. Be careful as this step can catch fire.
    c. Let cook until a tuile forms, hardens, and becomes mat.
    d. Once done, take the tuile off the heat.
    e. Place the tuile on kitchen paper to absorb the excess oil.
    f. Repeat until you finish the mixture.
3. For the lobster sauce:
    b. In a bowl, measure:
        i. 80g of powdered milk
        ii. 200g of water
        iii. 30g of albumen powder
        iv. 16g of inulin powder
        v. 1,5g of salt
        vi. 0,2g of xanthan gum
        vii. 0,4g of lobster flavor
    c. Mix the mixture using a mixing head on high speed for 2 minutes or until homogeneous with no lumps.
    d. Place the mixture inside a clean siphon and use 1 dose of gaz. Shake the siphon.
4. Plate the 3 items of the dish by placing some of the cream inside the hollow meringue as well as on the plate next to the cube. Place some of the tuile on top of the cube and the rest on the side.

Results

Meringue Cube

Figure 11 Meringue mixture before beating

Figure 12 Cube lined with parchment paper

Figure 13 Meringue cube in the process of cooking

The results for the meringue were very promising regarding the look of the end-product. The goal was for it to look like a cube but also like a rock you would find next to the ocean. This effect was well executed. After the cooking time the meringue was still not completely dry and thus not crispy. Adding maybe 30 minutes to one hour of cooking would have been able to attain that. Unfortunately, the time given to do the lab did not allow me to do so.

Regarding the taste, the ginger and the lemon were hard to notice compared to how pronounced they were before cooking. Increasing the amount of flavor by 30-50% could help it be more pronounced.

Coral Tuile

Figure 14 Coral tuile cooking

Figure 15 Coral tuile end product

The coral tuile was an overall success, whether it came to visual, flavor and texture. The orange color became even brighter after cooking making it a great visual addition to the plate. Moreover, the contrast of texture between the cream, the semi-soft meringue and the crispy tuile allowed for a pleasant experience during the tasting of the plate. In the future, I would try to continue to make tests to manage to not use white flour but pure compounds such as wheat starch, gluten, and other components found in flour. Tests were done previously using potato starch and were unsuccessful, which is why I used white flour for the rest of the prototypes.

Lobster cream

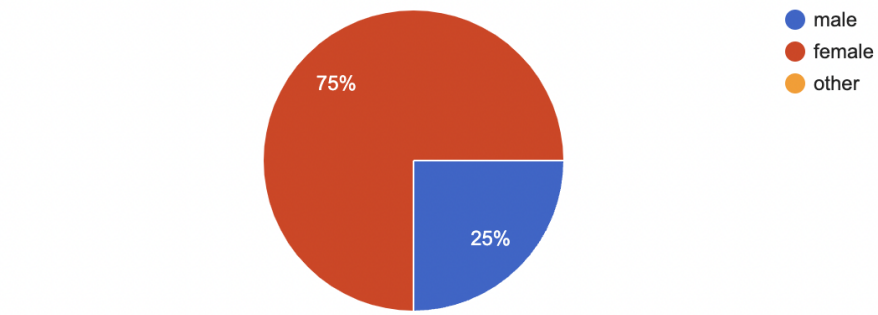
Figure 16 Final product

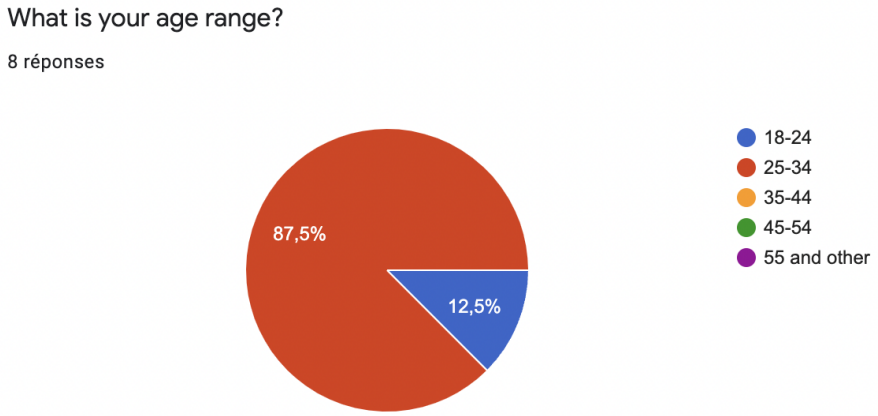
Figure 17 Final product cross section

Making the cream was a challenging part as I had one kitchen session to figure the recipe as my idea evolved so much throughout the sessions, we had to make our note-by-note recipe. The overall cream was a real success, texture-wise and flavor-wise. While making it, the mixture was too liquid and would not have worked if it had been put in the siphon as is. I decided to add albumin powder as well as xanthan gum to thicken the mixture and allow it to form a cream when using the siphon. In the future, I would like to make tests with whey protein powder instead of milk powder, and the use of saturated fats such as shortening to mimic the mouthfeel of milk and its composition. Also, albumin worked great as a thickener and tests could be made without using the xanthan gum.

Sensory Evaluation

Table 5 Table showing the results for each question asked in the sensory evaluation. Number of participants: 8.

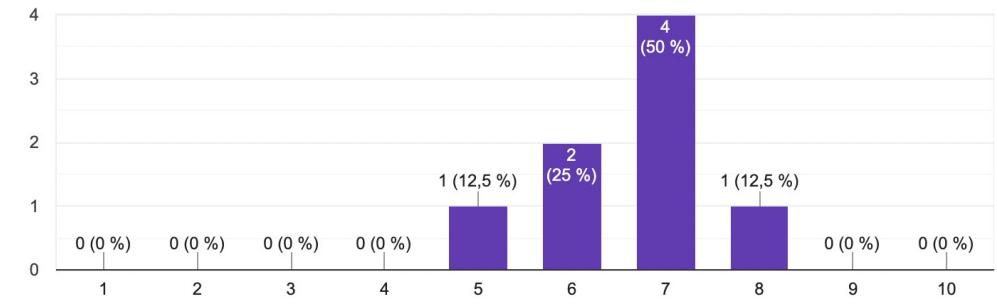




How would you rate the dish?

Copier

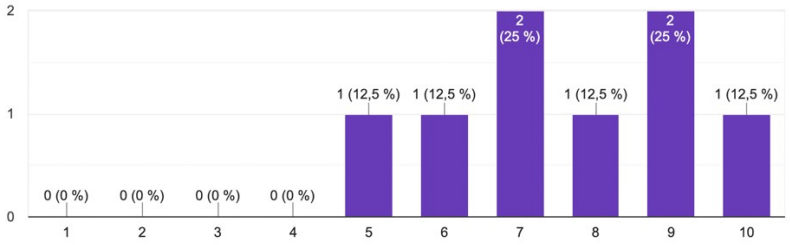
8 réponses



How would you rate the overall texture of the dish?

Copier

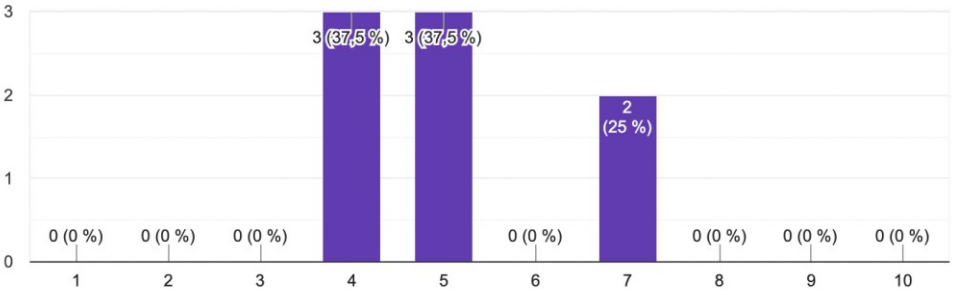
8 réponses

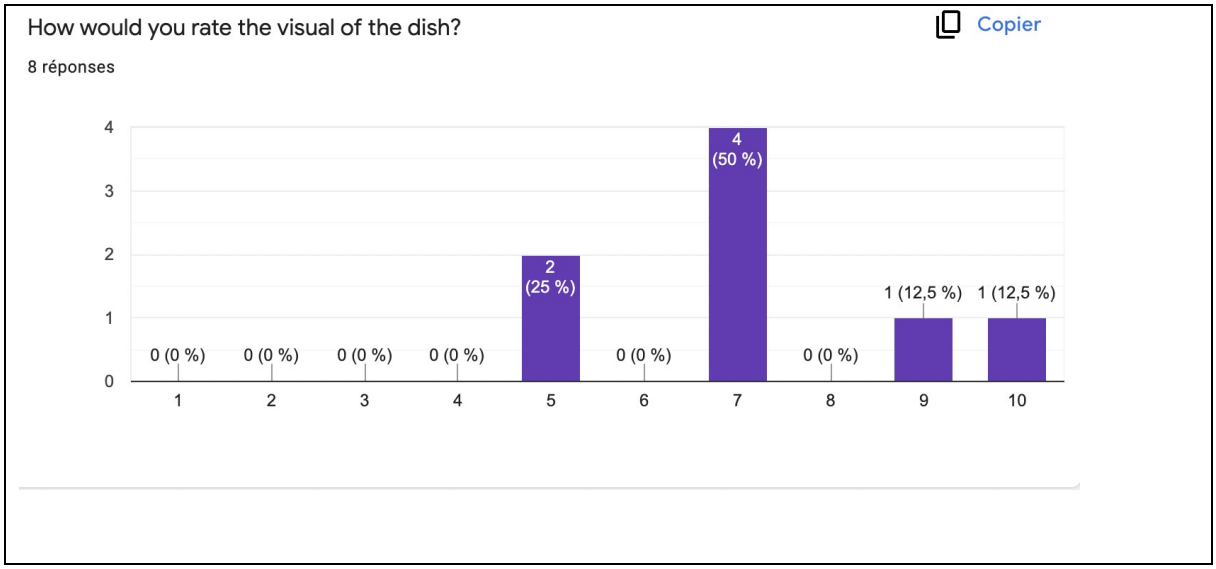


How would you rate the overall flavor of the dish?

Copier

8 réponses





As shown in table 5, a sensory evaluation was conducted where participants were asked to rate the product out of 10 based on 4 criteria: visual, taste, texture, and overall dish. They were also asked about their age range and gender: 8 people participated, 75% of them identified as females, 25% as males. 7 of them were aged between 25 and 34 years old while 1 of the was aged between 18 and 24 years old.

Overall, the dish was quite appreciated as it was given 7/10 by 50% of the participants, and no rating was under 5/10. The same goes for its visual. The texture seemed to be the most appreciated point with 6 of the participants giving it over 7/10 and 3 of them giving over 9/10. The flavor on the other hand was more debated with an average of 5/10.

During the sensory evaluation, comments were given to me by my peers, the main ones were:

- The contrast of textures between the cream, meringue and tuile makes it very nice to eat.
- The lemon flavor and ginger flavor in the meringue is hardly noticeable.
- The visual looks great, especially the tuile.
- Le lobster flavor in the cream comes out very well.
- The dish is great.

Based on this sensory analysis, more work must be done regarding the flavor profile of the dish, especially regarding the meringue cube. The visual, texture, and dish were still overall quite well appreciated making the project promising.

Fiber

The source of fiber used in that project was inulin powder. Inulin comes 100% from chicory root, it is described as a “dietary fiber with prebiotic activity derived from fructose extracted from roots and tubers” it its data sheet from Sosa (Sosa, 2017). Inulin was incorporated in two of the three components of the plate: in the cream and the meringue.
For the meringue, it was taken for granted that 100% of the water would evaporate in the cooking process. The dosage of inulin in the mixture is of 4g for 40g: 10%. For the cream, there is no evaporation as there is no cooking, making the dosage of 16g for approximately 317g: 5%. The technical data sheet from Sosa recommends a dosage of 5 to 10% of inulin, and states that dosing it higher than that may act as a laxative (Sosa, 2017).

Discussion

I decided to use xanthan gum in the cream for its thickening capacities (Katzbauer, 1998) as my mixture was too liquid to cream a creamy texture when used in a siphon. It also helps stabilize an emulsion, and my mixture was made of water and oil. To obtain a thin running sauce, Khymos recommends a dosage of 0.25% (Lersch, 2014). Unfortunately, due to a mistake in my calculation, I only added the equivalent of 0,06% which did not thicken the cream. I then proceeded to use another ingredient to thicken the sauce: albumin powder. I added 10% of it to the mixture and mixed it until homogeneous which gave it a thicker texture making it usable with the siphon. To succeed better at this step, I would make tests without the albumin and with the correct dosage of xanthan gum to see if this is enough to get a proper texture to use in the siphon. I would also make a test with no xanthan gum and only the albumin powder, as this worked well.

The current recipe from the cream uses milk powder, which while being processed, is not a pure compound. I chose to work with milk powder for its distinctive mouthfeel and flavor. Skim milk powder is composed of 32,5% protein, 0,43% fat and 52,1% carbohydrate (Marconi & Panfili, 2016). Those proteins are whey and casein. The whey protein: casein ratio of cow’s milk is 20:80 (Walshe et al., 2021). Knowing this information, future tests could be done replacing the milk powder with whey powder and lactose to start with, and with a more complex mix also using casein and saturated fat if the other tests were unsuccessful. As the cream is not

heated or processed, the point that could be problematic is the mouthfeel and texture but also the taste.

Overall, regarding the cream, I believe that managing to get rid of the albumin and replacing it with only xanthan gum would allow for a better mouthfeel. I also believe that replacing the milk powder with whey protein and other compounds could be an easy switch to something closer to note-by-note. The oil in the mixture could also be replaced by shortening for the specific mouthfeel obtained by saturated fats.

Regarding the tuile, tests were made using potato starch instead of white flour (T55). As shown on figure 9 of week 2 in the logbook bellow, these tests were not successful. There was no wheat starch available that day, hence the use of potato starch. As the number of sessions were limited, I did not have the time to insist on finding a formulation closer to note-by-note by replacing the flour. I did however discuss with my colleagues to try and understand the potential problem and why starch could not work instead of flour. Douglas Fornari, another student from the program, was working on similar tuiles and made tests using a mix of starch and gluten, to mimic the ratio commonly found in white flour, his tests were unsuccessful as well. More tests should be done trying different ratios of gluten and starch, both from wheat origin. Indeed, as explained in the book *Kitchen Smarts*, the process that happens when making tuiles is that: the starch granules firstly get rehydrated and thus separated in the slushy mixture that is prepared. This mixture is then added to hot oil which cause the water to evaporate, through this moving of the water, the granules also move away more from one another. As the frying continues, they dry, lose their mobility, and form this porous network that looks like coral, or laces, giving the final product: the coral tuile (America's Test Kitchen ed., 2017). The starch seems to be the main component causing the formation of the tuile. If the further tests with a mix of gluten and wheat starch are unsuccessful, the next logical step would be to look at the other components found in flour and try to get as close as possible to white flour by adding those to the gluten and starch mix.

For the meringue cube, the use of multiple coloring agents could be replaced by a black coloring agent that is water soluble as this would allow for less ingredients and a faster process. Also, the meringue should be dried for longer until it loses all its moisture and becomes crispy. The cubed shape was not perfect as the meringue retracted on itself during the cooking. I had placed an aluminum foil cube in the center to prevent that, but it still happened. More tests should be done to try and get a shape closer to a cube. Fortunately, as the goal of the plate is for it to look like a rock next to the sea, the visual worked in my favor. One taste that could be

done is to not make the cube hollow, fill it with the meringue, and cut out the center once cooked to fill it with the cream.

The fiber intake coming from this plate came solely from inulin powder. Inulin powder was chosen for its wide range of application and its neutrality. Moreover, having worked in the snack industry beforehand, I was familiar with using inulin powder in recipes and with its challenges, such as obtaining a homogeneous mixture while using inulin. Indeed, inulin powder tends to clump and not mix once it is rehydrated. While the data sheet from Sosa recommends rehydrating it in cold water and leave it as is for 12 hours before usage, I used it as I used to in my previous company and used a head blender to turn the mixture completely homogeneous before using it. To obtain more relevant information regarding the fiber content of the plate and not only the dosage of fiber per component of the plate, but there should also be a weighing of each component of the plate and from there a calculation of the actual fiber content of the plate. It is also important to note that inulin powder is made of 90% fibers and not 100%. This should be considered when calculating the final fiber content of the plate.

Many ideas were tried before getting to the “an ocean breeze” one. Firstly, I wanted to recreate a sushi but with chicken curry flavor. My main idea was to make a conglomele, one of Hervé This’ techniques from his note-by-note book. It consists of making spheres and form one big shape with those spheres by locking them inside a gel (This, 2016). My goal was to make a cube of small spheres ot represent the rice. However, by pouring the gel over the spheres, their shapes were barely noticeable and resulted in a disappointing visual (refer to week 1 of the logbook). Next, another idea came to my mind: to make one bigger sphere through reverse spherification, and trap it in the center of a cube for a clear visual. Unfortunately, as shown on week number 2 of the logbook, making a big round sphere through reverse spherification was complicated and I decided to freeze the mixture instead, and pour the agar around. After jellification and 3 days in the fridge, the blue center had completely diffused inside the red agar solution. I then switch to my meringue idea. For the gel to be successful, tests could be made where the spherification gets done in oil and not water to help prevent diffusion.

Conclusion

In conclusion, this note-by-note project is promising and was a success on most part. Work is still to be done regarding the flavor profile of it, the texture of the meringue, and the

relevance of using certain ingredients. Moreover, it could be improved by aiming towards more pure compounds to stop using other compounds that are currently used such as white flour and milk powder. There could be a reformulation of the cream, drying the meringue more, finding a water-soluble black colouring agent instead of mixing three colors to have a dark grey meringue, and most importantly working on the overall flavor of the dish to be able to detect the ginger and lemon so that they can complement the lobster flavor.

Note-by-note is a novel way of thinking about food and cooking. As a food scientist, it challenged my knowledge in certain additives and pure compounds, while pushing me to be creative and think outside the box. I believe that this introduction allowed me to rethink what cooking means, whether it is for homemade dishes or product development for the food industry.

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Logbook

MODULE CODE: TFCS9025
MODULE TITLE: Food Prototype Development and Evaluation
STUDENT NAME: Eléonore Boisseau
FOOD PRODUCT:

WEEK NO.: 1 **DATE: 28/03/22**

Weekly Aims and Objectives

First test of the product. The first goal is to master the conglomele technique for the “rice” part of the cube. The taste will be more focused on once the technique will be mastered. I will still use flavors to make trials in the meantime.

Materials and Method (Ingredients, Equipment and Method)

Ingredients:

- MSG
- Konjac powder
- red coloring (ideally powder) (ex: red iron oxide, or beetroot)
- titanium dioxide (or Calcium carbonate, or another white coloring agent)
- Rice starch
- Paprika oleoresin (or any orange coloring agent, powder or liquid)
- liquid or powdered inulin
- methylcellulose
- hot pepper flavor
- green coloring agent (powder or liquid)
- Agar agar
- sodium alginate (for spherification)
- calcium chloride (for spherification)
- modified tapioca starch (or other type of modified starch)
- salt
- neutral oil (any type)
- black colouring (powder or liquid)
- Any type of fiber in a powder (cellulose powder…)
- Potato Starch
- Coconut flavor
- Curry flavor
- Chicken flavor
- gelatin (in any form)
- cube mold (silicone ideally)
- Musc flavor
- Rosemary flavor

Note: this ingredients list was sent to Roisin before the first lab session. It was made long and non-exhaustive to be able to adapt my idea based on what was available. The underlined ingredients were the ones used in the end.

Equipment:

- Casserole
- Pipette
- Bowls
- Cube mold

Method:

1. Liquid to be sphered:
    a. 297g water
    b. 3g sodium alginate (1%)
    c. Flavour
    d. 0.5g of red powder coloring
    e. 0,15g of musc flavor
    f. 0,05g of rosemary flavor
2. Calcium bath:
    a. 500ml water
    b. 1g salt
    c. 5g calcium chloride
    d. Prepare calcium bath 500g of water and 5g of calcium chloride.
    e. Whisk very well until well dissolved can be used immediately or stored indefinitely.
3. Sphere making:
    a. Springe into water and leave for 1 minute to 90 seconds.
    b. Rinse under cold water to stop dehydration. If using MSK product it will never set. To keep for service, keep in beetroot juice. The shell life is as long as the product is fresh. Can never be turned back to a liquid.
4. Conglomele mix:
    a. 6g gelatin
    b. 94g water
    c. 10g powdered inulin

5. Final step:
    a. Place the spheres in a cube mold
    b. Pour the gelatin mixture over it
    c. Let it sit for minimum 1 hour in the fridge.
6. Place the mold upside down on a plate.

Results and discussion

During this laboratory session, I was able to try the Hervé This' conglomele technique. The purpose of this technique is to hold together spheres by pouring gelatin over the spheres placed in a mold. The goal here was to make a cube out of all the sphere. Unfortunately, the results were not promising on the visual side of it. The spheres could not be differentiated from one another once in the gelatin mix.

Figure 18 Flavors available.

Figure 19 Flavors available (2)

Figure 20 Flavors available (3)

Figure 21 Flavors available (4)

Figure 22 First trial, conglomele technique done on red spheres from direct spherification. Gelatin was used to hold it together. Note : it was taken out of the mold after only 20minute in the fridge as the lab was coming to an end.

Figure 23 First trial, conglomele technique done on red spheres from direct spherification

Figure 5 and 6 showing promising results as, when not fully set, the spheres are recognizable from one another. However, the shape would not hold.

Conclusions

In conclusion, the conglomele technique, while somehow promising, will not be tested for the second trial.

Recommendations for following week.

I will keep the idea of making a sphere inside a cube, but will use the reverse spherification technique to make one bigger sphere that will be trapped in the cube. The cube will be made with agar and not gelatin this time, to reduce the risk of syneresis. The flavor of the product will be done based on the flavors available.

Ingredients required for the following 2 weeks.

- Calcium gluconate
- Agar
- Neutral oil

WEEK NO.: 2 **DATE: 01/04/22**

Weekly Aims and Objectives

The goal of this session is to try the reverse spherification technique entrapped in a cube of agar solution. It is also to try to make a tuile using starch (I will use the one available) and water.

Materials and Method (Ingredients, Equipment and Method)

Ingredients:

- 200g Neutral oil (rapeseed oil ideally)
- Water
- 5g Sodium alginate
- 10g Calcium carbonate
- 6g Agar
- Salt
- Flavors (tbd)
- Water soluble coloring (tbd)
- 10g of Starch (potato or other)
- Powdered inulin

Equipment:

- Casserole
- Skillet

- Bowls
- Pipette
- Spoons
- Cube mold
- Plate
- Probe

Method:

2. For the cube:
    a. In a casserole, mix the 6g of agar with 294g of water.
    b. Add 5 drops (5x0.05g) of yuzu flavor, 4 drops of rhubarb flavor and 0.3g of powdered red coloring.
    c. Whisk it until homogeneous.
    d. Heat the mixture to 90C by checking the temperature using a probe
    e. Place in a sous vide bag and vacuum the liquid to get rid of bubbles
    f. Pour some of the mixture to 1/3 of the cube mold. Place it in the fridge.
    g. Keep the rest of the mixture at room temperature.
3. For the reverse spherification:
    a. For the sphered mixture:
        i. In a bowl, place the 4g of calcium gluconate with 96g of water with 1.3g of salt and 10g of powder inulin. Add 0.7g of powdered blue coloring and 11 drops of oyster flavor.
        ii. Blend the mixture until homogeneous
        iii. Place in a sous vide bag, and vacuum it until no bubbles are left.
        iv. Place in the fridge
    b. For the alginate bath:
        i. Create alginate bath by combining 5g of alginate in 495g of water.
        ii. Whisk until homogeneous. Blend if necessary.
        iii. Place in a sous vide bag, and vacuum it until no bubbles are left.
        iv. Place in the fridge
    c. For the spherification:
        i. Drop the mango mixture into alginate bath using a spoon previously dipped in the alginate bath to prevent sticking of the sphere.
        ii. Remove after 2 minutes.

iii. Remove into water and wash of solution.

4. Place the sphere on top of the agar that has set in the cube mold.
5. Pour the rest of the agar mixture on top, making sure to keep the sphere as centered as possible.
6. Place it in the fridge.
7. For the tuile with starch:
    a. Mix the 30g of starch with 370g of water into a slurry.
    b. Add in any desired flavoring
    c. Add in 0.5g of blue coloring agent
    g. On high heat, heat the neutral oil in a skillet
    h. Once hot, pour in one third of the starch mixture.
    i. Let cook until a tuile forms and becomes mat.
    j. Once done, take the tuile off of the heat.
    k. Repeat with the rest of the starch mixture
8. For the tuile with flour:
    a. Mix the 30g of white flour with 370g of water into a slurry.
    b. Add in 0.3g of orange powder coloring agent
    l. On high heat, heat the neutral oil in a skillet
    m. Once hot, pour in one third of the starch mixture.
    n. Let cook until a tuile forms and becomes mat.
    o. Once done, take the tuile off of the heat.
    p. Repeat with the rest of the starch mixture
9. For the tuile with starch:
    a. Mix the 30g of starch with 370g of water into a slurry.
    b. Add in 0.5g of blue coloring agent
    q. On high heat, heat the neutral oil in a skillet
    r. Once hot, pour in half of the starch mixture.
    s. Let cook until a tuile forms and becomes mat.
    t. Once done, take the tuile off of the heat.
    u. Repeat with the rest of the starche mixture
    v. While still hot, cut desired shape out of the tuile
    w. Cut the tuile into 5 rectangles matching the size of the cube mold
    c.
10. Plating:

a. Place the cube in the center of a plate.
b. Place the tuile pieces against each side of the cube.

Results and discussion

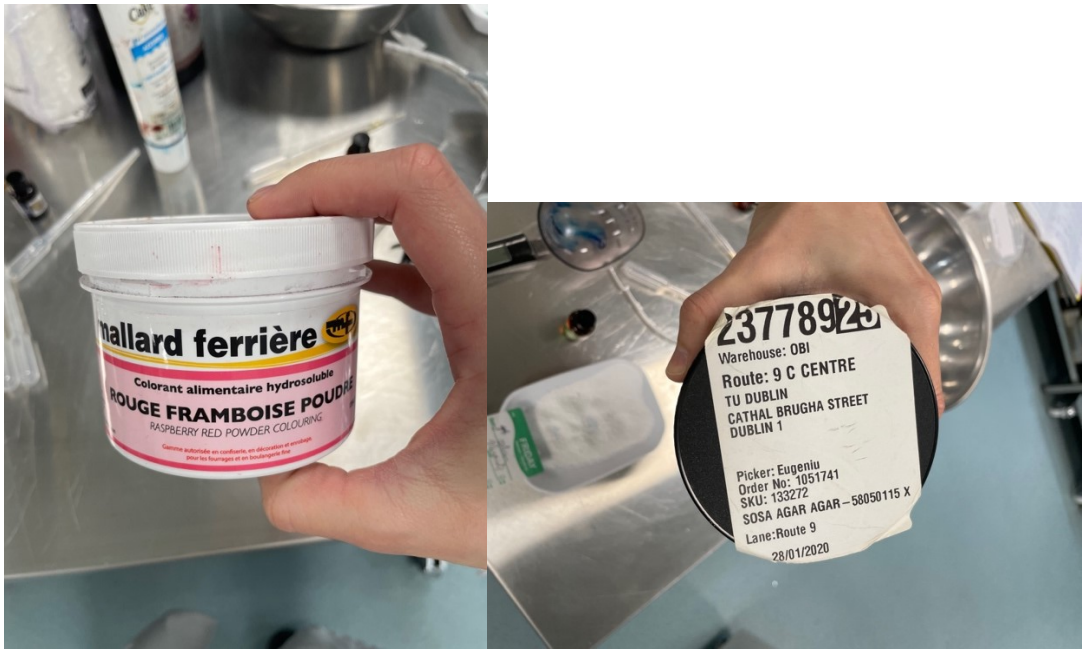

Figure 24 Red coloring used to color the agar cube

Figure 25 Coral tuile made using white flour, orange coloring, water and oil

Figure 26 failed attempt at making coral tuile using potato starch, blue coloring, water and oil

Figure 27 blue coloring used for the sphere and potato coral tuile

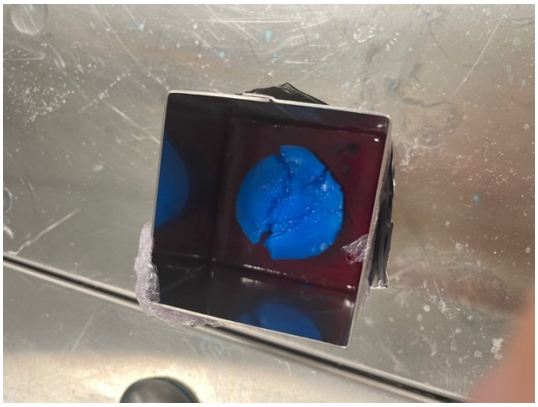

Figure 28 Prototype in the making. Here the first layer pf red agar has solidified and the insert (meant to be a sphere but failed) is placed in the center.

Figure 29 Final prototype

Figure 30 reverse spherification technique. The blue liquid was too liquid for the sphere to form properly once in the bath.

1. Results regarding the agar part of the cube:

   The agar was too strong making the texture of the cube not palatable. It did allow for the cube to hold well.
2. Results regarding the reverse spherification:

   The technique failed as the blue liquid was not viscous enough and would not hold its shape in the spoon, making the shape uneven.
3. Results regarding the flavor:

   ____ must be commented on on Monday after review of the final product

NOTE: these further results are based on observations made on **01/04/22** as the product needed to set before drawing any further conclusions.

Figure 31 End result of the prototype made of agar with a blue insert in the middle on the 01/04/22

Figure 32 Cross section of the end result of the prototype made of agar with a blue insert in the middle on the 01/04/22

Here we can observe that the prototype failed. The blue insert seems to have totally dispersed in the agar body as shown on figure 15, leaving behind an empty pocket in the center and making the whole cube purple or red. The prototype itself was lacking flavor and

Conclusions

In conclusion:

- The goal of having an insert in a jellified cube failed due to the dispersion of the liquid inside to the rest of the cube.

- The flavor combination is promising but more flavor will have to be added for it to be palatable.
- The reverse spherification technique did not result in proper spheres.
- The coral tuile technique is hard to master but is visually appealing and has a great crunchy texture.

Recommendations for following week.

As this prototype was not successful, a new recipe will should be tested the following week, while keeping the coral tuile, and the flavor combination for further tests.

Ingredients required for the following 2 weeks.
Albumen powder

MODULE CODE: TFPD9022
MODULE TITLE: Food Prototype Development and Evaluation
STUDENT NAME: _Eleonore Boisseau
FOOD PRODUCT: _Cube
WEEK NO.:_3 **DATE:04/04/22_____**
Weekly Aims and Objectives

The goals of this week is to try a new technique while keeping the flavors in mind (yuzu, rhubarb and oyster). The technique to be tried today is sugar-free meringue.

Materials and Method (Ingredients, Equipment and Method)

Ingredients:

- White flour
- Water
- Vegetable oil
- Salt
- Yuzu flavor
- Rhubarb flavor

- Lobster flavor
- Oyster flavor
- Flavor enhancer
- Powdered inulin
- Orange powder color
- Blue gel color
- Green gel color
- Black powder color
- Albumen powder
- Milk powder
- Lecithin (any type)

Material:

- Electric mixer with whisk attachment
- Metal cube mold (6cm x 6cm x 6 cm)
- Parchment paper
- Cellophane
- Aluminum foil
- Bowls
- Electric scale
- Electric micro scale
- Skillets
- Spatulas
- Silicone tray

Method:

2. For the coral tuile:
    c. Mix the 30g of white flour with 370g of water into a slurry.
    d. Add in 0.3g of orange powder coloring agent
    e. Add in 0.5g of salt
        i. Method 1 (in frying oil):
            1. On high heat, heat the neutral oil in a skillet
            2. Once hot, pour in one third of the starch mixture.
            3. Let cook until a tuile forms and becomes mat.

4. Once done, take the tuile off of the heat.

ii. Method 2 (on a skillet):

1. Poor a small amount of the mixture to the desired tuile size (about 10cm of diameter)
2. Let it cook until the tuile formed holes and is mat
3. Take it off of the skillet using a spatula

iii. Method 3 (in the oven):

1. Set the oven to 200C
2. Pour 10cm diameters of mixture onto a silicone tray and cook it for 3-5 minutes until the tuile is mat and dry.

2. For the meringue cube:
    a. Whisk together, for 5minutes on high speed:
        i. 30g of albumen,
        ii. 4g of inulin,
        iii. 170g of water,
        iv. 1g of salt,
        v. 10 drops of yuzu flavor
        vi. 10 drops of rhubarb flavor
    b. The mix should form a peak shape with the whisk is taken out of the mixer.
    c. Place a layer of aluminum foil under the metal cube to be able to fill it with the meringue mixture.
    d. Using a spatula, make sure to make space for addition of something in the center of the cube after cooking
    e. Cook it in the over at 120C for 30 minutes.

Results and discussion

Meringue:

The meringue unfortunately got stuck to the cube mold, and had a bitter aftertaste due to one of the flavour compounds. A second test was made using only yuzu flavor and not rhubarb flavor, and the cube mold had been lined with parchment paper that time. The result was more promising than the first one, even though the bitter taste was still present, meaning that it came from the yuzu flavor.

Photos from the 1st test of meringue:

Figure 33 Meringue (1st test) before cooking, no parchment paper

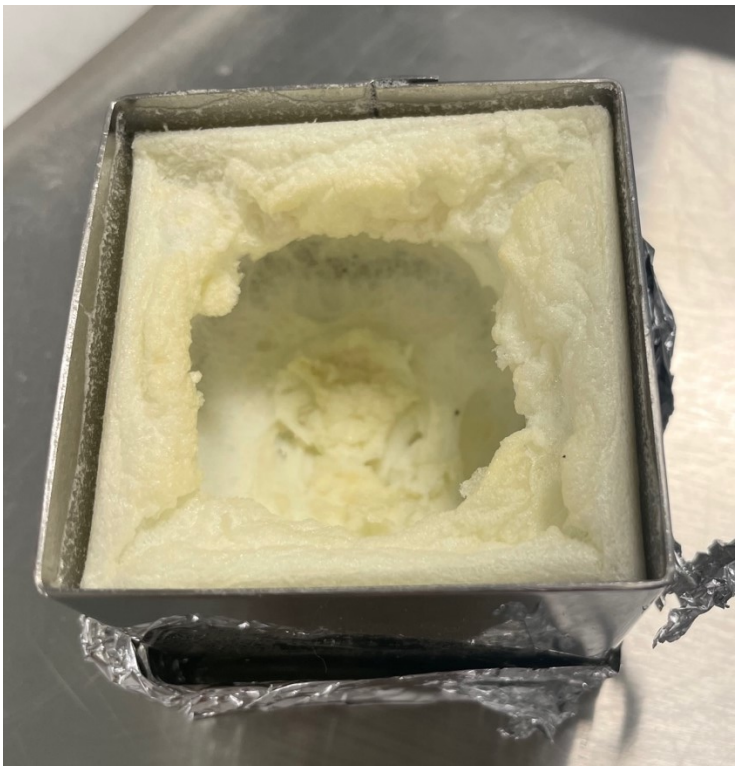

Figure 34 Meringue (1st test) after cooking, stuck to the mold

Figure 35 Meringue (1st test) after cooking, after unstucking from the mold

Photos of the 2nd test of meringue:

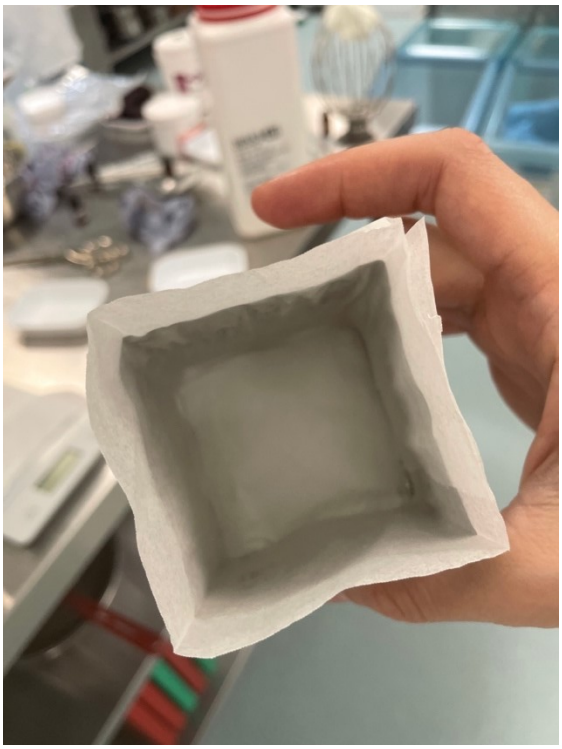

Figure 36 Photo showing how the mold was fully lined with parchment paper

Figure 37 Meringue (2nd test) in the mold before cooking

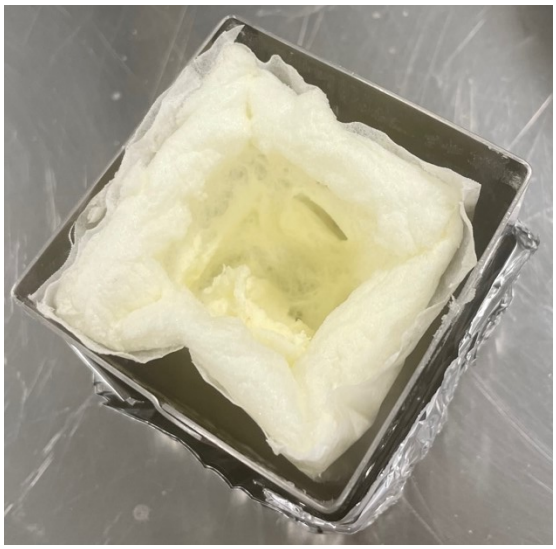

Figure 38 Meringue (2nd test) after cooking. You can observe some retraction

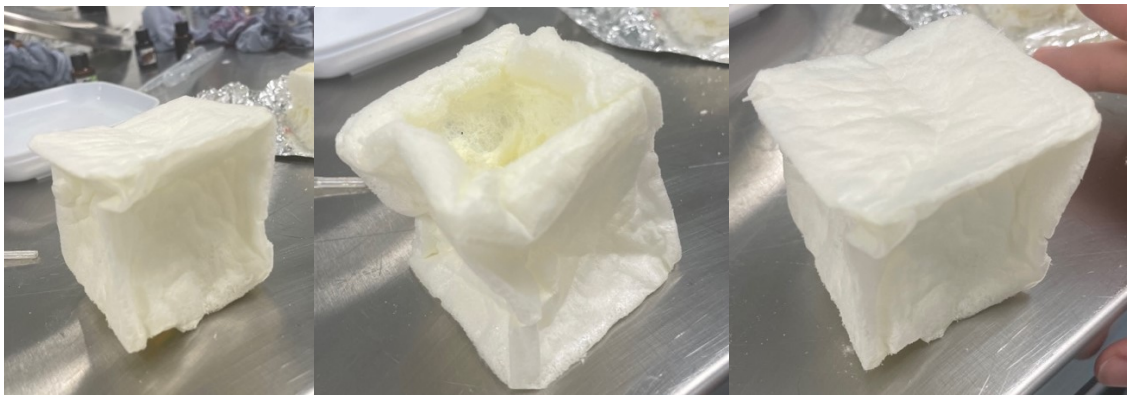

Figure 39 Final result of the 2nd test with meringue

Comments on meringue making:

- The first test was unsuccessful as it stuck to the metal mold, but the second test was promising.
- The meringue should be cooked for longer for it to be fully hard, and ideally at a lower temperature to prevent any undesired browning.
- A cube made of aluminum foil could be placed in the middle (with some parchment paper around it) to keep the shape of the meringue as homogeneous as possible, as the meringue shrank during cooking.
- The first meringue was bitter, probably due to one of the flavors or its amount that was added. The second meringue was done with only yuzu and no rhubarb flavor and the off flavor was still here.

Photos from the tuile making:

Figure 40 End result of tuile making with method 1 (frying oil)

Figure 41 Tuile made with method 1 to the left, and with method 3 to the right

Figure 42 Tuile making, method 2 (on a frying pan)

Figure 43 Tuile making, method 3, in the oven

Figure 44 End result of tuile making in the oven with method 3

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Comments on tuile making:

- Method 2 was a fail as it was impossible to take the tuile off of the pan without breaking it.

- Method 1 gave the most aesthetic result out of the 2 methods tested that were successful. Method 1 had more of that coral visual than method 3, which gave a thinner tuile but without the desired look

Conclusions

In conclusion, this week's trials were far more successful than the one from the previous week. While the project has completely shifted, the idea of flavor combination has not changed. There still needs to be a filling done to put inside the meringue, either a cream, a foam or an ice cream.

Recommendations for following week.

- Line the cube mold with Parchment paper before adding the meringue.
- Put 7 drops of rhubarb flavor and 5 drops of yuzu flavor in the meringue. Add a bit of lemon flavor to increase the citrusy yuzu flavor.
- Place a cube in the middle of the meringue to keep it hollow and prevent shrinkage during cooking. Line this cube with parchment paper as well
- Make the coral tuile using method 1. Add 0.5g of salt in it.
- Add more inulin powder in the meringue to have more fibers.
- Cook the meringue at 100C instead of 120C and for 40-50minutes instead of 30minutes to make sure it is fully dried.

Ingredients required for the following 2 weeks.

- Whey powder
- Lecithin
- Agar

Ingredients required for the following 2 weeks.

MODULE CODE: TFPD9022

MODULE TITLE: Food Prototype Development and Evaluation

STUDENT NAME: Eleonore Boisseau

FOOD PRODUCT: No name yet

WEEK NO.: 4 **DATE: 25/04/22**

Weekly Aims and Objectives

- Make the meringue drier
- Make a cream or or foam to be the filling of the meringue
- Serve the final product

Materials and Method (Ingredients, Equipment and Method)

Material

- 1 Oven

  Electrolux SkyLine Premium Electric Combi Oven 10GN1/1.

  More details here: https://www.electroluxprofessional.com/pd/cook-chill/skyline-premium-ovens/skyline-premium-ovens-electric/skyline-premium-ovens-10gn-1-1-electric/skyline-premium-electric-combi-oven-10gn1-1-217822/
- 1 Scale

  Dunnes Stores Digital Kitchen Scale, Style #7837422. Graduation of 1g. Can weigh up to 5 kg. More details here : https://www.dunnesstores.com/p/digital-kitchen-scales/7837422.
- 1 Micro scale

  Lidl Digital spoon scale. Graduation of 0,1g. Can weigh up to 0,3 kg. More details here : https://digitalprobox.com/lidl-digital-spoon-scale-to-measure-up-to-300-grams/.
- 1 Immersion hand blender

  From L. Tellier. Variable speed drive - RPM: 22 000 RPM (free speed / no-load speed) – 13 000 RPM (load speed). More details here: https://espacepro.louistellier.fr/Catalogue2020EN.pdf
- 1 Electric whisk

  Planetary mixer, 5L, electronic with hub. COD 600193. More details here: https://www.electroluxprofessional.com/pd/food-preparation/planetary-mixers/5-litres/be5-5-liters/planetary-mixers-planetary-mixer-5-lt.-electronic-with-hub-600193/
- 1 Siphon (a.k.a. whipped cream dispenser)

  Maximum capacity: 0,5L. Brand ISI. Used with a fluted sleeve. Material: inox, aluminum, and plastic. More details here: https://www.laboutiquedeschefs.com/patisserie-boulangerie/ustensiles-de-patisserie/siphons/siphon-a-chantilly-gourmet-whip-professionnel-05-litre
- 5 Bowls
- 1 skillet
- 1 spatula
- 1 knife
- 1 metal cube cake mold (diameter=12cm)

Vogue Square Mousse Rings 60x60x60mm Extra Deep. Code: CF165. Material: Stainless steel. More details here: https://www.nisbets.ie/vogue-square-mousse-rings-6x6cm-extra-deep/cf165

Ingredients

- White flour type 55 (20g)
- Water (530g)
- Albumin powder (60g)

  Supplier: Sosa. Ingredients: Albumin (eggs and derivatives). More details here: https://infusions4chefs.co.uk/sosa-albumin-powder-egg-white-500g/
- Inulin powder (15g)

  Plant fibers extracted from chicory root. Supplier: Sosa. Box of 600g. More details here: https://www.indispensables-sosa.com/en/product/hot-inulin
- Salt (3,5g)
- Water-soluble liquid flavors:
  - Lemon natural flavor (0,3g)

    Item no. 100.400.190. Dosif. NATURAL AROMA *: 0.2 g / kg (0.2 g = 6 drops approx.)
    More details here: https://www.redmondfinefoods.ie/modern-gastronomy-sosa/lemon-skin-natural-aroma-sosa-50g-100.400.190?returnurl=%2fmodern-gastronomy-sosa%2f

Table 6 Table containing photos taken of the lemon flavor used from Sosa. Source: personal photos.

- Ginger flavor (0,2g)

  More details here: https://infusions4chefs.co.uk/sosa-flavour-drop-ginger-50g/

Table 7 Ginger flavor used, from Sosa. Source: https://infusions4chefs.co.uk/sosa-flavour-drop-ginger-50g/

- Lobster flavor (0,4g)

  Item no. 100.400.225. Dosif. AROMA *: 2 g / kg (2 g = 70 drops approx.).
  More details here: https://www.redmondfinefoods.ie/modern-gastronomy-sosa/lobster-aroma-sosa-50g-100.400.225?returnurl=%2fmodern-gastronomy-sosa%2f

Table 8 Table of photos of the lobster flavor used. Source: personal photos.

- Coloring agents:
  - Orange powder (0,3g)

    Fat-soluble. Supplier: MSK. Colors: E102, E110.
    More details here: https://msk-ingredients.com/fat-soluble-colours/msk-7715-tangerine-fat-soluble-powder-colour-25g?limit=75

Table 9 Photo of the orange color use, from MSK. Source: personal photo

- Liquid blue (1g)

  Colour: blue E133. Water soluble. Recommended quantity: 4g/kg. Supplier: Il Punto Italiana
  More details here:
  https://www.meilleurduchef.com/en/shop/pastry/ingredients/burgundy-red-food-colouring/mfe-food-colouring-gel-blue.html

- Liquid red (1,2g)

  Colour: Red E129. Water soluble. Recommended quantity: 4g/kg. Supplier : Il Punto Italiana. More details here:
  https://www.meilleurduchef.com/en/shop/pastry/ingredients/burgundy-red-food-colouring/mfe-food-colouring-gel-blue.html

- Liquid green (1,2g)

  Colour: Red E102, E133. Water soluble. Recommended quantity: 4g/kg. Supplier : Il Punto Italiana. More details here:
  https://www.meilleurduchef.com/en/shop/pastry/ingredients/burgundy-red-food-colouring/mfe-food-colouring-gel-blue.html

- Peanut oil (560g)
- Powdered milk (100g)

Method:

5. For the meringue cube:
   f. In a bowl, measure:
      i. 30g of albumen,

ii. 4g of inulin powder,
iii. 170g of water,
iv. 1g of salt,
v. 0,3g of liquid lemon flavor
vi. 0,2g of liquid ginger flavor
vii. 1g of liquid blue coloring (water soluble)
viii. 1,2g of liquid red coloring (water soluble)
ix. 1,2g of liquid green coloring (water soluble)

g. Using a head mixer, mix the mixture for 5 minutes, until completely smooth and no lumps are left.
h. Whisk for 5 minutes on high speed, or until a peak shape form when the whisk is taken out of the mixer:
i. Place a layer of aluminum foil under the metal cube and line it with parchment paper.
j. Using a spatula, add in the meringue mixture Inside the metal cube.
k. Make a cube of (diameter=4cm) using aluminum foil. Line it with parchment paper and place it in the center of the meringue to prevent excessive shrinkage during cooking and to create a hollow center.
l. Cook it in the oven at 100C for 20 minutes. Check the meringue and help it keep its cube shape by pushing on the parts that rose from the cube.
m. Continue to cook it for 30 more minutes.

6. For the coral tuile:
    f. In a bowl, add:
        i. 160g of water
        ii. 60g of peanut oil
        iii. 20g of T55 flour
        iv. 0,3g of orange powder coloring agent (water soluble).
        v. 1g of salt.
    a. Heat peanut oil in a skillet on high heat until the oil attains 180C.
    b. Pour in 80g of the mixture in the oil. Be careful as this step can catch fire.
    c. Let cook until a tuile forms, hardens, and becomes mat.
    d. Once done, take the tuile off the heat.
    e. Place the tuile on kitchen paper to absorb the excess oil.
    f. Repeat until you finish the mixture.

7. For the lobster sauce:
    g. In a bowl, measure:
        i. 100g of powdered milk
        ii. 200g of water
        iii. 50g of vegetable oil
        iv. 30g of albumen powder
        v. 5g of inulin powder
        vi. 0,2g of xanthan gum
        vii. 1,5g of salt
        viii. 0,4g of lobster flavor
    h. Mix the mixture using a mixing head on high speed for 2 minutes or until homogeneous with no lumps.
    i. Place the mixture inside a clean siphon and use 1 dose of gaz. Shake the siphon.
8. Plate the 3 items of the dish by placing some of the cream inside the hollow meringue as well as on the plate next to the cube. Place some of the tuile on top of the cube and the rest on the side.

Results and discussion

Figure 45 Meringue mixture before beating

Figure 46 Cube lined with parchment paper

Figure 47 Meringue cube in the process of cooking

The results for the meringue were very promising regarding the look of the end-product. The goal was for it to look like a cube but also like a rock you would find next to the ocean. This effect was well executed. After the cooking time the meringue was still not completely dry and thus not crispy. Adding maybe 30minutes to one hour of cooking would have been able to attain that. Unfortunately, the time given to do the lab did not allow me to do so.

Regarding the taste, the ginger and the lemon were hard to notice compared to how pronounced they were before cooking. Increasing the amount of flavor by 30-50% could help it be more pronounced.

Figure 48 Coral tuile cooking

Figure 49 Coral tuile end product

The coral tuile was an overall success, whether it came to visual, flavor and texture. The orange color became even brighter after cooking making it a great visual addition to the plate. Moreover, the contrast of texture between the cream, the semi-soft meringue and the crispy tuile allowed for a pleasant experience during the tasting of the plate. In the future, I would try to continue to make tests to manage to not use white flour but pure compounds such as wheat starch, gluten, and other components found in flour. Tests were done previously using potato starch and were a complete fail, which is why I used white flour for the rest of the prototypes.

Figure 50 Final product

Figure 51 Final product cross section

Making the cream was a challenging part as I had one kitchen session to figure the recipe as my idea evolved so much throughout the sessions we had to make our note-by-note recipe. The overall cream was a real success, texture-wise and flavor-wise. While making it, The mixture was too liquid and would not have worked if it had been put in the siphon as is. I decided to add albumin powder as well as xanthan gum to thicken the mixture and allow it to form a cream when using the siphon. In the future, I would like to make tests with whey protein powder instead of milk powder, and the use of saturated fats such as shortening to mimic the mouthfeel of milk and its composition. Also, albumin worked great as a thickener and tests could be made without using the xanthan gum.

Conclusions

In conclusion, this kitchen session was a success, and I am satisfied with the final prototype I was able to present. There still are many points of improvement such as working on the formulation of the cream, drying the meringue more, finding a water-soluble black colouring agent instead of mixing three colors to have a dark grey meringue, and most importantly working on the overall flavor of the dish to be able to detect the ginger and lemon so that they can complement the lobster flavor.

Recommendations for following week.

NA

Ingredients required for the following 2 weeks.

NA