Note-by-Note dish “Ukrainian fortress”

Note-by-Note assignment

TFCS 9025: Advanced molecular gastronomy

Prepared by:

Artem OSMOLOVSKYI

Student No.: D22126828

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Introduction

Molecular gastronomy may be defined as a scientific discipline to understand better culinary transformations; usage of typical chemistry lab equipment for food preparation is defined as molecular cooking (Burke, *et al.,* 2021). Idea not new itself (Marcus, 2013), but regarding public's need in new experiences an innovations, is popularized by enthusiasts and molecular gastronomy co-creator Herve This.

Note-by-Note approach is far more radical – This (2014) suggests us to forget about ordinary ingredients and to use and combine the ones which are as pure as possible. Like combination of the notes in the melody. Chef should think about all the aspects of the dish and he/she is not limited to pre-defined ingredients characteristic. In his book *Note-by-note cooking: the future of food* (2014), Herve This is explains the equivalence of natural and synthesized molecules on the example of water to show that we (as a public) shouldn't be afraid of the synthesized substances. However, monsieur This is not paying enough attention to the matrix and its role in health consequences of food consumption. Drinking demineralised water may have undesired health consequences (Kozisek, 2005). It is a widely-known fact that we need minerals in water for proper functioning (Rosborg, *et al.,* 2019).

In the same way we can argue the importance of matrix in digestion of minerals and nutrients. Micellarization and intestinal uptake of carotenoids shown to be impacted by dietary fat content (Mashurabad, et al., 2017). Aren't we refusing the role of other constituents of the food matrix when using Note-by-Note approach? Yes, at least to some extent. Using pure compounds makes it difficult to mimic nature-created systems with thousands of compounds in them. Current state of art in science cannot research and describe the role of each of the constituents in the complex systems due to large number of compounds virtually possible and actually present in the world.

Complexity of compound understanding can be clearly shown on example of Thalidomide tragedy where anti-nuasea drug appreared to have teratogenic effects (Kim and Scially, 2011)

The (R)-isomer shows needed anti-nuasea effects, whereas the (S)-isomer is teratogenic. Some time it was believed that using pure optical isomer it would be possible to avoid side effects, but later it was discovered that under biological conditions, the isomers interconvert, so separating the isomers before use is ineffective (Vargesson, 2015). But it is not the case for all compounds that have isomers. Stereochemistry and chirality are extremely important and already being investigated to create more effective and safer drugs (Chhabra, 2013). Can we still say that the same chemical compound synthesized by different approaches is definitely the same? Yes and no. For the simple systems (like in water synthesis) parameters can be controlled quite well and

there are not so many opportunities for the reaction to go another way than predicted. But synthesizing big organic molecules is not easy. Even peptide synthesis requires much effort (reference to author's experience in organic chemistry). Reactions are not going completely to the end, rather equilibrium is created. By-products are created. And current methods of analysis still are not able to identify clearly each of the synthesized products in most of the reactions.

Taking into account the argumentation above, differentiation between naturally and synthetically produced compounds seems logical and justified.

Pharmaceutical industry uses a lot of solvents due complex and numerous purification processes (Morales-Gonzales, et al., 2021) thus generating relatively high environmental footprint (Martín-Matute, et al., 2021). Extracting pure compounds for Note-by-Note (NbN) can be also connected to risk of excessive usage of resources for the sake of purity.

Ultra-processed food is associated with obesity and cardio-metabolic risks; cancer, type-2 diabetes and cardiovascular diseases (Elizabeth, et al., 2020). Being ultra-processed, NbN dishes may lead do undesirable health effects if being consumed regularly. Can it be "the future of food"? Let time show the trends and outcomes.

According to Bruke (2021, p.816) referring to measurements by Julien Binz, NbN cooking is "twice as fast and half as expensive to produce (compared with ordinary restaurant meals)". We can accept the fact that NbN may require less energy usage and being more time- and cost-effective. But can it be a solution for the households? Health concerns remain.

Potential interest in NbN is for "cooking as an art" where the chef has unlimited number of variations. The cook has to think about all aspects of food: shape, consistency, colour, odour, taste, trigeminal sensations, nutritional properties and temperature (This, 2014).

NbN can be able to satisfy novel-seeking behaviour in humans and provide creators with opportunities they haven't had before. It creates a high-profitable niche for product development taregeted on high-income experience-seeking individuals, on author's own opinion.

Regarding food waste and NbN, further research should be done to evaluate ecological footprint of dishes created. However, some of potential benefits include compactness of matter which leads to lower transportation costs and lower storage prices. It may help to reduce foodwaste as well. Powdered forms have also longer shelf-life than traditional components with high water activity (fruits, vegetables, meat, milk products). There is a possibility that more products will be delivered to the consumer in a good condition, bought by him/her during shelf-life and still have

a significant time reserve before expiration date, enabling consumer to use the product in a comfortable rhythm.

NbN can also find its applications in particular dietary needs, where person/patient cannot receive traditional food and alternatives are needed.

Food waste has lots of definitions. One of the lastest is provided by Girotto et al. (2015) citing European Project FUSIONS:

> Any food, and inedible parts of food, removed from (lost to or diverted from) the food supply chain to be recovered or disposed (including composted, crops ploughed in/not harvested, anaerobic digestion, bio-energy production, co-generation, incineration, disposal to sewer, landfill or discarded to sea).

Greenhouse gases emissions and excessive resource usage are linked to and though to be driven by the food waste, among other factors (Schanes, *et al.,* 2018). At least 1/3 of all food is wasted and more than 1 million tones are wasted each year in Ireland (Colgan, 2019).

"Private households have been identified as key actors in food waste generation" (Schanes, *et al.,* 2018).

Thus, food waste problem should be solved on different stages – through the whole chain of The Farm to Fork Strategy of the European Union (EU).

Shelf-life extention can become one of the solutions (Spada, *et al.,* 2018) with possible six-fold waste reduction with frozen foods in comparison with fresh foods (Martindale and Schiebel, 2017). Note-by-Note approach, as discussed earlier, can prevent food waste because of long shelf-life of most of its constituents which are delivered and stored in powder form or stabilized solutions stored in ambient conditions.

Second approach is to reduce food waste during production process.

A large-scale problem for EU population and Ireland in particular is vitamin D deficiency.

> Vitamin D deficiency has again become a major public health interest with its association with osteoporosis, osteomalacia, fractures, and more recently with prevention of cancer, diabetes, heart disease and other chronic illnesses. (Holick, 2010)

Mushrooms are widely consumed worldwide and provide multiple health benefits (antitumor, immunomodulating, antioxidant, radical scavenging, antihypercholesterolemia, antiviral, antibacterial, hepatoprotective, and antidiabetic effects) due to the presence of lectins, vitamins

(i.e., vitamin D_2) polysaccharides, phenolics and polyphenolics, terpenoids, ergosterols in them (Roncero-Ramos and Delgado-Andrade, 2017).

Up to 20% of mushrooms are wasted because they don't meet specifications. Mushrooms are also reach in ergosterol which is converting to vitamin D2 under UV irradiation. Thus, mushroom waste can potentially be valorized by food and pharmaceutical industries (Papoutsis, et al., 2020).

In the idea of Note-by-Note dish Vitamin D enrichment is regarded as a strategy to fight deficiency related to lifestyle providing 15 μg (daily reference value for adult) of the vitamin per portion (EFSA, 2016).

Aim of the assignment

Aim: Create and develop an original dish which is as close as possible to note-by-note cooking and deals with food waste topic.

Objectives:

1. Define "deals with topic of food waste" meaning for the current project.
2. Conduct a relevant literature research and discuss critically the topics of molecular gastronomy, Note-by-Note cooking and food waste.
3. Design a prototype and define ingredients needed.
4. Apply a fundamental "trial and error method" of problem solving, enriching it with scientific evidence wherever possible.
5. Document the steps taken and produce a report on data collected.

Final materials and methods

Equipment

SkyLine Premium Combi Boiler Oven with digital control, 10x1/1GN

Robot coupe Mini MP 160 V.V.

La Minerva Vacuum Packaging Machine Pack 16 (Brodericks equipment asset tag 46447, tested 10/08/2022) Program parameters (SEL= SELECT, Vac=99, Gas=0, Sal=2.0)

Polar C-Series Upright Fridge 600Ltr

Weighing scales SliverCrest (Model No. HG09439D, version 06/2022)

HomeDepo Digital Kitchen Scales 500g*0.01g (Model B0BKJRQBMH)

5L mixing bowl (2 pieces)

2L mixing bowl (3 pieces)

Spoon (Stainless steel 7oz.)

Knife set (LIDL)

2 oven trays (roasting tins)

2 kitchen towels(Dunnes stores)

Nonstick baking paper

Plastic vessels for weighing

Vac pack bags large (3)

Saucepan size 20 (stainless steel vogue)

Tala A10550 Stainless Steel Measuring Spoons, 5 Piece Set for Measuring Dry and Liquids

Transparent manual wrapping film Rapok Cling Film Food Grade

Damp muslin cloth

*some equipment naming was not found in Equipment Stores Inventory obtained on my request and precisions are thus missing regarding models and trademarks. However, the difference in them won't change the result significantly. Main equipments are oven, scales and Robot Coupe Mini. Details for them are provided.

Ingredients

For curd part:

Ingredient	Quantity, g	Producer	Comments
Fresh milk 3.5% fat	500	Arrabrawn	2L pack
Brown sugar	60	Gem Pack foods Ltd.	Ingredients: sugar (98%), Cane molasses. Better to use white sugar.
Citric acid	1.5	Louis François	E330 Acide citrique Monohydrate. Batch: 245C1 Best before: 04/2024. Specific maximum level: quantum satis (ANNEX II, Part B of Commission Regulation (EU) No 1129/2011)
Blue colorant	0.5	il Punto Italiana	E133 (Cake decoration®, concentrated gel, 100g pack, ingredients: water, glucose syrop, sugar, E406 Agar Agar, E422 Vegetable glycerine, E202 potassium sorbate, E330 citric acid). Maximum dosage: do not exceed 3g per kg of product.

For yellow sphere part:

Ingredient	Quantity, g	Producer	Comments
Water	460	TU Dublin water supplier	Tap water
Calcium lactate	20	MSK Ingredients Ltd.	MSK-3859. Batch:44348, Best before end: May-22 Ingredients:calcuim lactate. Value pack 1kg
Brown sugar	20	Gem Pack foods Ltd.	Ingredients: sugar (98%), Cane molasses. Better to use white sugar.
Granny Smith Apple (natural)	0.25 (5 drops)	MSK Ingredients Ltd.	Water soluble flavour drops, 30ml. Batch: MSK-7942/46576 Best before end: Feb-23. Ingredients: natural flavouring substances, triacetin (E1518), propylene glycol (1520)
Champagne-Type flavouring	0.15 (3 drops)	MSK Ingredients Ltd.	Water soluble flavour drops, 30ml. Batch: MSK-1633/40990 Best before end: Apr-21. Ingredients: flavouring substances, propylene glycol (1520)
Lemon yellow liquid colouring	0.95	Mallard Ferriere	E102. Ingredients: water, tartrazine 1,74%, sodium chloride and sulfate 0,26% 0,2%, sodium benzoate. In foodstuffs, concentration limited to 2-2,5 g/kg. Can have undesired effects on children's activity and attention. Production date: 01/12/2023, DDM: 01/12/2023, Lot number: 5711304, pack: 100 ml

For 1% sodium alginate bath:

Ingredient	Quantity, g	Producer	Comments
Water	495	TU Dublin water supplier	Tap water
Sodium alginate	5	MSK Ingredients Ltd.	MSK-3857. Batch:30765, Best before end: Jan-20 Ingredients:pure sodium alginate E401. Value pack 1kg

For cookie part:

Ingredient	Quantity, g	Producer	Comments
Cornflour	51.8	Gem Pack foods Ltd.	500g pack
Brown sugar	14.75	Gem Pack foods Ltd.	Ingredients: sugar (98%), Cane molasses. Better to use white sugar.
Banana powder	8.6	Sosa Ingredients S.L.	Freeze dried. Code Sosa: 39475, Batch: L7LI21270, production date 27/09/2021, best before: 27/09/23. 600g pack. Ingrdients: Banana. May contain trace amounts of milk and derivatives.
Ovalbumin	6.8	Sosa Ingredients S.L.	Albuwhip. Powdered egg albumin. Ingredients: albumin. 500g pack. Lot and

			production date: 040820, Best before: 04/08/22, code Sosa: 00200510, health mark ES 40.069089/B CE
Gluten	4.6	Spiegelhauer	Best before: 11/04/2024
Refined sunflower oil	36	The King. QP Foods UK LTD	Produced in Ukraine. Net weight 4600g (5L). Cholesterol free
Xanthan gum	see in the recipe	En-place Foods UK Ltd	Lot: L00762. Best before: 12/06/24, 300g pack. Recommended concentration: 1g for 300ml

Methods

Blue curd part:

1. Weigh 1.5g of citric acid and 60g of brown sugar in a plastic vessel for weighing.
2. Weigh 500g of milk in a saucepan.
3. Add ingredients prepared on stage (1) to saucepan with milk (2).
4. Add 0.5g of blue colourant.
5. Heat until milk coagulates.
6. Filter through a damp muslin cloth.
7. Serve on the plate.

Yellow sphere part

Alginate solution: weigh 5 g of sodium alginate and add to 495g of water in the saucepan. Use Robot coupe Mini MP 160 mixing for 5 min on speed 4 to dissolve alignate. Vaccum pack using large vac pack bag using La Minerva Vacuum Packaging Machine available in the kitchen. Put the obtained solution in the fridge at -4°C for 24h.

Main solution (yellow Ca lactate solution):

1. Weigh 20g of calcium lactate and 20g of brown sugar in a plastic vessel for weighing.
2. Dissolve the mixture (1) in pre-weighed 460g of water in 2L mixing bowl using spoon. It may take take some time. If needed, light heating in the saucepan may help.
3. Add 5 drops of Granny Smith Apple and 3 drops of Champagne-Type flavouring to room temperature solution (wait until cools down if heated before).
4. Weigh and add 0.95g yellow colouring.
5. Mix with the spoon to homogenize the solution.
6. Vaccum pack using large vac pack bag using La Minerva Vacuum Packaging Machine available in the kitchen.
7. Put the obtained solution in the fridge at -4°C for 24h.

Main solution (after 24h)

1. Take the solutions of alginate and calcium lactate prepared 24h before
2. Put them in 2 separate 2L bowls.
3. Take Tala measuring spoon with 2cm diameter and fill it as shown on Figure 2 (left). Cover it with manual wrapping film and put in the freezer for 60 min.

4. Check whether the solution freezed, if yes – unwrap it, extract the hemisphere formed and put it in aligante bath solution for 2 min.
5. Take the formed sphere out of the alginate bath and put in 2L bowl of fresh water.
6. Take out in 10-20 sec and use for final composition of the dish.

Cookie

1. Add to 2L bowl 51.8 g of corn flour, 14.75g of brown sugar, 8.6g of banana powder, 6.8g of ovalbumin, 4.6g of gluteln and 36 g of refined sunflower oil.
2. Mix for 2 min to obtain homogeneous dough.
3. Take 20g of obtained mixture and add 0.5g of xanthan gum, add 2 drops of water and mix for 2 min to make dough homogeneous.
4. Take a tray, cover with anti-stick paper and form a concave hemisphere of the mixture obtained at stage (3).

Results

Blue curd part

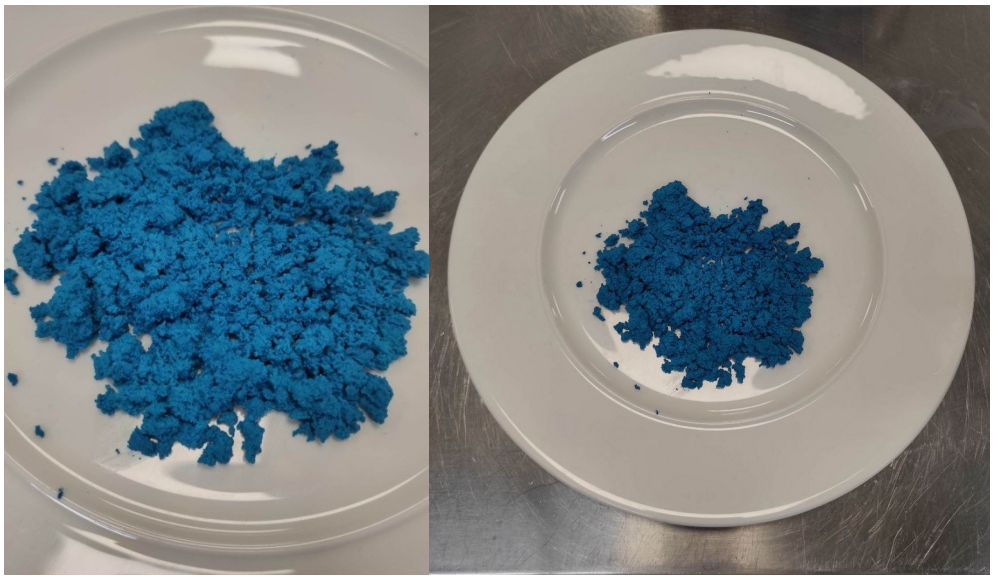

Figure 1. Blue curd part of the dish obtained by acid-driven coagulation of casein.

During week 3 blue curd part recipe was finally accepted and result is shown on the Figure 1. Curd has a blue colour, sweet and creamy taste.

Coagulation will be discussed in Discussion part. Here it is only important to mention that in order to reduce citric acid usage 3g/L solution was used which led to very light sourness, which is almost not perceivable because of creamy and sweet taste of the curd.

Yellow sphere part

Freezing (Figure 2) was used to make sphere formed during reverse spherification more stable in the shape, giving time to form a proper gel structure. Afterwards, frozen sphere was immersed to alginate solution for reverse sphericication.

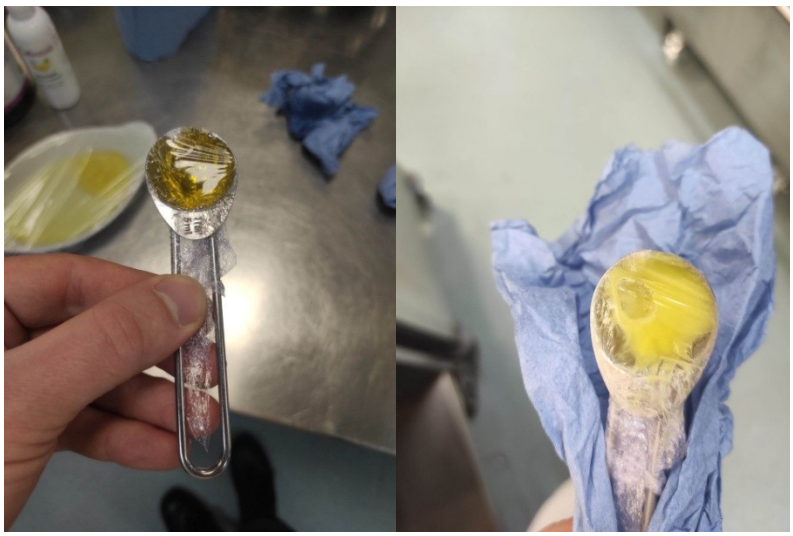

Figure 2. Main solution containing calcium lactate before (left) and after (right) freezing.

Cookie part

Addition of xanthan gum helped to make dough more elastic. Banana flavor incorporated by freeze fried banana powder according to manufacturer's instructions.

Figure 3. Cookies obtained with simplified recipe and xanthan gum addition.

After initial tasting, formed cookie (figure 3) was made and placed to the oven. Upon readiness, it was incorporated into the dish.

Figure 4. Dough components before baking.

Final dish was composed from blue curd (figure 1), cooked version of cookie (figure 4) and yellow sphere part (figure 2) after going through reverse spherification.

Fiinal result is presented in figure 5:

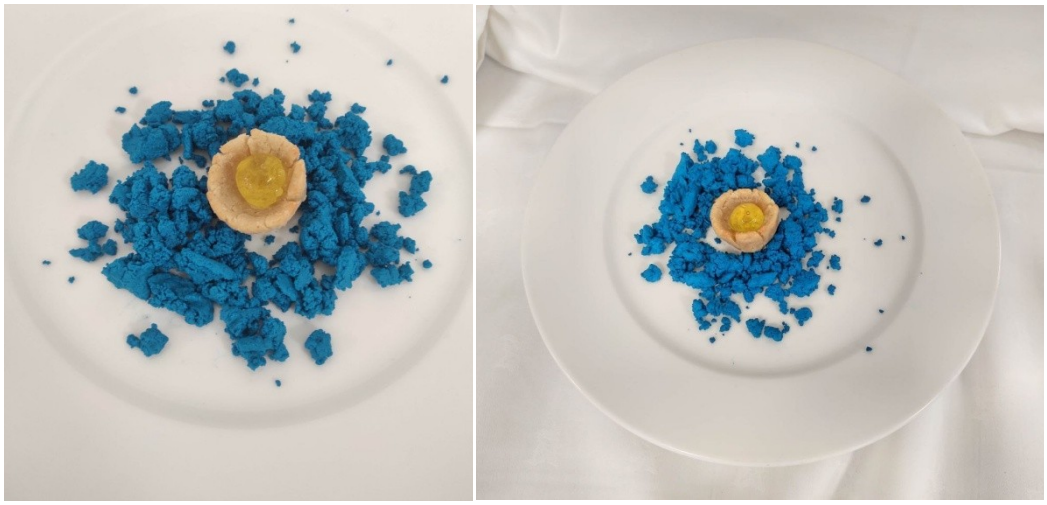

Figure 5. Note-by-Note dish "Ukrainian fortress". Final version

Discussion

Blue curd part

"Casein is the most important protein component in milk, both quantitatively and nutritionally" (Sarode, *et al*., 2016). Typically casein is produced by separation from other milk's constituents by selective precipitation using acid or rennet and membrane filtration techniques (Raak and Corredig, 2022). To prepare casein, acidity should be adjusted to pH 4.6 or lower (Alexander, 1927). Actually, this pH value is currently used to define casein (Alichanidis, *et al*., 2016). In curds, main constituents are casein and fat (Banks and Tamime, 1987), so we can say that using milk coagulation is quite in accordance with practical note-by-note cooking.

Using 4.5g of citric acid in 500mL of water would create pH = 2.3 (approx., according to my knowledge in analytical chemistry and pK_a values of citric acid). As milk is a water-based system and pH scale is logarithmic, let's suggest that pH of milk won't be more than 10% different than for water solution of citric acid. Low pH, which means high concentration of H^+ ions, being far under isoelectric point of casein (pH4.6), leads to quick coagulation, thus forming smaller curd particles than for slower processes. However, initial idea was to make curd taste like an orange and oranges are acidic, with pH typically varying from 3 to 4.5 (Sabzi, *et al.,* 2020). But not all the acidity of the milk solution with citric acid is transferring to curd (solid-liquid distribution coefficient), thus to obtain sour taste of the curd more acid is needed. As used during the class demonstration by Pauline Danaher, 2g/L of citric acid doesn't lead to acid flavour of the curd, so it was decided to use 9g/L. This could have been obvious, but this concentration is actually producing sour taste, but it's intensity is too high. Taking in account the time constraints and common use of ingredients, it was decided to use 5 g/L (0,024 M) concentration for the next experiment and switch to another part of the recipe. This decision was

changed on the week 3 in order to limit citric acid usage to 3 g/L and save creamy taste without major sour notes.

Blue colourant can attain maximum concentration in food products of 3g/kg, thus using amounts stated in ingredients section is permitted.

Orange essential oil flavouring was added before heating which led to its either evaporation or thermic destruction of the compounds responsible for flavour. Discussion of these processes needs further investigation, but is not relevant as easier solution exists – addition of orange essential oil should be done on the last stage, after filtration and cooling of the curd.

Figure 6. Milk solution with added ingredients before (left) and after (right) casein coagulation.

Figure 7. Result of week 1 kitchen trails.

Conclusion: 4.5g of citric acid in 500 mL creates excessive acidity, so next time 2.5g can be used to coagulate milk and add sour taste.

Cookie part

Dough prepared on week 2 by the recipe above appeared to be quite friable (easily crumbled). We can state insufficient binding. Cookie formed was highly crumble (Figure 8).

Figure 8. Cruble cookie – result of the first trial.

> Gluten is the main storage protein of wheat grains. Gluten is a complex mixture of hundreds of related but distinct proteins, mainly gliadin and glutenin…Gluten is heat stable and has the capacity to act as a binding and extending agent and is commonly used as an additive in processed foods for improved texture, flavor, and moisture retention (Biesiekierski, 2017).

This information leads us to two possible explanations:

1. We haven't added enough water. Without water gluten is not formed.
2. We haven't added enough gluten.

The first one was correct in our case. For the second trial 15g of the mix of primary recipe were taken and 3g of gluten were added together with 6g of water. The difference of binding capacity was easily detectable by touch and shear. However, this time it was higher than expected and water content felt excessive. We can find explanation of Schopf and Scherf (2021) that this excessive water is "not not absorbed by the gluten-starch matrix *determines the consistency of the dough structure"*.

Figure 9. Second trial. Cookie is much more binded, feeling too viscous in the mouth.

Thrid trial: 15g of the initial mix + 5g gluten + 4.4g water, 220°C without fan, 5min.

Figure 10. Third trial. Excessive water is still present

Regarding trials 2 and 3 we can conclude the need to decrease gluten and water level even more to avoid excess water outside of the system and to make cookies less viscous.

For the last trial, quantities of gluten and water were even more reduced:

Fourth trial: 15g of the initialix + 2.75g of gluten + 1.2g of water, 220°C without fan, 7min.

Figure 11. Final (4^{th}) trial of cookie-making process result.

Overall, as a result of fourth trial, optimal content of water and gluten seemed to be present. However, “sandy” textural feeling was present in cookies prepared. Rheological, pasting and textural properties of corn flour and rice flour are different (Al-Attar*, et al.,* 2022). Sandyness can be due to the use o the rice flour, so it is there is an interest to change it by cornflour for the next weeks.

Xanthan gum can thicken and stabilize most of water-based systems (Katzbauer, 1998). It can be also used with Guar gum in gluten free recipes to improve elasticity of doughs (Lersch, 2014, p. 47). Usage of xanthan gum available in the kitchen should be considered to improve elasticity of the dough used for cookie-making.

Short conclusions of week 2

1. Gluten content is responsible for binding. Its content should be optimized to get optimal ratio between friability and elasticity.
2. Water conent is crucial for proper dough formation.
3. Flour type is important, being responsible for rheological, pasting and textural properties of the doughs.
4. Xanthan gum can be regarded as elasticity enhancer for cookie-making.

Main solution for reverse spherification (calcium lactate + flavouring + colourant)

Figure 12. Yellow-coloured Ca^{2+}-containing solution prepared for reverse spherification.

It has to be noted, that author heated up the solution and added colourant before heating and not after as stated in the recipe. Taking into account chemical stability of E102 up to 200 °C in air (Leulescu, et al., 2018) it shouldn't have led to major changes and changes in colour were not observed. However, as the matter of precaution, it is advised to add colourant and flavourings after heating to cooled to room temperature solutions to avoid evaporation of aromas and thermal degradation of labile compounds.

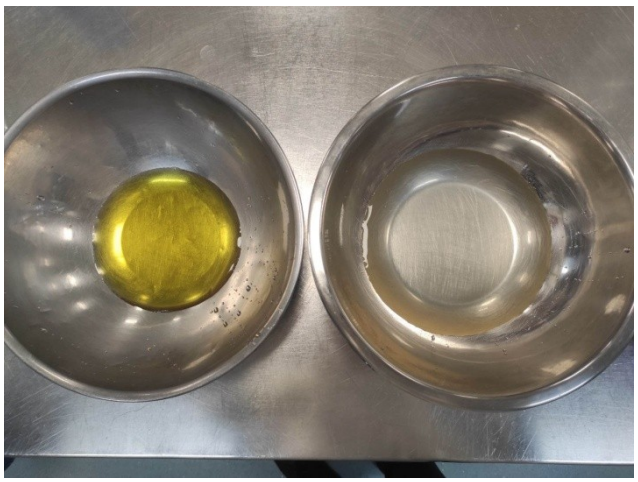

Figure 13. Main solution (left) and calcium alginate bath.

We won't discuss much about alginates. Only important mention is that they are linear unbranched polymers able to form a gel matrix in the presence of Ca^{2+} ions (Bi, *et al.,* 2022). These ions were provided by calcium lactate which is an odourless water-soluble additive convenient to use for reverse spherification.

Conclusions

Note-by-Note dish "Ukrainian fortress" was developed to meet project's aims. Compounds used in product development were under practical NbN concept, author trying to use pure ingredients and produce and original dish with sense. Topics of molecular gastronomy, NbN cooking and food waste were discussed. Vitamin D extracted from the wasted mushrooms is thought to be used in this dish to enrich consumer's diet with daily reference value of this vitamin and to help valorization of foodwaste to create a more sustainable society. Due to early developmet stage of vitamin D extraction from the mushrooms it remains a concept for further development. Trial and error method enriched with scientific knowledge of the author was applied to develop the final recipe. All stages of product development were properly documented and documented and discussed on a weekly basis supported by the logbooks attached.

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Logbooks

MODULE CODE: TFCS9025

MODULE TITLE: Advanced molecular gastronomy

STUDENT NAME: Artem OSMOLOVSKYI

FOOD PRODUCT: Note-by-Note dish "Ukrainian fortress". Curd-based part.

WEEK NO.: 1 **DATE: 20/03/2023**

Weekly Aims and Objectives

Develop a recipe to create "blue ocean" – curd-based part of "Ukrainian fortress dish":

-test curd formation due to coagulation;

-find optimal citric acid concentration;

-search for the fitting flavor;

-navigate in the variety of ingredients in the kitchen, finding the ones ordered and exploring possible new options from the orders of other students.

Materials and Method (Ingredients, Equipment and Method)

Ingredients

Ingredient	Quantity, g	Producer	Comments
Fresh milk 3.5% fat	500	Arrabrawn	2L pack
Citric acid	4.5	Louis François	E330 Acide citrique Monohydrate (210g/mol). Batch: 245C1 Best before: 04/2024. Specific maximum level: quantum satis (ANNEX II, Part B of Commission Regulation (EU) No 1129/2011)
Blue colourant	0.4	il Punto Italiana	E133 (Cake decoration®, concentrated gel, 100g pack, ingredients: water, glucose syrop, sugar, E406 Agar Agar, E422 Vegetable glycerine, E202 potassium sorbate, E330 citric acid). Maximum dosage: do not exceed 3g per kg of product.
Orange essential oil flavouring	0.4 (8 drops)	MSK Ingredients Ltd	MSK-0109, Batch 44451, ingredients: orange essential oil)

*g are used for liquids as weighed by the scales

Equipment

Weighing scales SliverCrest (Model No. HG09439D, version 06/2022)

HomeDepo Digital Kitchen Scales 500g*0.01g (Model B0BKJRQBMH)

Saucepan size 20 (stainless steel vogue)

Plastic vessels for weighing

Vogue Heavy Duty Solid Spoon St/st - 18"

Plate (ceramic)

Colander (steel)

2L mixing bowl (2 pieces)

Damp muslin cloth

Plastic vessels for weighing

Method

8. Weigh 4.5g of citric acid.
9. Weigh 500g of milk in a saucepan.
10. Add citric acid prepared on stage (1) to saucepan with milk (2).
11. Add 0.4g of blue colourant and 8 drops of orange essential oil to the mix from the stage (3).
12. Heat until milk coagulates.
13. Filter through a damp muslin cloth.

Results and discussion

Milk curds contain mostly casein

"Casein is the most important protein component in milk, both quantitatively and nutritionally" (Sarode, *et al*., 2016). Typically casein is produced by separation from other milk's constituents by selective precipitation using acid or rennet and membrane filtration techniques (Raak and Corredig, 2022). To prepare casein, acidity should be adjusted to pH 4.6 or lower (Alexander, 1927). Actually, this pH value is currently used to define casein (Alichanidis, *et al*., 2016). In curds, main constituents are casein and fat (Banks and Tamime, 1987), so we can say that using milk coagulation is quite in accordance with practical note-by-note cooking.

Using 4.5g of citric acid in 500mL of water would create pH = 2.3 (approx., according to my knowledge in analytical chemistry and pK_a values of citric acid). As milk is a water-based system and pH scale is logarithmic, let's suggest that pH of milk won't be more than 10% different than for water solution of citric acid. Low pH, which means high concentration of H^+

ions, being far under isoelectric point of casein (pH4.6), leads to quick coagulation, thus forming smaller curd particles than for slower processes. However, initial idea was to make curd taste like an orange and oranges are acidic, with pH typically varying from 3 to 4.5 (Sabzi, *et al.,* 2020). But not all the acidity of the milk solution with citric acid is transferring to curd (solid-liquid distribution coefficient), thus to obtain sour taste of the curd more acid is needed. As used during the class demonstration by Pauline Danaher, 2g/L of citric acid doesn't lead to acid flavour of the curd, so it was decided to use 9g/L. This could have been obvious, but this concentration is actually producing sour taste, but it's intensity is too high. Taking in account the time constraints and common use of ingredients, it was decided to use 5 g/L (0,024 M) concentration for the next experiment and switch to another part of the recipe.

Blue colourant can attain maximum concentration in food products of 3g/kg, thus using amounts stated in ingredients section is permitted.

Orange essential oil flavouring was added before heating which led to its either evaporation or thermic destruction of the compounds responsible for flavour. Discussion of these processes needs further investigation, but is not relevant as easier solution exists – addition of orange essential oil should be done on the last stage, after filtration and cooling of the curd.

Figure 1. Milk solution with added ingredients before (left) and after (right) casein coagulation.

Figure 2. Result of week 1 kitchen trails.

Conclusions

4.5g of citric acid in 500 mL creates excessive acidity, so next time 2.5g can be used to coagulate milk and add sour taste.

Recommendations for the following week

Start cookie-making trials.

Ingredients required for the following 2 weeks

Rice flour

Brown sugar

Whey protein

Butter powder Mantepols

Orange pulp

Ovalbumin

Gluten

Baked bread

Refined sunflower oil

Calcium lactate

Sodium alginate

Granny Smith Apple (natural)

Lemon yellow liquid coloring

Champagne-Type flavouring

Pineapple flavouring

Freeze dried banana powder

Cornflour

Xanthan gum

Yellow colourant

Additional info:

References

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Ingredients photos

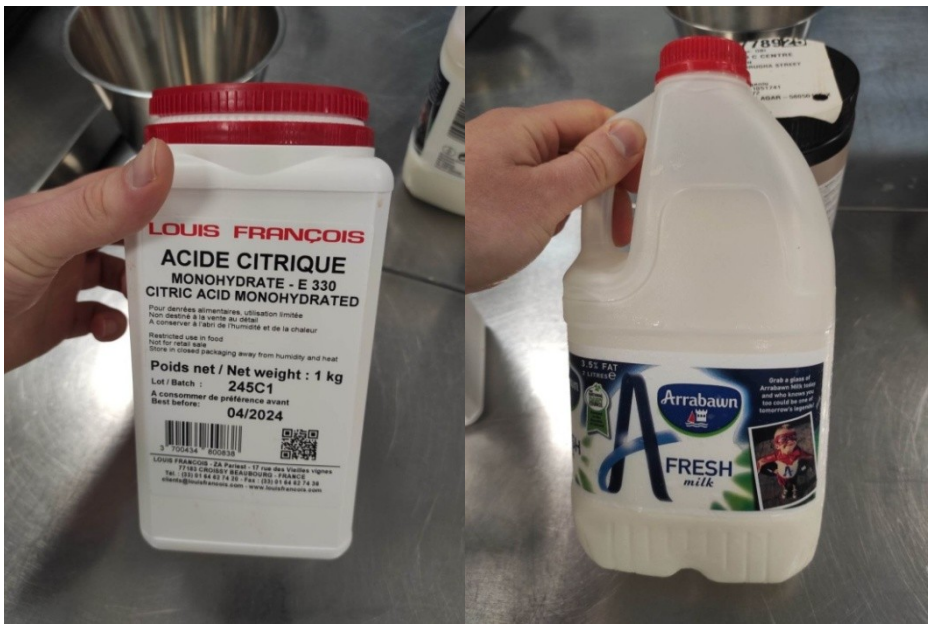

Figure 3. Citric acid, Louis Francois (left) and Arrabrawn Fresh milk 3.5% fat, 2L pack.

Figure 4. Cake decoration® blue colorant concentrated, Il Punto Italiana production.

Figure 5. Orange essential oil flavouring from MSK ingredients.

MODULE CODE: TFCS9025

MODULE TITLE: Advanced molecular gastronomy

STUDENT NAME: Artem OSMOLOVSKYI

FOOD PRODUCT: Note-by-Note dish “Ukrainian fortress”. Cookie part.

WEEK NO.: 2 **DATE: 27/03/2023**

Weekly Aims and Objectives

Make a cookie part of the dish.

Materials and Method (Ingredients, Equipment and Method)

Equipment

SkyLine Premium Combi Boiler Oven with digital control, 10x1/1GN

Weighing scales SliverCrest (Model No. HG09439D, version 06/2022)

HomeDepo Digital Kitchen Scales 500g*0.01g (Model B0BKJRQBMH)

2L mixing bowl (2 pieces)

Spoon (Stainless steel 7oz.)

Plastic vessels for weighing

Saucepan size 20 (stainless steel vogue)

Damp muslin cloth

Ingredients

Ingredient	Quantity, g	Producer	Comments
Rice flour	51	East End, Vibrant foods Ltd.	1.5 kg bag. Best before end: 09/2023. Batch No. 2255111
Brown sugar	14	Gem Pack foods Ltd.	Ingredients: sugar (98%), Cane molasses. Better to use white sugar.
Whey protein	3,5	Bulk	Lot 000194562, best before end: 06/2024. Health mark: GB CL 117. Pack: 500g. Ingredients: Whey Protein Concentrate (Milk), Sunflower Lecithin.
Butter powder Mantepols	1,1	Sosa Ingredients S.L.	Ingredients:butter, skimmed milk powder, stabilizer (E450).
Orange pulp	1,5	Sosa Ingredients S.L.	Freeze dried orange pulp in powder. Ingredients: orange (90%), maltodextrine. Code Sosa: 44050732. 500g pack. LOT and production date: 061120. Best before: 06/11/22
Ovalbumin	5	Sosa Ingredients S.L.	Albuwhip. Powdered egg albumin. Ingredients: albumin. 500g pack. Lot and production date: 040820, Best before: 04/08/22, code Sosa: 00200510, health mark ES 40.069089/B CE
Gluten	3,2	Spiegelhauer	Best before: 11/04/2024
Baked bread	0,25 (5 drops)	MSK Ingredients Ltd.	Batch: MSK-1628/45657, best before end: Oct-24, Ingredients: natural and/or n&a flavour (contains vegetable glycerine)
Colorant	0,21	il Punto Italiana	E102 (Cake decoration®, concentrated gel, 100g pack, ingredients: water, glucose syrop, sugar, E406 Agar Agar, E422 Vegetable glycerine, E202 potassium sorbate, E330 citric acid). Maximum dosage: do not exceed 3g per kg of product.
Refined sunflower oil	35	The King. QP Foods UK LTD	Produced in Ukraine. Net weight 4600g (5L). Cholesterol free

Initial method

Roasted flour cookies (This, 2014, p. 233)

Original recipe: Heat some potato starch in a pan, stirring continuously, until it begins to colour, transfer the lightly browned starch to a salad bowl and add sucrose (table sugar), oil, a few drops of water, a soup spoon (10 ml) of egg white powder and a teaspoon of gluten. Knead into small balls, flatten, bake for 10 min at 220 °C.

As Lersch (2014, p. 63) states: “Roasting alters the starch and gluten, and the flour looses much of it's elasticity and yields a sandy texture“. To decrease possible sandyness, roasting step was removed from the recipe.

Modified method which was used:

1. Weigh and mix in one 2L bowl: 51g of rice flour, 14g of sugar, 3.5g of whey protein, 1.1g of butter powder, 1.5g of orange pupl, 5g of albumin, 3.2g of gluten and 35g of sunflower oil.
2. Add 5 drops of baked bread flavouring.
3. Add 0.21g of colourant (yellow).
4. Mix by hand for 2 min.
5. Take a an oven tray, put non-stick paper on it
6. Form the cookie in the form of circle with height 0.5cm and put in on the prepared tray.
7. Bake cookie from (6) in the oven for 5 min at 200°C with fan.

Results and discussion

Dough prepared by the recipe above appeared to be quite friable (easily crumbled). We can state insufficient binding. Cookie formed was highly crumble (Figure 1).

Figure 1. Cruble cookie – result of the first trial.

> Gluten is the main storage protein of wheat grains. Gluten is a complex mixture of hundreds of related but distinct proteins, mainly gliadin and glutenin…Gluten is heat stable and has the capacity to act as a binding and extending agent and is commonly used as an additive in processed foods for improved texture, flavor, and moisture retention (Biesiekierski, 2017).

This information leads us to two possible explanations:

3. We haven’t added enough water. Without water gluten is not formed.
4. We haven’t added enough gluten.

The first one was correct in our case. For the second trial 15g of the mix of primary recipe were taken and 3g of gluten were added together with 6g of water. The difference of binding capacity was easily detectable by touch and shear. However, this time it was higher than expected and water content felt excessive. We can find explanation of Schopf and Scherf (2021) that this

excessive water is “not not absorbed by the gluten-starch matrix determines the consistency of the dough structure”.

Figure 2. Second trial. Cookie is much more binded, feeling too viscous in the mouth.

Thrid trial: 15g of the initial mix + 5g gluten + 4.4g water, 220°C without fan, 5min.

Figure 3. Third trial. Excessive water is still present

Regarding trials 2 and 3 we can conclude the need to decrease gluten and water level even more to avoid excess water outside of the system and to make cookies less viscous.

For the last trial, quantities of gluten and water were even more reduced:

Fourth trial: 15g of the initialix + 2.75g of gluten + 1.2g of water, 220°C without fan, 7min.

Figure 4. Final (4th) trial of cookie-making process result.

Overall, as a result of fourth trial, optimal content of water and gluten seemed to be present. However, “sandy” textural feeling was present in cookies prepared. Rheological, pasting and textural properties of corn flour and rice flour are different (Al-Attar*, et al.,* 2022). Sandyness can be due to the use o the rice flour, so it is there is an interest to change it by cornflour for the next weeks.

Xanthan gum can thicken and stabilize most of water-based systems (Katzbauer, 1998). It can be also used with Guar gum in gluten free recipes to improve elasticity of doughs (Lersch, 2014, p. 47). Usage of xanthan gum available in the kitchen should be considered to improve elasticity of the dough used for cookie-making.

Conclusions

5. Gluten content is responsible for binding. Its content should be optimized to get optimal ratio between friability and elasticity.
6. Water conent is crucial for proper dough formation.
7. Flour type is important, being responsible for rheological, pasting and textural properties of the doughs.
8. Xanthan gum can be regarded as elasticity enhancer for cookie-making.

Recommendations for the following week

Use corn flour instead of rice four.

Consider using xanthan gum for elasticity of the dough in cookie-making.

Start working on the third, alginate-made part of the dish.

Ingredients required for the following 2 weeks

Rice flour

Brown sugar

Whey protein

Butter powder Mantepols

Orange pulp

Ovalbumin

Gluten

Baked bread

Refined sunflower oil

Calcium lactate

Sodium alginate

Granny Smith Apple (natural)

Lemon yellow liquid coloring

Champagne-Type flavouring

Pineapple flavouring

Freeze dried banana powder

Cornflour

Xanthan gum

Yellow colourant

References

Al-Attar, H., Ahmed, J. and Thomas, L. (2022) Rheological, pasting and textural properties of corn flour as influenced by the addition of rice and lentil flour. *LWT*. 160, 113231. doi:10.1016/j.lwt.2022.113231.

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Schopf, M. and Scherf, K.A. (2021) Water Absorption Capacity Determines the Functionality of Vital Gluten Related to Specific Bread Volume. *Foods*. 10 (2), 228. doi:10.3390/foods10020228.

This, H. (2014) *Note-by-note cooking: the future of food*. Arts and traditions of the table. New York, Columbia University Press

MODULE CODE: TFCS9025

MODULE TITLE: Advanced molecular gastronomy

STUDENT NAME: Artem OSMOLOVSKYI

FOOD PRODUCT: Note-by-Note dish "Ukrainian fortress". Blue curd and yellow alginate solution preparation.

WEEK NO.: 3 **DATE: 17/04/2023**

Weekly Aims and Objectives

Curd and yellow-coloured alginate solution preparation.

Materials and Method (Ingredients, Equipment and Method)

Equipment

Robot coupe Mini MP 160 V.V.

La Minerva Vacuum Packaging Machine Pack 16 (Brodericks equipment asset tag 46447, tested 10/08/2022) Program parameters (SEL= SELECT, Vac=99, Gas=0, Sal=2.0)

Polar C-Series Upright Fridge 600Ltr

Weighing scales SliverCrest (Model No. HG09439D, version 06/2022)

HomeDepo Digital Kitchen Scales 500g*0.01g (Model B0BKJRQBMH)

2L mixing bowl (3 pieces)

Spoon (Stainless steel 7oz.)

Knife set (LIDL)

2 oven trays (roasting tins)

2 kitchen towels(Dunnes stores)

Nonstick baking paper

Plastic vessels for weighing

Vac pack bags large (3)

Saucepan size 20 (stainless steel vogue)

Ingredients

For curd part:

Ingredient	Quantity, g	Producer	Comments
Fresh milk 3.5% fat	500	Arrabrawn	2L pack
Brown sugar	60	Gem Pack foods Ltd.	Ingredients: sugar (98%), Cane molasses. Better to use white sugar.
Citric acid	1.5	Louis François	E330 Acide citrique Monohydrate. Batch: 245C1 Best before: 04/2024. Specific maximum level: quantum satis (ANNEX II, Part B of Commission Regulation (EU) No 1129/2011)
Blue colorant	0.5	il Punto Italiana	E133 (Cake decoration®, concentrated gel, 100g pack, ingredients: water, glucose syrop, sugar, E406 Agar Agar, E422 Vegetable glycerine, E202 potassium sorbate, E330 citric acid). Maximum dosage: do not exceed 3g per kg of product.

For yellow sphere part:

Ingredient	Quantity, g	Producer	Comments
Water	460	TU Dublin water supplier	Tap water
Calcium lactate	20	MSK Ingredients Ltd.	MSK-3859. Batch:44348, Best before end: May-22 Ingredients:calcuim lactate. Value pack 1kg
Brown sugar	20	Gem Pack foods Ltd.	Ingredients: sugar (98%), Cane molasses. Better to use white sugar.
Granny Smith Apple (natural)	0.25 (5 drops)	MSK Ingredients Ltd.	Water soluble flavour drops, 30ml. Batch: MSK-7942/46576 Best before end: Feb-23. Ingredients: natural flavouring substances, triacetin (E1518), propylene glycol (1520)
Champagne-Type flavouring	0.15 (3 drops)	MSK Ingredients Ltd.	Water soluble flavour drops, 30ml. Batch: MSK-1633/40990 Best before end: Apr-21. Ingredients: flavouring substances, propylene glycol (1520)
Lemon yellow liquid colouring	0.95	Mallard Ferriere	E102. Ingredients: water, tartrazine 1,74%, sodium chloride and sulfate 0,26% 0,2%, sodium benzoate. In foodstuffs, concentration limited to 2-2,5 g/kg. Can have undesired effects on children's activity and attention. Production date: 01/12/2023, DDM: 01/12/2023, Lot number: 5711304, pack: 100 ml

For 1% sodium alginate bath:

Ingredient	Quantity, g	Producer	Comments
Water	495	TU Dublin water supplier	Tap water
Sodium alginate	5	MSK Ingredients Ltd.	MSK-3857. Batch:30765, Best before end: Jan-20 Ingredients:pure sodium alginate E401. Value pack 1kg

Method

Blue curd part:

14. Weigh 1.5g of citric acid and 60g of brown sugar in a plastic vessel for weighing.
15. Weigh 500g of milk in a saucepan.
16. Add ingredients prepared on stage (1) to saucepan with milk (2).
17. Add 0.5g of blue colourant.
18. Heat until milk coagulates.
19. Filter through a damp muslin cloth.
20. Serve on the plate.

Yellow sphere part. Solution preparation:

Alginate solution: weigh 5 g of sodium alginate and add to 495g of water in the saucepan. Use Robot coupe Mini MP 160 mixing for 5 min on speed 4 to dissolve alignate. Vaccum pack using large vac pack bag using La Minerva Vacuum Packaging Machine available in the kitchen. Put the obtained solution in the fridge at -4°C until the next week.

Main solution (yellow Ca lactate solution):

8. Weigh 20g of calcium lactate and 20g of brown sugar in a plastic vessel for weighing.
9. Dissolve the mixture (1) in pre-weighed 460g of water in 2L mixing bowl using spoon. It may take take some time. If needed, light heating in the saucepan may help.
10. Add 5 drops of Granny Smith Apple and 3 drops of Champagne-Type flavouring to room temperature solution (wait until cools down if heated before).
11. Weigh and add 0.95g yellow colouring.
12. Mix with the spoon to homogenize the solution.
13. Vaccum pack using large vac pack bag using La Minerva Vacuum Packaging Machine available in the kitchen.
14. Put the obtained solution in the fridge at -4°C until the next week.

Results and discussion

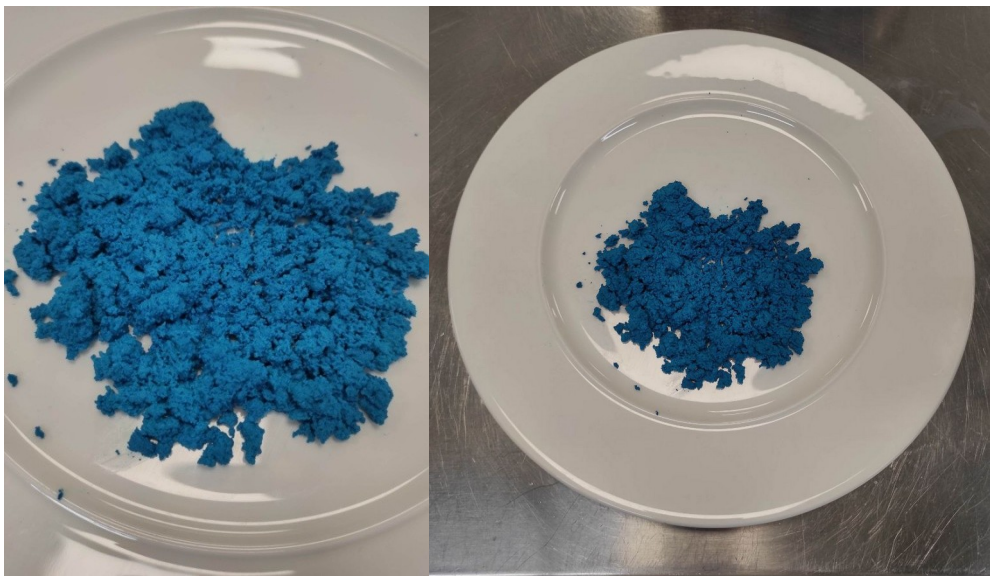

Figure 1. Blue curd part of the dish obtained by acid-driven coagulation of casein.

Coagulation was discussed in detail in Week 1 logbook. Here it is only important to mention that in order to reduce citric acid usage 3g/L solution was used which led to very light sourness, which is almost not perceivable because of creamy and sweet taste of the curd. Cooking is trying and this result seemed optimal to the researcher, so final recipe of curd preparation is defined as in this logbook.

Figure 2. Yellow-coloured Ca^{2+}-containing solution prepared for reverse spherification.

It has to be noted, that author heated up the solution and added colourant before heating and not after as stated in the recipe. Taking into account chemical stability of E102 up to 200 °C in air (Leulescu, et al., 2018) it shouldn't have led to major changes and changes in colour were not observed. However, as the matter of precaution, it is advised to add colourant and flavourings

after heating to cooled to room temperature solutions to avoid evaporation of aromas and thermal degradation of labile compounds.

Conclusions

Concentration of citric acid of 3g/L was found optimal for curd formation. Reverse spherification solution preparations were prepared for following week. Thermosensitive ingredients should be added after heating and cooling down the solution as stated in the initial recipe.

Recommendations for the following week

Continue experiments with the dough, replacing rice flour with corn flour. Compose the final dish by gathering the parts.

Ingredients required for the last week

Rice flour

Brown sugar

Whey protein

Butter powder Mantepols

Orange pulp

Ovalbumin

Gluten

Baked bread flavouring

Refined sunflower oil

Champagne-Type flavouring

Freeze dried banana powder

Cornflour

Xanthan gum

Yellow colourant

References

Leulescu, M., Rotaru, A., Pălărie, I., Moanță, A., Cioateră, N., Popescu, M., Morîntale, E., Bubulică, M.V., Florian, G., Hărăbor, A. and Rotaru, P. (2018) Tartrazine: physical, thermal and biophysical properties of the most widely employed synthetic yellow food-colouring azo dye. *Journal of Thermal Analysis and Calorimetry*. 134 (1), 209–231. doi:10.1007/s10973-018-7663-3.

MODULE CODE: TFCS9025

MODULE TITLE: Advanced molecular gastronomy

STUDENT NAME: Artem OSMOLOVSKYI

FOOD PRODUCT: Note-by-Note dish "Ukrainian fortress". Dough improvement and final dish composition.

WEEK NO.: 4

DATE:

21/04/2023

Weekly Aims and Objectives

Dough improvement and final dish composition.

Materials and Method (Ingredients, Equipment and Method)

Equipment

SkyLine Premium Combi Boiler Oven with digital control, 10x1/1GN

Polar C-Series Upright Freezer 600Ltr

Weighing scales SliverCrest (Model No. HG09439D, version 06/2022)

HomeDepo Digital Kitchen Scales 500g*0.01g (Model B0BKJRQBMH)

2L mixing bowl (4 pieces)

Spoon (Stainless steel 7oz.)

1 oven tray (roasting tin)

2 kitchen towels(Dunnes stores)

Nonstick baking paper

Plastic vessels for weighing

Saucepan size 20 (stainless steel vogue)

Ceramic plate

Tala A10550 Stainless Steel Measuring Spoons, 5 Piece Set for Measuring Dry and Liquids

Transparent manual wrapping film Rapok Cling Film Food Grade

Materials

Ingredient	Quantity, g	Producer	Comments
Cornflour	51.8	Gem Pack foods Ltd.	500g pack
Brown sugar	14.75	Gem Pack foods Ltd.	Ingredients: sugar (98%), Cane molasses. Better to use white sugar.
Banana powder	8.6	Sosa Ingredients S.L.	Freeze dried. Code Sosa: 39475, Batch: L7LI21270, production date 27/09/2021, best before: 27/09/23. 600g pack. Ingrdients: Banana. May contain trace amounts of milk and derivatives.
Ovalbumin	6.8	Sosa Ingredients S.L.	Albuwhip. Powdered egg albumin. Ingredients: albumin. 500g pack. Lot and production date: 040820, Best before: 04/08/22, code Sosa: 00200510, health mark ES 40.069089/B CE
Gluten	4.6	Spiegelhauer	Best before: 11/04/2024
Refined sunflower oil	36	The King. QP Foods UK LTD	Produced in Ukraine. Net weight 4600g (5L). Cholesterol free
Xanthan gum	see in the recipe	En-place Foods UK Ltd	Lot: L00762. Best before: 12/06/24, 300g pack. Recommended concentration: 1g for 300ml

For reverse spherification: soultions prepared during Week 3.

Method

Yellow sphere

7. Take the solutions of alginate and calcium lactate prepared on week 3.
8. Put them in 2 separate 2L bowls.
9. Take Tala measuring spoon with 2cm diameter and fill it as shown on Figure 2 (left). Cover it with manual wrapping film and put in the freezer for 60 min.
10. Check whether the solution freezed, if yes – unwrap it, extract the hemisphere formed and put it in aligante bath solution for 2 min.
11. Take the formed sphere out of the alginate bath and put in 2L bowl of fresh water.
12. Take out in 10-20 sec and use for final composition of the dish.

Cookie

5. Add to 2L bowl 51.8 g of corn flour, 14.75g of brown sugar, 8.6g of banana powder, 6.8g of ovalbumin, 4.6g of gluteln and 36 g of refined sunflower oil.
6. Mix for 2 min to obtain homogeneous dough.
7. Take 20g of obtained mixture and add 0.5g of xanthan gum, add 2 drops of water and mix for 2 min to make dough homogeneous.

8. Take a tray, cover with anti-stick paper and form a concave hemisphere of the mixture obtained at stage (3).
9. Put tray with the concave hemisphere (4) in the oven for 5 min at 200°C without fan.
10. Take the cookie out in 5 min, let it cool down and use in dish formation.

Full dish. Note-by-Note dish "Ukrainian fortress"

1. Take pre-prepared curd out of the fridge, remove packaging, put curd on the plate
2. Put cookie part in the middle of the curd.
3. Put yellow semisphere on the top of the cookie.
4. Add Vitamin D2 extracted from the mushroom waste (wasn't available in the kitchen) by dropping the extract on the cookie part.

Results and discussion

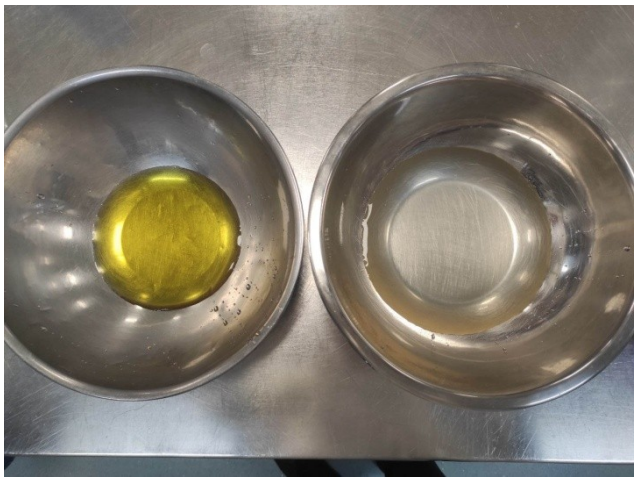

Figure 1. Main solution (left) and calcium alginate bath.

We won't discuss much about alginates. Only important mention is that they are linear unbranched polymers able to form a gel matrix in the presence of Ca^{2+} ions (Bi, *et al.,* 2022). These ions were provided by calcium lactate which is an odourless water-soluble additive convenient to use for reverse spherification.

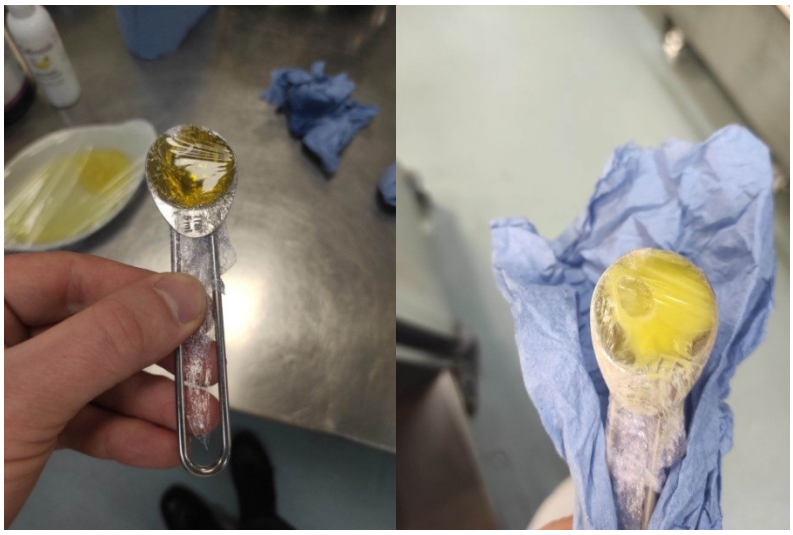

Figure 2. Main solution containing calcium lactate before (left) and after freezing.

Freezing (Figure 2) was used to make sphere formed during reverse spherification more stable in the shape, giving time to form a proper gel structure.

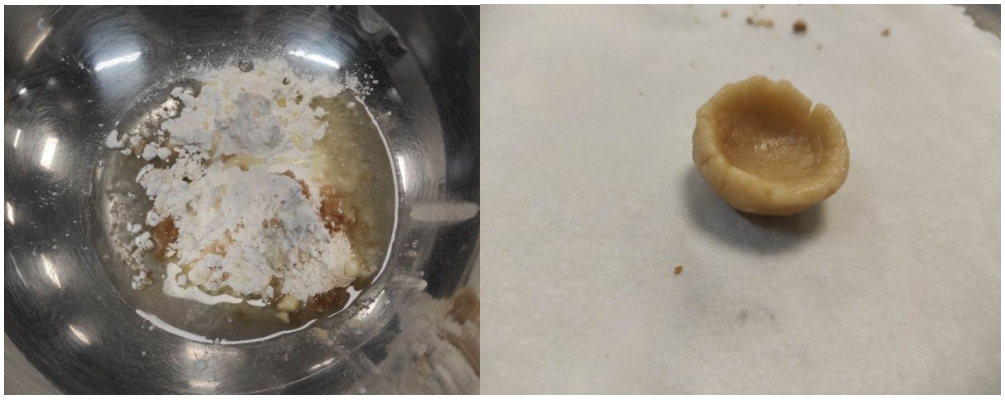

Figure 3. Dough components before (left) and after (right) mixing.

Addition of xanthan gum helped to make dough more elastic. Comparing to previous weeks, ingredients list was shortened for simplification of the food matrix. Banana flavor incorporated by freeze fried banana powder according to manufacturer's instructions.

Figure 4. Cookies obtained with simplified recipe and xanthan gum addition.

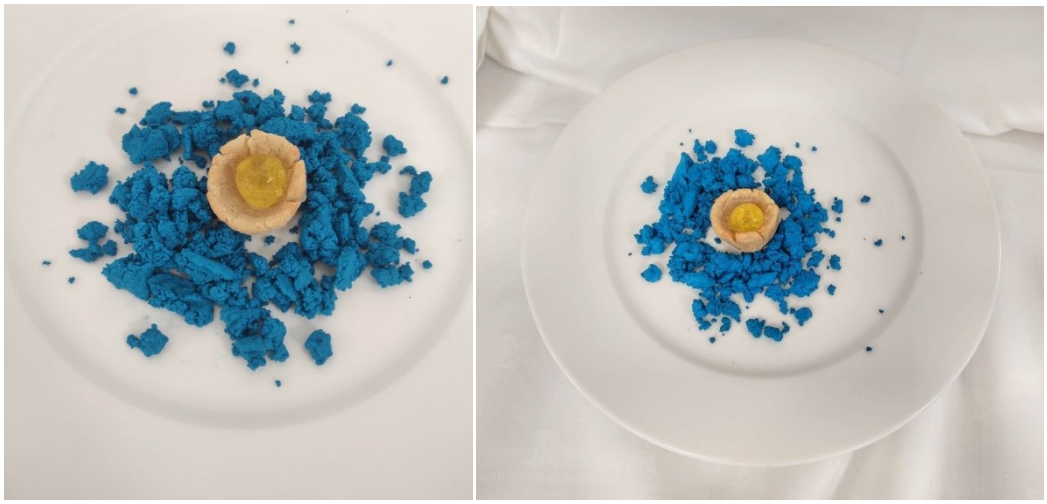

Figure 5. Note-by-Note dish "Ukrainian fortress". Final version

Conclusions

Addition of xanthan gum improves elasticity of the cookies.

Prior freezing of Ca^{2+} solution helps to obtain regular spheric form during reverse spherification.

Note-by-Note dish can be developed in 4 weeks and constitutes a good training exercise to practice NbN cooking and understanding the phenomena laying down the cooking processes.

Recommendations for the following week

Development process is over. No recommendations for the next week.

Ingredients required for the following 2 weeks

It is over. Not more ingredients needed.

References

Bi, D., Yang, X., Yao, L., Hu, Z., Li, H., Xu, X. and Lu, J. (2022) Potential Food and Nutraceutical Applications of Alginate: A Review. *Marine Drugs*. 20 (9), 564. doi:10.3390/md20090564.

Final comments

Despite the formal structure presented, this module was more about troubleshooting. For the person qualified in chemistry, not familiar with typical food ingredients, this type of a task is rather an exercise to combine the ingredients presented, than to create a dish in a logical step-by-step approach.

I understand that in each project logical sequences of aims, objectives and the process of achieving them is highly demanded (as proposed in Handbook of Molecular Gastronomy by Bruke (2021, p.814)). But despite my efforts, I cannot say it was like that. No, on the contrary. It was the process when I decided to do something, realized that we don't have these ingredients and started looking to redefine the idea. That is the process when nobody really understands the purpose. When the key aim is to learn to deal with the things you have, combine them in a new way and say it was intended to be like that from the beginning. Because nobody actually knows how it should have been. Only you decide. And you try, you fail, try again, fail better and you learn through this iterative process.