Note by Note - The Molecular Cappuccino

Advanced Molecular Gastronomy TFCS9025: 2022-23

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DT9006

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1. INTRODUCTION

Molecular gastronomy began to attract attention from both scientists and chefs alike in 1988. It is a scientific discipline which investigates the several phenomena that occur during cooking and uses these phenomena to create an innovative approach to cooking (Burke *et al*, 2016). Herve This, in 2011, mentioned that it is a discipline just like any science, which has both scientific and educational applications, and combines elements of chemistry and physics in order to create applications useful within pharmacy, cuisine and cosmetics (This, 2011). Molecular gastronomy can also be seen as progressive cuisine which incorporates food science with culinary techniques to perform innovative preparations and transformations of raw materials in order to create an attractive final product. Through the incorporation of food science into the world of culinary arts, molecular chemists are able to utilise their knowledge on the chemical and physical processes which occur during cooking, and determine why or why not a particular recipe is successful or not (Marcus, 2013). Molecular gastronomy aims to differentiate between science and technology, to allow for consumer clarity regarding the difference between science and cooking (This, 2013).

Note by note cooking, a development of molecular gastronomy, was first articulated in 1994 by Herve This. The initial objective of molecular gastronomy was to improve food, however, Note by Note cooking would also allow for foodstuffs to be created from just pure compounds (This, 2013). This would mean that no whole foodstuffs such as meat, fish or vegetables would be used within the process of dish preparation, only compounds or mixtures of compounds. The first emergence of Note by Note cooking was evident between 2009 and 2011, with chefs such as Pierre Gagnaire and representatives of the Cordon Bleu since creating and even serving note by note dishes to hundreds of clients. Some chefs even acquired Michelin stars for their dishes. However, there are still some concerns regarding cooking using only pure compounds. Many people are apprehensive on the feasibility of molecular cuisine, in relation to nutritional and toxicological concerns. Additionally, food neophobia, the hesitance of the human mindset to change what we know, needs to be tackled and challenged to allow molecular cuisine to grow (This, 2013).

This report will focus on whether molecular gastronomy can aid the waste management of spent coffee grains from sources such as coffee shops and households, which could be reused in order to create alternative products or even recycled to re-brew a second coffee instead of being disposed of. It was reported in a paper written in 2017 by Martinez-Saez and colleagues that the materials recycled from coffee waste can be utilised as high quality, low cost resources (Martinez-Saez et al., 2017). Coffee is the second most traded product worldwide and has seen a production and consumption increase of more than 60% in the past 30 years (Murthy and Naidu, 2012). Spent coffee grain represents the majority of the waste derived from the coffee production industry, both beverage production and instant coffee. For each kilogram of instant coffee produced, around 2 kilograms of wet spent coffee grain is obtained. The global amount for spent coffee waste equates to approximately 60 million tonnes annually (Forcina et al, 2023). Substantial amounts of this figure (45%) come from by-products such as coffee pulp, husks and spent coffee grounds. This large quantity clearly illustrates the need for spent coffee waste to be combatted. This can be done through a circular economy approach or the recycling of spent coffee into alternative products (Forcina et al, 2023). The scope of this project is to outline the concerns of food waste and the environmental crisis we are currently undergoing as a population, and how molecular cooking, Note by Note in particular, can help in reducing food waste by utilising just compounds to create identical dishes.

This report will outline the methodology of producing a molecular coffee product, with the prospective outlook of upscaling this product in order to aid in the future reduction of spent coffee grain waste during coffee production.

2. AIMS & OBJECTIVES

2.1. Project aims

The aim of this project is to research and understand the skills and elements involved in molecular gastronomy and apply these aspects in the form of Note by Note cooking. The ingredients which are allowed to be used and their functionalities in each recipe must be fully comprehended in order to successfully develop a dish from entirely pure compounds. Each dish must be inspired by a current environmental problem associated with food waste.

2.2. Primary objectives

- Develop an understanding of what Molecular Gastronomy is.
- Research and implement cooking techniques used in molecular gastronomy.
- Research appropriate recipes in order to create a note by note dish.
- Understand the elements of what exactly a Note by Note dish is.
- Fully comprehend each chosen ingredient and their roles in the recipe of the final dish.
- Implement the concept of food waste into the dish.
- Create a final product which combines all elements of science and technology in cooking.

3. MATERIALS & METHODS

3.1. Materials

Sodium citrate (MSK), Sodium alginate (MSK), Calcium chloride (MSK), water (preferably deionised), chicory & coffee essence (Camp coffee club), red, orange and green food colourings (*Il Punto italiana, Italy*), egg white powder (SOSA albuwhip), citric acid (Louis Francois, France), glucose (Belgogluc CF-81), weighing boats, cornstarch, castor sugar (musgraves, Ireland), olive oil (musgraves, Ireland), hand blender, cooking hobs (electrolux - supplied by brodericks) microscale ONBALANCE CH-1000), a pan, metal mixing bowls, a whisk, sieve funnel, dropper, glass to serve. *See appendix I for ingredient images.*

3.2. Method

3.1.2. Spherified coffee balls recipe (adapted from Horowitz, 2018).

Sodium alginate bath

1. Weigh out 2.5g (0.5% by mass) of sodium alginate on a weighing boat.
2. Weigh out 3g of sodium citrate on a weighing boat.
3. Weigh out 484.5ml of deionised water in one mixing bowl.
4. Slowly add the sodium alginate and sodium citrate to the water bowl whilst mixing the solution at a moderate speed with a hand blender. Mix well until the sodium alginate is completely dissolved in the water.
5. Add 10ml of coffee essence to the mixture and blend until dispersed.
6. Add 2 drops each of food colourings (red, orange, green) to the mixture whilst still mixing with the hand blender until the new brown colour is evenly dispersed.
7. Leave this solution to the side and allow it to rest for 40 minutes to deaerate (see logbook 1).

Calcium chloride bath

8. Weigh out 5g (1% by mass) of calcium chloride on a weighing boat.
9. Measure 495ml of deionised water into a mixing bowl.
10. Slowly add the calcium chloride to the water and mix using a whisk until fully dissolved.

The spheres:

11. Using a dropper, slowly add the sodium alginate/coffee essence solution to the calcium chloride bath using a dropper. One drop at a time. Try to keep the head of the dropper close to the surface of the bath to ensure spherical shape is obtained.
12. Allow the drops to rest in the bath for 3-4 minutes.
13. Pour the contents of the calcium chloride bath into a sieve, collecting the spheres.
14. Slowly add the spheres into a tertiary water bowl.
15. Remove the spheres carefully from the water bowl and place them at the bottom of the serving glass.

3.1.2. Foam preparation: (recipe adapted from: Lavelle *et al.*, 2021)

1. Measure 75ml of deionised water.
2. Weigh out 12g (10% by weight) of egg white powder on a weighing boat using a scale.
3. Weigh 5g of citric acid using a scales
4. Weigh out 20g of castor sugar using a scale.
5. Measure out 10ml of glucose using a scales
6. Beat the preparation with a whisk until a foam begins to form.
7. Leave foam refrigerated until ready to serve.
8. Option to microwave foam prior to serving.

3.1.3. Tuile latte art (recipe adapted from: chef studio.com, 2020).

1. Measure 20g of corn starch on a weighing boat
2. Add the cornstarch to 80ml of water.
3. Measure 5ml of olive oil on a pan
4. At medium heat, fry the wet cornstarch until the solution solidifies.

3.1.4. The final product served *(see figure 1.)*

1. Gather serving glass of choice
2. Place spherical coffee balls at the bottom of the glass.
3. Slowly rest the foam above the coffee spheres.
4. Product should resemble a cappuccino/latte.

4. RESULTS & DISCUSSION

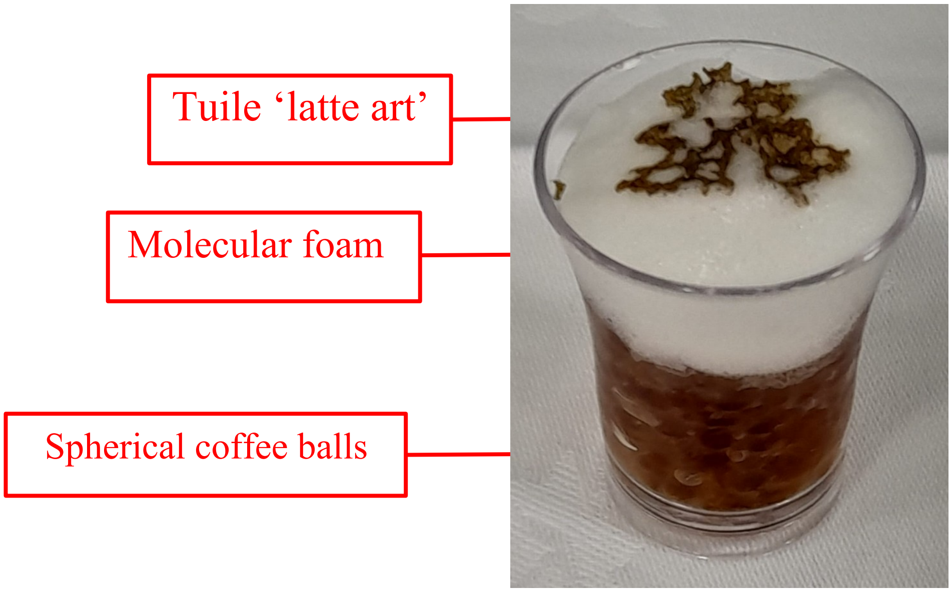

Figure 1. The final product

4.1. Product overview - Culinary techniques

The figure above shows the final product developed after a four week kitchen period using several skills fundamental to molecular gastronomy. The top layer consists of a tuile achieved by the cooking of corn starch and water on an oiled pan until a solidified structure with moderate browning was achieved. This component of the dish is created in order to imitate the 'latte art' present at the top of a regular coffee. Below the tuile is a molecular foam (see figure 3). This foam was developed over the course of two weeks in order to mimic and taste like a sweet milk foam, the top layer of a cappuccino. The foam has been created by whisking and beating egg white powder, water, castor sugar, citric acid and glucose until a foam is formed. Initially the foam was created without the use of castor sugar, however, after a sensory analysis it was decided that the addition of castor sugar would mask the acidity of the citric acid and more successfully mimic a sweeter foam. Foams are dispersions of gases in liquids. Egg white powder was utilised for its protein content. Proteins hydrophobic properties at the air-water interface results in stable foam formation (Audebert et al., 2019). Their amphiphilic properties allow for proteins to be surface active molecules, assembling at the interface. This makes them effective foaming agents that form a viscoelastic film upon blending through intramolecular interactions (Cao *et al.*, 2019). A paper written in 2009 by Narchi and co-workers indicated that the use of glucose in combination with a protein (protein-polysaccharide mixture) exhibits an increase in foam viscosity, therefore it can be determined that the glucose syrup used in this recipe contributes to the stability of this foam (Narchi *et al*., 2009).

Finally, the third component of the dish is the coffee flavoured spheres which act as an innovative take on the coffee bean component of a regular cappuccino. The spheres have been created using the direct spherification method of molecular gastronomy. A sodium alginate/citrate bath was made mixed with coffee essence. This solution will be transformed to spheres. When sodium alginate, a polysaccharide extracted from seaweed, is combined with calcium (chloride), a gel is formed without the need of heat. The displacement of the sodium in the alginate with calcium binds together the long alginate chains and forms a gel (Sen, 2017). This gel is achieved by dropping the solution into a calcium chloride bath and allowing the drops to rest for 3-4 minutes. The drops are then transferred into a water bath prior to serving. When consumed with the mechanical stress of chewing breaking these gel membranes, there is a release of flavour from the spheres into the mouths of the consumers.

These components; the tuile, the foam and the spherical coffee balls combine to create the final 'Molecular Cappuccino'. The three components can be seen in figure(s) 3, 4 and 5 below. The development of this concept from week one until week four can be seen in figure 2 below.

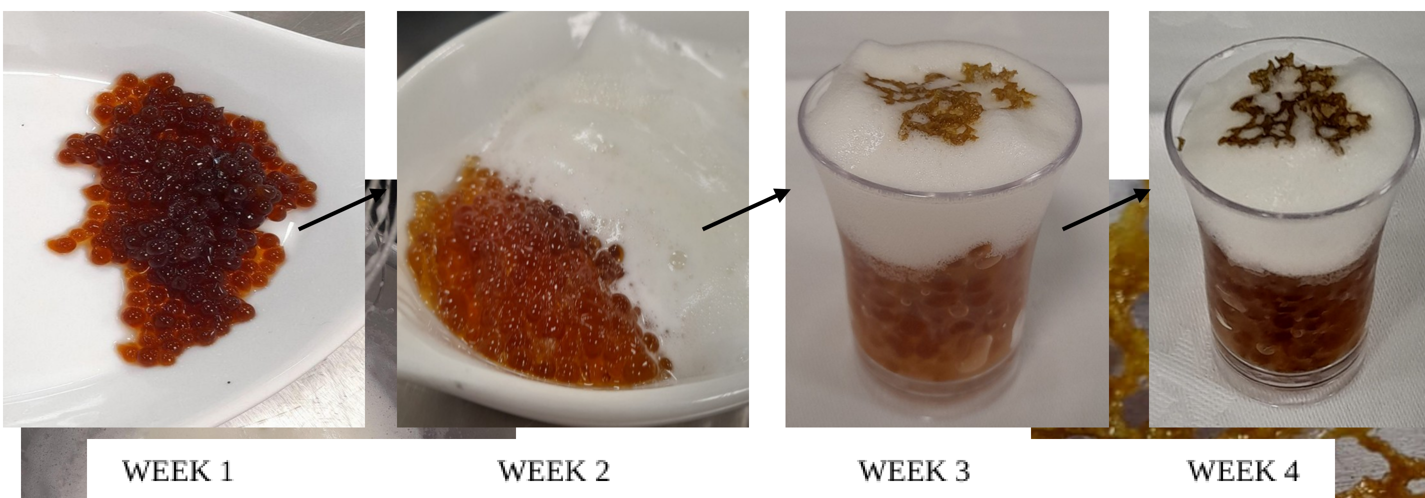

Figure 2. Developmental illustration timeline of product from week one to week four.

Figure 3. Final foam directly after stirring

Figure 4. Close up of spherified coffee balls

Figure 5. Tuile

4.2. Final sensory perception of concept

Over the course of the four developmental kitchens, a personal sensory analysis was carried out to assess the flavour and appearance of the product. Table one below illustrates the terminology used to characterise the final product after its developmental phases.

4.2.1. Week one sensory overview

After creating the spherical coffee balls during the first week of this project, it was immediately determined that the coffee essence did not have a strong enough flavour profile to mimic the profound taste of coffee. Therefore it was determined that the request of a pure coffee compound should be made to the personnel in charge of incoming orders. Unfortunately this ingredient was not available and the final product had quite a weak coffee flavour.

4.2.2. Week two sensory overview

The second week of this kitchen period focused on the creation of the coffee foam which would sit on top of the spherical coffee balls. This foam was created using the process seen in section 3.1.2. above. The presence of citric acid in the recipe resulted in the prototype having a very sour/acidic flavour profile. Initially it was predicted that the citric acid would exhibit a bitter taste like that of coffee but it was not the case.

4.2.3. Week three sensory overview

The molecular foam from week two was reformulated in order to make it sweeter. The addition of 20g of castor sugar to the recipe resulted in a foam with a sweeter taste than week two. This was a more acceptable flavour profile which imitated a sweeter milk foam to mimic that of dairy milk. The presence of the citric acid was also evident but in a much lesser intensity than the previous week. The tuile was also created this week and needed no alterations to the recipe in order to improve its flavour.

4.2.4. Week four sensory overview

The combination of all three components mentioned above resulted in a product with an acceptable appearance and flavour profile. Future recommendations would suggest the reformulation of this product using pure coffee flavour compounds instead of chicory and coffee essence.

Table 1. Terminology used to determine the sensory characteristics of the final product components

Spherified coffee balls			**Molecular foam**			**Tuile**		
Appearance	**Flavour**	**Colour**	**Appearance**	**Flavour**	**Colour**	**Appearance**	**Flavour**	**Colour**
Spherical	Weak	Weak	White	Bitter	White	Non uniform	Bland	Brown
Watery	Bitter	Brown	Volume	Sweet		Oily	Fatty	Shiny
Non-uniform	Smoky	Like-coffee	Foamy	Milky		Crisp		
			Aerated	Strong				

4.3. Product stability

Figure 6 below illustrates the final product after one week of rest time between kitchen sessions. This product was allowed to rest for one week to determine the long term stability of the separate components. This product, with further future developments, will be created for immediate consumption, however to achieve a greater understanding of the ingredients used in note by note cooking, a small experiment was performed. It is evident in figure 5 that the stability of both the foam and the spheres was not suitable for long term storage in refrigerated temperatures (<4℃). The molecular foam completely lost its integrity and was no longer visible. A comparison between day one and day seven can be seen in figure 7 below. As for the spheres, the colour became weaker and almost diluted as the water was expelled from the interior of the structure. The stability of the outer shell seems to be the reasoning for this loss of structure and colour. The deformation within the spheres could be more accurately determined by small deformation oscillation rheology. Alginate gels can be described as viscoelastic materials which exhibit viscous and elastic properties when exposed to a particular stress or force. The G' (or G prime) is said to be a measure of the elastic component (hardness), with G" (G double prime) being a measure of its viscous dissipation (Lee & Rogers, 2012). It can be assumed that the breakdown of the calcium chloride membrane of the gelated spheres is due to its high solubility. As the excess water is expelled from the spheres over time, it is possible that the calcium chloride membrane breaks down, thus altering the integrity of the spherified balls (Lee & Rogers, 2012). As for the foam, it can be concluded that the breakdown of air bubbles contributes to the instability of the foam over time, causing it to lose its volume and structure (Damodaran et al., 2008). This instability can be as a result of drainage or collapsing of the foam. Drainage of the foam occurs quite rapidly as a result of the thinning of the liquid film which separates the aforementioned air bubbles. This drainage may then accelerate the onset of coalescence or ostwald ripening (the diffusion of a gas in a liquid), which contributes to the collapse of the foam over time (Wierenga, Basheva &Delahaije, 2023).

Figure 6. Product after one week rest time

Figure 7. Comparison before and after rest time

4.4. Limitations & Future Developments

In order to develop this product further, the use of pure coffee compounds to augment the flavour profile of the product should be used. Additionally, the research of utilising more stable ingredients should be explored to increase the length of time that the product maintains its integrity. This could be achieved with the addition of higher quantities of glucose syrup to increase the viscosity of the foam. As seen in section 4.3. above, it was determined that the stability of the product was not optimal over longer time periods. In the hypothetical situation that this product was created for consumption, the length of time at which it takes to finish a cup of coffee may vary from one customer to another, therefore a stable product over the course of several hours must be considered.

The scaling up of this product to full sized coffee cups should also be considered as this prototype was only served in a shot glass to fit with the 'molecular theme'. The cost of these ingredients must also be compared with that of a regular sized cup of coffee in order to provide further determinations of the feasibility of this product. As with price sensitive consumers, if these ingredients were to create a product much more expensive than that of regular coffee, it would not be feasible.

A more profound sensory analysis with a trained panel should also be conducted in order to accurately determine the acceptance of the product, in terms of both its appearance and flavour. This proved to be a limitation to this project as the availability of willing sensory participants was low due to the unfamiliarity of the product to the general population.

Additionally, as seen in figure 8 below, a baby Guinness was created simultaneously to the molecular cappuccino during the final product development kitchen. This type of product could be included to extend the portfolio of possibilities using the techniques mentioned in the methodology section above, the only variation was the use of black food colouring. This product could also fit into the project's brief of ‘food waste’ under the umbrella of spent brewers grain, however, this was not a focus for this report and was only performed to showcase another avenue these molecular gastronomy techniques could fit into.

Figure 8. The Molecular Baby Guinness

5. CONCLUSION & RECOMMENDATIONS

In conclusion, it can be determined that the choice and quantities of the ingredients are extremely influential in the success of the end product of a molecular gastronomy dish. It was evident during the development of this concept that there was a need to manipulate and alter the recipes which were initially chosen at the beginning of the process. Alterations for the two main components of this dish, the foam and the spheres were considered and implemented over the four week kitchen period. The cooking techniques in order to create all three components of this dish such as spherification, foaming and creating a tuile mixture to be cooked were also developed throughout this process.

The initial foam which was produced had a profound acidic taste due to the presence of citric acid within the recipe. This was combatted by the addition of castor sugar to create a flavour profile which was similar to a sweet milk foam. Additionally, the spherical coffee balls lacked in flavour with the use of just the coffee essence. It was requested that a pure coffee flavour compound could be ordered and used in the future formulation of the dish however it was not available for the duration of this developmental period. The further manipulation of ingredients may contribute to a more stable product, by creating a more robust foam in addition to a spherical gel less susceptible to drainage and collapsing. These factors contributed to the aim of the project which allowed for augmented understanding of the functionality of the ingredients and techniques used in molecular gastronomy, in addition to understanding their limitations.

It can be recommended for the future development of this product that there is a more in depth sensory analysis conducted to aid in the understanding of the acceptance of this product to the general public.

Perhaps with the further development and research of this concept, the use of note by note cuisine can aid in tackling the 60 million tonne waste we see annually in the coffee industry. It can be concluded that the objectives of this project have been met. An augmented understanding of the techniques and fundamentals of molecular gastronomy and note by note cuisine has been achieved and a concept has been created by the manipulation of specific ingredients which were initially novel to the developer of this dish.

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7. LOGBOOKS

Logbook Week 1

MODULE CODE: TFPD9022

MODULE TITLE: Advanced Molecular Gastronomy TFCS9025: 2022-23

STUDENT NAME: Sean Browne

FOOD PRODUCT: The Molecular Cappuccino

WEEK NO: 1

Weekly Aims and Objectives

For the first week of this molecular gastronomy project, the aim is to familiarise myself with the ingredients chosen for the development of this note by note dish. All recipes have been researched but not yet personally tested. Therefore, augmented understanding of the behaviour of the ingredients will be the aim of this training kitchen. This kitchen will only focus on one component of the dish, the spherified coffee balls.

Objectives:

- Begin with gathering ingredients and following the recipe.
- Observe the effects of the ingredients on the final product.
- Assess ingredient quantities.
- Carry out a personal sensory analysis on the dish.

Materials and Method (Ingredients, Equipment and Method)

<u>Materials</u>

Sodium citrate (MSK), Sodium alginate (MSK), Calcium chloride (MSK), water (preferably deionised), chicory & coffee essence (Camp coffee club), red, orange and green food colourings (*Il Punto italiana, Italy*), hand blender, microscale ONBALANCE CH-1000), metal mixing bowls, a whisk, sieve funnel, dropper, glass to serve. *See appendix I for images.*

<u>Methodology</u>

Sodium alginate bath

1. Weigh out 2.5g (0.5% w/w) of sodium alginate on a weighing boat.
2. Weigh out 3g of sodium citrate on a weighing boat.
3. Weigh out 484.5ml of deionised water in one mixing bowl.
4. Slowly add the sodium alginate and sodium citrate to the water bowl whilst mixing the solution at a moderate speed with the hand blender. Mix well until the sodium alginate is completely dissolved in the water.
5. Add 10ml of coffee essence to the mixture and blend until dispersed.
6. Add 2 drops each of food colourings (red, orange, green) to the mixture whilst still mixing with the hand blender until the new colour is evenly dispersed.
7. Leave this solution to the side and allow it to rest for 40 minutes to deaerate.

8. Calcium chloride bath (recipe :
9. Weigh out 5g (1%w/w) of calcium chloride on a weighing boat.
10. Measure 495ml of deionised water into a mixing bowl.
11. Slowly add the calcium chloride to the water and mix using the hand blender until fully dissolved.

12. The spheres:
13. Using a dropper, slowly add the sodium alginate/coffee essence solution to the calcium chloride bath using a dropper. One drop at a time. Try to keep the head of the dropper close to the surface of the bath to ensure spherical shape is obtained.

Allow the drops to rest in the bath for 3-4 minutes.

Results and discussion

Using the methodology above, the sphere formation was successful as seen in figure 1 below. The spheres maintained their form using the ingredient quantities above and showed durability when being transported from one mixing bowl to another.

One observation made was that the spheres carried a substantial amount of excess water from the water bath which they were allowed to rest in at the end of the process. Therefore a skewed mouthfeel was felt during tasting. Additionally, the amount of coffee extract used was not enough as the coffee flavour was minimal and requires more extract.

Conclusions

In conclusion, drying the samples prior to serving may augment the mouthfeel of the final spheres. This must be performed with caution as the destruction of the integrity of that shape of the spheres must be avoided. This product is also a mimic of the liquid cappuccino, therefore not too much excess water should be removed.

The availability of using a stronger coffee compound as opposed to just coffee extract will be requested from professors as it is not felt that the extract will have a positive effect on the final flavour of the spheres.

Figure 1. De-aerated sodium alginate bath with colourings and coffee extract. Note the spheres on the left with excess water visible.

Figure 2. Close up of spherical coffee balls

Recommendations for following week.

Next week's kitchen will focus on the production of the foam fraction of the molecular cappuccino. The spheres will also be constructed simultaneously with an attempt to augment the flavour with a coffee flavour compound. The spheres will also be dried in order to alter the mouthfeel of the product

Ingredients required for the following 2 weeks.

Sodium citrate (MSK), Sodium alginate (MSK), Calcium chloride (MSK), water (preferably deionised), chicory & coffee essence (Camp coffee club), red, orange and green food colourings (*Il Punto italiana, Italy*), egg white powder (SOSA albuwhip), citric acid (Louis Francois, France), glucose (Belgogluc CF-81), weighing boats, hand blender, microscale ONBALANCE CH-1000), a pan, metal mixing bowls, a whisk, sieve funnel, dropper, glass to serve. *See appendix I for images.*

Logbook Week 2

MODULE CODE: TFPD9022

MODULE TITLE: Advanced Molecular Gastronomy TFCS9025: 2022-23

STUDENT NAME: Sean Browne

FOOD PRODUCT: The Molecular Cappuccino

WEEK NO:2

Weekly Aims and Objectives

For this week's kitchen there will be a focus on the molecular foam to sit on top of the spherificated balls made in week one. The aim of this week's kitchen has a similar look to last week's kitchen. The raw ingredients will be gathered and mixed together as seen in the recipe below. The performance of the foam directly after whisking and 30m minutes after whisking will be monitored

Objectives:

- Begin with gathering ingredients and following the recipe.
- Observe the effects of the ingredients on the final product.
- Assess ingredient quantities.
- Carry out a personal sensory analysis on the dish.
- Create a foam which holds and maintains integrity.

Materials and Method (Ingredients, Equipment and Method)

Materials

Sodium citrate (MSK), Sodium alginate (MSK), Calcium chloride (MSK), water (preferably deionised), chicory & coffee essence (Camp coffee club), red, orange and green food colourings (*Il Punto italiana, Italy*), egg white powder (SOSA albuwhip), citric acid (Louis Francois, France), glucose (Belgogluc CF-81), weighing boats, hand blender, microscale ONBALANCE CH-1000), a pan, metal mixing bowls, a whisk, sieve funnel, dropper, glass to serve. *See appendix I for images.*

Methodology

The methodology used for the spherical coffee balls can be seen above in the report in section 3.1.2. or above in logbook week 1.

<u>Methodology for molecular foam</u>

1. Measure 75ml of deionised water.
2. Weigh out 10g of egg white powder on a weighing boat using a scale.
3. Weigh 5g of citric acid using a scales
4. Measure out 10ml of glucose using a scales
5. Beat the preparation with a whisk until a foam begins to form.
6. Leave foam refrigerated until ready to serve.
7. Option to microwave foam prior to serving.

Results and discussion

The creation of this foam was a success with the recipe used above see figure one below. In terms of the spherified coffee balls, the drying of the product was not effective due to the constant release of excess water coming from the spheres over a long time period. The balls were left to sit in blue roll for 30 minutes while the foam was setting. Interestingly, even with the release of excess water coming from the spheres, they still maintained their size and shape. The foam was left to rest at 4C for 30 minutes and was then observed for performance. The top layer of the foam maintained its air and volume, however when inspected further the bottom later almost separated into an aqueous solution containing the elements mentioned above in the methodology.

Figure 1. Final foam directly after stirring

The product was then constructed with the foam sitting above the coffee spheres in order to attempt to mimic a cappuccino. This can be seen in figure 2 below. A secondary product was also made and left labelled in the fridge to rest for one week until the next sensory session. This was performed to see the effect of time on the integrity of the product.

Conclusions

In conclusion, the foam maintained its form over the course of 30 minutes prior to whisking to an extent. This was sufficient in order to allow for the construction of the molecular cappuccino by sitting this foam on top of the spheres without flow or decomposition.However, the flavour of the foam was much too sour due to the presence of citric acid. This was hoped to provide a bitter flavour to mimic that of coffee, but it was in fact too sour to do so. As seen last week, the spheres also performed well.

Unfortunately there is no availability of pure coffee flavouring, therefore going forward the sensory aspect of the product may be sweden due to the weakness of the coffee extract.

Figure 2. Final product from today's kitchen.

Recommendations for following week.

Now that it has been determined that the ingredients and formulation for the body of the product work efficiently and produce a dish that maintains its integrity and is durable, next week's focus will focus on a tuile latte art to place on top of the product to further mimic a cappuccino. Additionally, the flavour of the foam should be improved through the addition of castor sugar or some form of sweetener. Once all elements have been constructed, next week the product will be served in its prospective serving glass.

The sample that has been placed in the fridge will also be taken out and investigated. This will provide information on the long term stability of the dish.

Ingredients required for the following 2 weeks.

Sodium citrate (MSK), Sodium alginate (MSK), Calcium chloride (MSK), water (preferably deionised), chicory & coffee essence (Camp coffee club), red, orange and green food colourings (*Il Punto italiana, Italy*), egg white powder (SOSA albuwhip), citric acid (Louis Francois, France), glucose (Belgogluc CF-81), weighing boats, cornstarch, castor sugar (musgraves, Ireland), olive oil (musgraves, Ireland), hand blender, cooking hobs (electrolux - supplied by brodericks) microscale ONBALANCE CH-1000), a pan, metal mixing bowls, a whisk, sieve funnel, dropper, glass to serve.

Logbook Week 3

MODULE CODE: TFPD9022

MODULE TITLE: Advanced Molecular Gastronomy TFCS9025: 2022-23

STUDENT NAME: Sean Browne

FOOD PRODUCT: The Molecular Cappuccino

WEEK NO: 3

Weekly Aims and Objectives

The primary aim of this week's kitchen is to create a tuile using fried cornstarch and water to imitate latte art at the surface of the foam. Alternatively, the foam will be created again with the addition of castor sugar to improve its flavour. The methodology of the spherified balls will remain the same. The test sample from last week will also be inspected for stability capabilities.

Objectives:

- Begin with testing recipes for tuile creation.
- Make the spherified balls
- Make foam again and alter the recipe with more castor sugar.
- Carry out a personal sensory analysis on the dish.
- Construct dish in serving class.

Materials and Method (Ingredients, Equipment and Method)

Materials

Sodium citrate (MSK), Sodium alginate (MSK), Calcium chloride (MSK), water (preferably deionised), chicory & coffee essence (Camp coffee club), red, orange and green food colourings (*Il Punto italiana, Italy*), egg white powder (SOSA albuwhip), citric acid (Louis Francois, France), glucose (Belgogluc CF-81), weighing boats, cornstarch, castor sugar (musgraves, Ireland), olive oil (musgraves, Ireland), hand blender, cooking hobs (electrolux - supplied by brodericks) microscale ONBALANCE CH-1000), a pan, metal mixing bowls, a whisk, sieve funnel, dropper, glass to serve.

Methodology

The methodology used for the spherified coffee balls and the foam can be seen above in the report in section 3.1.2. or above in logbook(s) week 1 and 2. Note 20g of castor sugar was added to the foam to create a better flavour. 12g of egg white powder was also used instead of 10g to make 10% of the total weight of the recipe being from egg white powder.

<u>Methodology for tuile latte art</u>

1. Measure 20g of corn starch on a weighing boat
2. Add the cornstarch to 80ml of water.
3. Measure 5ml of olive oil on a pan
4. At medium heat, fry the wet cornstarch until the solution solidifies.
5. Let cool prior to placing the tuile on top of the foam.

Results and discussion

The creation of the tuile using the methodology above was successful in maintaining the shape and appearance of latte art which will sit on top of the molecular foam. No additional colourings were needed to create this brown colour due to the natural browning from the chosen cooking process. The tuile was also light enough and didn't sink into the foam when placed on top of it. This not only showed that the tuile was a suitable molecular cooking technique to form a component which suits this dish, it also shows the stability of the foam in its initial stages after whisking. The complete product was placed into a transparent serving glass to allow the consumer to see its internal structure and allow for them to create their own opinion of the product and its similarities to that of a cappuccino. Figure 1. below illustrates the near final product.

Figure 1. Final product from week 3 containing all components

Figure 2. tuile

The sample from last week's session was also taken from the fridge. As seen in figure 3 below, the product is not stable for long periods of time. The foam lost all volume and height. Additionally, the coffee balls almost completely deteriorated and lost their deep brown clolour.

Figure 3. Prototype after 1 week rest time

Figure 4. Comparison before and after rest time

Conclusions

To conclude, all three elements have now been created to successfully create the final dish in the next kitchen. The coffee spheres and the foam exhibit good stability for the time necessary to construct the product. Additionally the tuile maintains its integrity on top of the foam. These three components will be re-made again next week as seen in logbooks 1-3 to create the final dish. The addition of castor sugar to the foam recipe improved the flavour profile dramatically.

Recommendations for following week.

For the following week, All components of the final dish will be created together. The combination of all methodologies will be used and the final 'Molecular Cappuccino' will be constructed. Photos will be taken for the final report.

Ingredients required for the following 2 weeks.

Sodium citrate (MSK), Sodium alginate (MSK), Calcium chloride (MSK), water (preferably deionised), chicory & coffee essence (Camp coffee club), red, orange and green food colourings (*Il Punto italiana, Italy*), egg white powder (SOSA albuwhip), citric acid (Louis Francois, France), glucose (Belgogluc CF-81), weighing boats, cornstarch, castor sugar (musgraves, Ireland), olive oil (musgraves, Ireland), hand blender, cooking hobs (electrolux - supplied by brodericks) microscale ONBALANCE CH-1000), a pan, metal mixing bowls, a whisk, sieve funnel, dropper, glass to serve.

Logbook Week 4

STUDENT NAME: Sean Browne

FOOD PRODUCT: The Molecular Cappuccino

WEEK NO: 4

Weekly Aims and Objectives

The aim of this kitchen will be to create all three components of the final dish and construct it prior to taking photographs for the report. Photos of all equipment and ingredients will also be taken to reference in the final report.

Objectives:

- Make again all three components of the dish
- Construct the final product.
- When the foam and alginate bath are resting, photos to be taken of materials.
- Carry out a personal sensory analysis on the dish
- Construct dish in serving glass
- Take photos of the final dish for report.

Materials and Method (Ingredients, Equipment and Method)

Materials

Sodium citrate (MSK), Sodium alginate (MSK), Calcium chloride (MSK), water (preferably deionised), chicory & coffee essence (Camp coffee club), red, orange and green food colourings (*Il Punto italiana, Italy*), egg white powder (SOSA albuwhip), citric acid (Louis Francois, France), glucose (Belgogluc CF-81), weighing boats, cornstarch, castor sugar (musgraves, Ireland), olive oil (musgraves, Ireland), hand blender, cooking hobs (electrolux - supplied by brodericks) microscale ONBALANCE CH-1000), a pan, metal mixing bowls, a whisk, sieve funnel, dropper, glass to serve.

Methodology

Sodium alginate bath

1. Weigh out 2.5g (0.5% w/w) of sodium alginate on a weighing boat.
2. Weigh out 3g of sodium citrate on a weighing boat.
3. Weigh out 484.5ml of deionised water in one mixing bowl.
4. Slowly add the sodium alginate and sodium citrate to the water bowl whilst mixing the solution at a moderate speed with the hand blender. Mix well until the sodium alginate is completely dissolved in the water.
5. Add 10ml of coffee essence to the mixture and blend until dispersed.
6. Add 2 drops each of food colourings (red, orange, green) to the mixture whilst still mixing with the hand blender until the new colour is evenly dispersed.
7. Leave this solution to the side and allow to rest for 40 minutes to deaerate.

   Calcium chloride bath

8. Weigh out 5g (1%w/w) of calcium chloride on a weighing boat.
9. Measure 495ml of deionised water into a mixing bowl.

10. Slowly add the calcium chloride to the water and mix using the hand blender until fully dissolved.

The spheres:

11. Using a dropper, slowly add the sodium alginate/coffee essence solution to the calcium chloride bath using a dropper. One drop at a time. Try to keep the head of the dropper close to the surface of the bath to ensure spherical shape is obtained.
12. Allow the drops to rest in the bath for 3-4 minutes.
13. Pour the contents of the calcium chloride bath into a sieve, collecting the spheres.
14. Slowly add the spheres into a tertiary water bowl.
15. Remove the spheres carefully from the water bowl and place them at the bottom of the serving glass.

Foam preparation: (recipe taken from:

1. Measure 75ml of deionised water.
2. Weigh out 10g of egg white powder on a weighing boat using a scale.
3. Weigh 5g of citric acid using a scales
4. Weigh out 2g of castor sugar using a scale.
5. Measure out 10ml of glucose using a scales
6. Beat the preparation with a whisk until a foam begins to form.
7. Leave foam refrigerated until ready to serve.
8. Option to microwave foam prior to serving.

Tuile latte art (recipe taken from:

1. Measure 20g of corn starch on a weighing boat
2. Add the cornstarch to 80ml of water.
3. Measure 5ml of olive oil on a pan
4. At medium heat, fry the wet cornstarch until the solution solidifies.

The final product served

1. Gather serving glass of choice
2. Place spherified coffee balls at the bottom of the glass.
3. Slowly rest the foam above the coffee spheres.
4. Product should resemble a cappuccino/latte.

Results and discussion

As seen in figure one below, the creation of the final product was a success. Over the course of the past 4 weeks, the making of the initial coffee spheres followed by the molecular foam a and then the tweak produced a mimic of a mini molecular cappuccino. As mentioned in logbook 2, there was no pure coffee flavour compounds available to use, therefore a coffee essence was used throughout the process. This resulted in a weaker flavour profile than anticipated, however, it was clear from asking colleagues that the appearance of the product did in fact mimic a cup of coffee, which was the main objective of this course. Additionally the foam with added castor sugar had a sweet flavour to imitate that of milk and held its integrity for at least 30 minutes after whipping. Additionally, the tuile, when cooled, added a latte art feel to the dish. When placed on top of the foam it also maintained its integrity and didn't become soft or 'soggy', therefore it was also a suitable recipe for this product.

Figure 1. Final product

Conclusions

To conclude, this product for the report proved to be a success with the combination of ingredients and various recipes which came together to turn an initial idea into a molecular dish. This aided me, the student, in learning and applying many techniques related to molecular gastronomy and provided a greater understanding of the purpose of note by note cooking.

Future Recommendations

Moving forward with this concept, the use of pure coffee compounds to augment the flavour profile of the product should be used. Additionally, the research of utilising more stable ingredients should be explored to increase the length of time that the product maintains its integrity.

The scaling up of this product to full sized coffee cups should also be considered as this prototype was only served in a shot glass to fit with the ‘molecular theme’. The cost of these ingredients must also be compared with that of a regular sized cup of coffee in order to provide further determinations of the feasibility of this product. As with price sensitive consumers, if these ingredients were to create a product much more expensive than that of regular coffee, it would not be feasible.

8. APPENDICES

Appendix I
Images of ingredients and equipment used for product