

HOMEWORK ASSIGNMENT

For Roisin Burke and Pauline Danaher

DT414

Victor Petrakov

C11517637

Table of Contents

Introduction.....	1
Molecular Gastronomy	1-2
Note by Note.....	2
Dirac.....	3
Cocktails.....	3
Project Aims.....	4
Final Materials and Methods.....	4-10
Results.....	11-20
Discussion of Results.....	21-23
Conclusion.....	23
References	24-25
Appendices.....	26-35

Introduction

One of the most extensive water demand scenario studies was done by [De Fraiture and Wichelns \(2010\)](#). These studies focused on alternative strategies for meeting increased demands for water and food in 2050. As highlighted in the guidelines of the 7th International competition for Note by Note cooking, Note by Note Project was developed by Hervé This for sustainable development, important for feeding the humankind in 2050, when the population of the Earth will perhaps reach 10 billion people. This project is an important contribution to the fight against spoilage, while sparing water, energy, foodstuffs, and taking care of the environment. A note by note dish will be created by using pure compounds e.g sodium chloride which is found in salt.

Molecular Gastronomy

In 1988, Nicholas Kurti, a Hungarian physicist, and French chemist Hervé This co-founded the academic discipline of molecular gastronomy (This & Rutledge, 2009). Molecular gastronomy is the scientific discipline dedicated to the exploration and investigation of culinary mechanisms of phenomena which are related to the sensory perception of food (Snitkjær, 2010). In terms of cooking, it is a modern style practiced by chefs in professional kitchens, taking advantage of technical innovations made by food scientists. Although related to cooking, molecular gastronomy is not a style of cooking (van der Linden et al., 2008). It is an investigation of the physical and chemical changes that occur to ingredients while cooking, as well as social, artistic, and technical aspects of culinary arts.

Slowly, applications of molecular gastronomy are being introduced into restaurants in Ireland. (Valverde, Burke and Traynor, 2011). Chefs have used methods such as sous vide cooking, which can cook meats at optimal temperatures, emulsifiers to stabilize mixtures, rotary evaporators to distill solvents, and liquid nitrogen for multiple culinary purposes e.g smooth ice cream.

Molecular gastronomy was developed to modernise how we eat, but it might also save the planet. This (2013) believes the techniques it gave rise to could be used to help feed the world while saving energy. This has created Note by Note cuisine, which is a style of cooking based on the application of molecular gastronomy

Note by Note

Note by Note cooking was first introduced in 1994, when molecular cooking was spreading in the professional culinary world (Ashley, 2013). No traditional foods are used, It is the production of food using pure compounds or mixtures or pure compounds.

To practice Note by Note cooking, all that is needed is that the compounds are food grade, which means edible with no harmful impurities (U.S Food and Drug Administration, 2018). The chef has to design the various parts of the dish, the colours, tastes, odours, temperatures, trigeminal stimulation, consistency and nutritional aspects (Burke and Danaher, 2017). A Note by Note dish will be created using pure compounds and additives.

Dirac

Recently, scientists have been creating artificial meats using scientific techniques without traditional farming methods. The physical and chemical analysis of meat leads to many different option for making artificial meat.

This (2016) explains the recent phenomena:

“Many different systems can be made when the meat composition and/or structure is “reproduced”. In vitro systems obtained by cultivation of muscular fibres is only one possibility among many.”

Through Note by Note cooking, chefs and scientists have began creating artificial meats in the form of diracs. A dirac consists of pure compounds such as water, proteins, and additives, which enhance consistency, taste, aroma and colour.

This (2015) explains that a dirac is composed of 60 percent protein and 40 percent water, just like the structure of meat, but not just any protein is used, proteins that coagulate are needed. Proteins like egg white protein, milk proteins and vegetable proteins can be used.

The dirac will be made using brown rice protein, which is a full protein made up of all 20 amino acids, just like meat.

Cocktails

Recently, bartenders have begun using molecular techniques in bartending. It is explained by Micah Melton (2014)

“Molecular mixology is using culinary technique to add experiential elements to cocktails,”

A Note by Note style cocktail will be created using pure compounds, and additives for flavour, aroma, texture.

Project Aims

The aim of the project is to create a dirac dish and a cocktail in accordance with the guidelines of the 7th International Competition for Note by Note cooking.

Final Materials and Methods

Dirac

50g 2-acetyl-1-pyrroline (brown rice protein with all amino acids) see Appendices II for full breakdown of aminos.

200g water

20g sucrose

5g sodium chloride

40g Albumins, mucoproteins, and globulins

1.42g soda bicarbonate

10g acetic and 3-methylbutanoic acids, 2-phenylethanol

0.1g oct-1-en-3-ol

Equipment

Bowl

Wooden Spoon

Rational SelfCooking Centre SCC101E

Ikea Koncis roasting tin

Process

1. Add all ingredients to bowl
2. Whisk ingredients
3. Grease roasting tin with frylight coconut flavour cooking oil spray
4. Add to mix to roasting tin
5. Bake in the oven at 190 degrees celsius for 20 minutes
6. Remove from oven and let cool

Banknote

Ingredients

30g Corn Starch

40g water

0.36g sodium chloride

0.05g Cobalt chloride

0.10g Lead iodine

0.004g Pyridines, pyrazines, and furans

Equipment

Stainless steel whisk

Cling film

18cm plate

Microwave

Process

1. Whisk all ingredients to a thickness of white glue
2. Stretch cling film across the plate
3. Pour mix onto plate and tilt the plate to spread the mix across
4. Microwave on a high heat for 40 seconds

Edible Coins

Ingredients

2g Agarose and Agarpectin

192g water

14.3 sodium chloride

0.1g limonene and α -terpineol

Equipment

Copper Pot

Tablespoon

Small bowl

Rational SelfCooking Centre SCC101E

Silicone mould tray (24.25mm diameter moulds)

Process

1. Add all ingredients to copper pot and bring to a boil.
2. Boil down the liquid until small amount of liquid remains
3. Remove from heat and let cool briefly
4. Pour 10g of liquid in silicone moulds
5. Refrigerate for 2 hours

Credit Card

Ingredients

Glucose - Made up of 480g sucrose and 60g water

To make Glucose, add sucrose and water to copper pot and heat to a boil for 5 minutes.

Ingredients

120g glucose

57g water

0.05g Cobalt chloride

0.10g Lead iodide

Equipment

Robot Coupe R301 Ultra

Silicone mould tray (85.60 × 53.98 mm diameter moulds)

Copper Pot

Tablespoon

Process

1. Add glucose and water to copper pot and bring to a boil
2. Evaporating the liquid until the glucose begins turning to a caramel.
3. When glucose begins to caramel, add the blue and yellow colouring and stir in.
4. Remove the caramel from copper pot and put on sipit to cool.
5. Cut the piece into fine powder using Robot Coupe
6. Sprinkle a 2 mm thickness of the carameled glucose powder into 85.60 × 53.98 mm diameter mould.. Remove the disc from the mould and bake in a hot oven.
7. Bake in the oven on greased tray for 5 minutes at 180 degrees

Cocktail

Ingredients

100g sucrose

100g water

10g ascorbic acid

0.36g sodium chloride

0.5g limonene and α -terpineol

0.5g fibretone

0.5g anethole

20g soy lecithin foam

0.5g Carmine (E120)

Soy Lecithin Foam

150g sucrose

150g water

1g carbonyl, sulfur alicyclic aromatic benzenoid and heterocyclic compounds

0.5g 4-Methyl-2-phenyl-2-pentenal

4g soybean lecithin

Equipment

Copper Pot

Severin 170W White Hand Blender S73736

Large bowl

Tablespoon

Chef & Sommelier Cabernet Martini Glass 210ml

Process

1. Combine water, sucrose, citric acid, sodium chloride, and flavourings in a copper pot and heat until dissolved
2. Remove from heat and let cool in refrigerator for one hour
3. Add soy lecithin, sucrose, water and flavourings to pot and dissolve
4. Remove from heat and transfer to large bowl
5. When cocktail mix is chilled, pour into martini glass
6. Using the hand blender, make soy lecithin foam by blending liquid in bowl until you make enough foam
7. Using a tablespoon, add soy lecithin foam to top of cocktail
8. Serve cocktail

Results

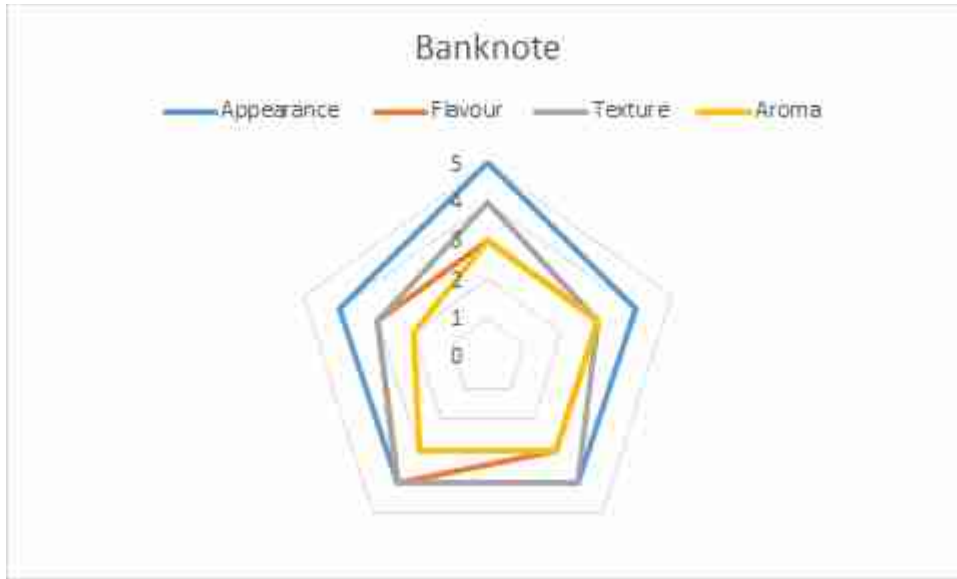
Stage 1

Bank Note



Image 1.1: Banknote

Banknote made from corn starch, water, sodium chloride, blue and yellow colouring, and bacon flavouring



Finding 1.1: Sensory analysis of banknote from week two

The sensory analysis from week 2 identified that the appearance, aroma, texture and flavour was of good standard.

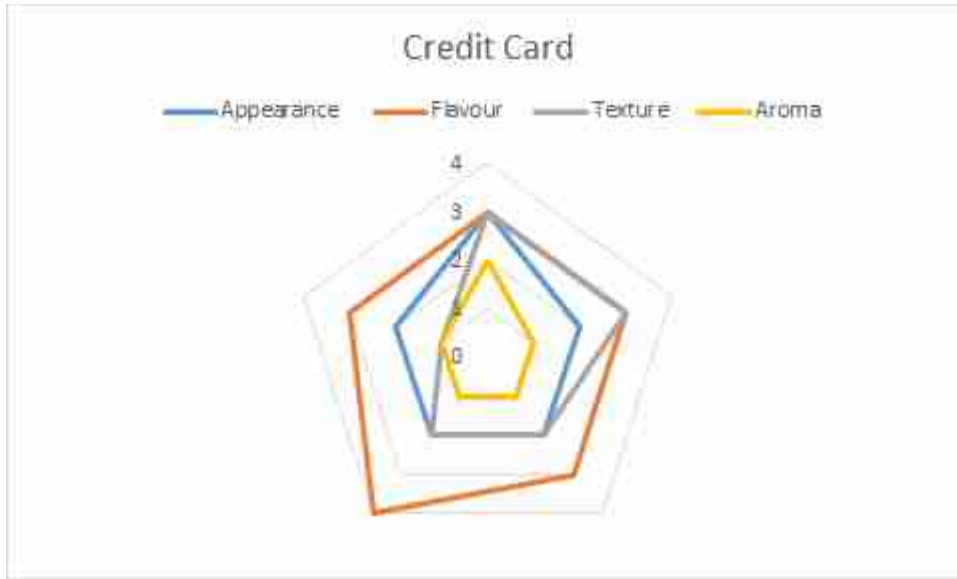
Stage 2

Credit Card



Image 2.1: Caramel used to make credit card wafer

Image above shows caramel chunk on sipit before being made into a powder . Ingredients - Glucose, water, blue and yellow colouring.



Finding 2.1: Sensory analysis of credit card from week one

Sensory analysis from week one shows poor aroma, appearance and texture, and average flavour. The process was changed for greater results.

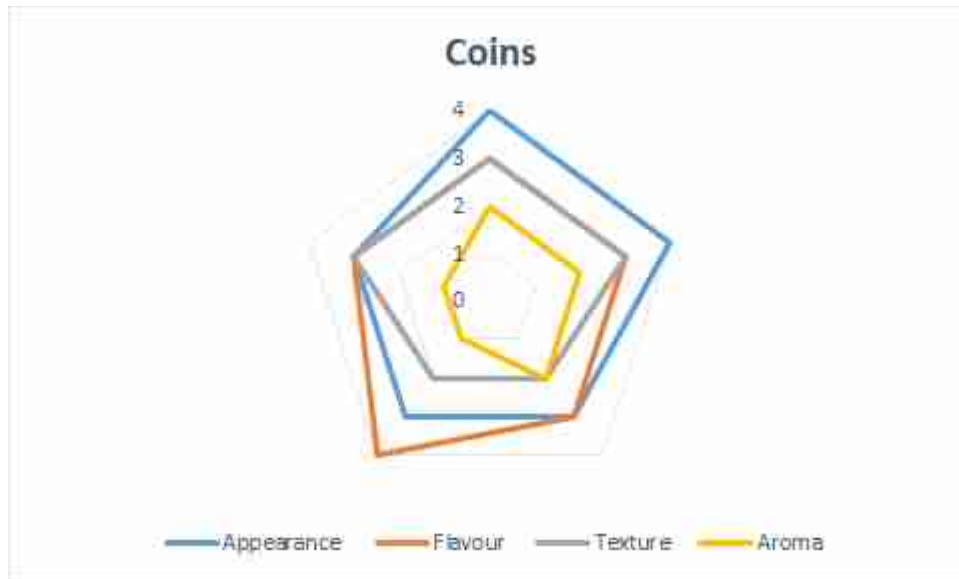
Stage 3

Coins



Image 3.1: Coins from week three

Image above shows coins from week three. Ingredients - Agar, water sodium chloride, yellow colouring



Finding 3.1: Sensory analysis of coins week three

Sensory results from week three show positive results, bar the aroma, which was minimal. Recipe was changed to improve results.

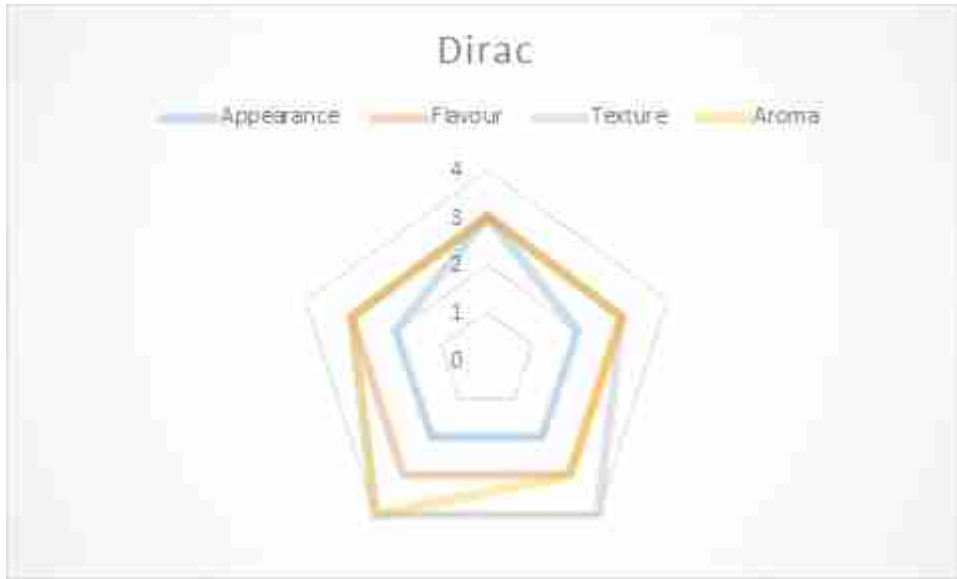
Stage 4

Dirac



Image 4.1: Dirac from week four

Dirac from week four. Ingredients Maskelmän Organic rice protein, water, sucrose, corn flour, sodium chloride, egg white, soda bicarbonate.



Finding 4.1: Sensory analysis of dirac from week 4

Sensory results indicated the appearance, flavour needed improving. Some results show a liking for the texture and aroma.

Complete Dirac dish



Image 5.1: Final dirac dish

Final result with wallet case (dirac), banknotes, credit card and coins.

Cocktail



Image 6.1: Cocktail made from pure compounds

Complete cocktail with flavours of coffee, orange, milk chocolate, hazelnut and star anise.
Ingredients based on 3fe christmas coffee blend

Discussion of results

Stage 1

Banknote

For the banknote, pea protein powder was removed, replaced with additional cornstarch to reproduce original texture. Pyridines, pyrazines, and furans produces the main bacon flavours, by providing the unique aroma and meaty taste (Nguyen, 2015). This was added through bacon flavouring by Mane to improve taste and aroma. Cobalt chloride and lead iodine compounds were added to create a green coloured banknote. This colour was achieved adding Mallard Ferriere yellow and blue colouring to the mix.

Stage 2

Credit Card

For the credit card, an extra step in the process was added to the initial concept in week one as sensory analysis from week one shows poor aroma, appearance and texture, and average flavour. Robot Coupe was used to cut the caramel into a fine powder, then the powder was added to the mould. The mould 85.60 × 53.98 mm diameter and 2mm thickness of powder was sprinkled then removed and baked in the oven. This resulted in a rectangular wafer crisp, similar to the Pierre Gagnaire recipe, served in Hong Kong, April 24, 2008.

Stage 3

Coins

The coins were made similar to the initial concept. Agarose and agarpectin, or agar agar is produced from seaweed and is used as vegetarian gelatin substitute (Adams, 2018). Textura powdered agar was used. The liquid was boiled longer to produce a more firm coin. Yellow colouring was removed to give a silver look, orange essence, which main flavour components are limonene and α -terpineol, was added to enhance flavour and aroma

Stage 4

Dirac

The dirac was made similar to the initial concept in week 4. A roasting tin instead of a muffin tin was used to create a flat shape. Corn Flour was removed to create a flat dirac which resembled a thin wallet case. Acetic and 3-methylbutanoic acids, 2-phenylethanol are the main flavour compounds of balsamic vinegar, which was added for flavour, colour and sweetness balance.. Oct-1-en-3-ol, which is the main flavour compound of mushroom was added to enhance flavour using Sosa mushroom flavouring. Sosa recommend a dose of 0,2 g/kg 0,2 g, half of this amount was used as the total volume of the dirac is under half a kilogram. Sosa (2018) explain that the number of drops taking as reference, in general, natural flavours have a higher density. Soda bicarbonate was used as a raising agent for the dirac, but it was ineffective. Albumins, mucoproteins, and globulins were added using egg whites to provide texture. Sucrose and sodium chloride were used as flavour enhancers.

Previously Herve this explained that a dirac is composed of 60 percent protein and 40 percent water. This composition was difficult to work with, so a ratio of 75 percent water and 25 percent protein was used, which the is the updated ratio recommended by Herve This in the international note by note contest guidelines. For the protein component, the main flavour profile was made from 2-acetyl-1-pyrroline, which is found in brown rice. Brown rice protein was used for its lighter style and amino acid composition, which it has all 20 amino acids, the same composition as meat or fish muscle tissue (Storcksdieck, Bonsmann and Hurrell, 2007). Maskelmän organic rice protein was the brand use to create the dirac.

Cocktail

The cocktail recipe is based on 3fe coffee companies christmas blend coffee, which has flavours of milk chocolate, candied orange and hazelnut. Water was mixed with sucrose, sodium chloride and ascorbic acid to create sweet depth and balance. Flavours of hazelnut (fibreone), orange (limonene and α -terpineol) and star anise (anethole) were added to the liquid. Carmine (E120) was added using Mallard Ferraire red colouring, to give the cocktail a Christmas look. Soy lecithin was blended with sucrose, water, coffee flavouring (carbonyl, sulfur alicyclic aromatic benzenoid and heterocyclic) and milk chocolate flavouring (4-Methyl-2-phenyl-2-pentenal) to create a nice aromatic foam for the cocktail. Flavourings for cocktails were all products of the Sosa alphabet of flavours.

Conclusion

By using pure compounds and food grade additives a dish and cocktail were created for the International Contest for Note by Note Cooking N°7. The theme this year was to create a dirac dish and a cocktail using note by note cooking methods. The preparations named "dirac's" are systems that should have the same type of nutritional properties that muscle tissue (meat, fish). This was achieved by creating a dish which visual resembled a wallet, credit card, banknote and coins. Brown rice protein was used to mimic the nutritional properties of meat.

References

Adams, A. (2018). *How to Use Agar-Agar in Cooking*. [online] Spruce Eats. Available at: <https://www.thespruceeats.com/what-is-agar-agar-p2-1000960> [Accessed 6 Jan. 2019].

Ashley, S. (2013). Synthetic Food: Better Cooking Through Chemistry. Available at: www.pbs.org/wgbh/nova/next/physics/synthetic-food-better-cooking-through-chemistry/

Burke, R. and danaher, P. (2017). *Note by Note: A New Revolution in Cooking*. [online] Available at: <https://arrow.dit.ie/cgi/viewcontent.cgi?article=1060&context=dgs> [Accessed 3 Jan. 2019].

de Fraiture, C. and Wichelns, D. (2010). Satisfying future water demands for agriculture. *Agricultural Water Management*, 97(4), pp.502-511.

FDA. 2016. Determining the Regulatory Status of a Food Ingredient. U.S. Food and Notes, Drug Administration, U. S. Department of Health and Human Services, <http://www.fda.gov/Food/IngredientsPackagingLabeling/FoodAdditivesIngredients/ucm228269>. [Accessed 3 Jan. 2019].

Food and Drug Administration (2018). *Determining the Regulatory Status of a Food Ingredient*. [online] FDA. Available at: <https://www.fda.gov/food/ingredientspackaginglabeling/foodadditivesingredients/ucm228269.htm> [Accessed 3 Jan. 2019].

Melton, M. and Magyarics, K. (2014). Science-Inspired Sips. *Cheers*, 25(3), p.28.

Nguyen, M. (2015). *The science of bacon*. [online] scienceandfooducla. Available at: <https://scienceandfooducla.wordpress.com/2015/04/07/the-science-of-bacon/> [Accessed 6 Jan. 2019].

Snitkjær, P. (2010). Investigations of meat stock from a Molecular Gastronomy perspective. PhD thesis. University of Copenhagen. Denmark.

Sosa (2018). *The alphabet flavour box*. [online] Sosa. Available at: <https://www.sosa.cat/catalogues/sosa12en.pdf> [Accessed 6 Jan. 2019].

Storcksdieck, S., Bonsmann, G. and Hurrell, R. (2007). Iron-Binding Properties, Amino Acid Composition, and Structure of Muscle Tissue Peptides from in vitro Digestion of Different Meat Sources. *Journal of Food Science*, 72(1), pp.S019-S029.

This, H. & Rutledge, D. (2009). Analytical methods for molecular gastronomy. *Analytical and Bioanalytical Chemistry*, 394 (3), 659-661.

This, H. (2013). *Where high science and fine cuisine collide*. [online] The Irish Times. Available at: <https://www.irishtimes.com/news/science/where-high-science-and-fine-cuisine-collide-1.1252074> [Accessed 3 Jan. 2019].

This, H. (2015). *The Diracs*. [online] Pierregagnaire.com. Available at: https://www.pierregagnaire.com/pierre_gagnaire/travaux_detail/101 [Accessed 3 Jan. 2019].

This, H. (2016). What can “Artificial Meat” be? Note by note cooking offers a variety of answers. *French Academy of Agriculture*, p.4.

Valverde, J., Burke, R. and Traynor, M. (2011). Molecular Gastronomy in Ireland. *Journal of Culinary Science & Technology*, 9(4), pp.205-211.

van der Linden, E., McClements, D. & Ubbink, J. (2008). Molecular Gastronomy: A Food Fad or an Interface for Science-based Cooking? *Food Biophysics*, 3 (2), 246-254.

Appendices

Log Book

Assignment Week 1

Aim

Create an edible credit card

Objective

Use note by note cooking to create a food which resembles a credit card

Credit card

Ingredients

Glucose 120g - Made up of 120g sucrose and 60g water

To make Glucose, add sucrose and water to copper pot and heat to a boil, dissolving the sucrose. Continue to boil to evaporate liquid content until liquid is a thick syrup.

120g glucose

57g water

0.05g Mallard Ferriere blue colouring

0.10g Mallard Ferriere yellow colouring

Process

1. Add glucose and water to copper pot and bring to a boil
2. Evaporating the liquid until the glucose begins turning to a caramel.
3. When glucose begins to caramel, add the blue and yellow colouring and stir in.
4. Remove the caramel from copper pot and put on sipit to cool.
5. Cut the piece into fine powder using Robot Coupe

Recommendations for next week

Try a different process for the future credit card product. Next week will focus on the dirac, with two different recipes tested as a dirac.

Week 2

Aim

Create two diracs which may be used in the final assessment

Objectives

Use note by note cooking to create a dirac which resembles a lethal wallet case, and a dirac which resembles a banknote.

Edible Paper (Money)

Ingredients

20g Corn Starch

30g cold water

8g bulk protein pea powder isolate

0.36g sodium chloride

0.05g Mallard Ferriere blue colouring

0.10g Mallard Ferriere yellow colouring

Equipment

Stainless steel whisk

Cling film

18cm plate

Microwave

Process

- 1 Whisk all ingredients to a thickness of white glue
2. Stretch cling film across the plate
3. Pour mix onto plate and tilt the plate to spread the mix across
4. Microwave on a high heat for 40 seconds

Edible wallet case

Ingredients

8.5g Gelatin

35g cold water

52g bulk powder protein powder isolate

86g glucose syrup

30g coconut oil

124g icing sugar

Equipment

Copper Pot

Tablespoon

Large bowl

Wooden Spoon

Process

1. Combine gelatin and water in copper pot
2. Bring up heat to melt gelatin
3. Add glucose and coconut oil. Mix well
4. Just before coconut oil melts, remove from heat
5. Cool until lukewarm
6. In a large bowl add icing sugar and pea protein powder
7. Make a well in the centre with a wooden spoon
8. Pour in lukewarm gelatin mixture and stir it in
9. Mix in until stickiness of the sugar disappears

10. Knead until mixture is smooth, does not stick to your hands

11. Shape into two 10x14cm rectangles

Recommendations for next week

Banknote turned out well, but will not be used as a dirac. Research Amino Acids in proteins you are using to make sure it made up same muscle tissues as meat. Focus on cocktail and coins next week.

Week 3

Aim

Create edible coins and a cocktail to be used in the final assessment.

Objectives

Using note by note cooking create edible coins and a cocktail from pure compounds.

Edible Coins

Ingredients

2g Agar

192g water

14.3g sodium chloride

0.05g Mallard Ferriere yellow colouring

Equipment

Copper Pot

Tablespoon

Small bowl

Silicone mould tray (24.25mm diameter moulds)

Process

1. Add all ingredients to copper pot and bring to a boil.
2. Boil down the liquid until small amount of liquid remains
3. Remove from heat and let cool briefly
4. Pour 10g of liquid in silicone moulds
5. Refrigerate for 2 hours

Cocktail

Ingredients

100g sucrose

100g water

5g citric acid

0.72g sodium chloride

0.5g Sosaorange flavouring

0.5g Sosa hazelnut flavouring

0.5g Sosa star anise flavouring

20g soy lecithin foam

Soy Lecithin Foam

150g sucrose

150g water

1g Sosa coffee flavouring

0.5g Sosa cacao flavouring

4g Textura soy lecithin

Equipment

Copper Pot

Severin 170W White Hand Blender S73736

Large bowl

Tablespoon

Chef & Sommelier Cabernet Martini Glass 210ml

Process

1. Combine water, sucrose, citric acid, sodium chloride, and flavourings in a copper pot and heat until dissolved
2. Remove from heat and let cool in refrigerator for one hour
3. Add soy lecithin, sucrose, water and flavourings to pot and dissolve
4. Remove from heat and transfer to large bowl
5. When cocktail mix is chilled, pour into martini glass

6. Using the hand blender, make soy lecithin foam by blending liquid in bowl until you make enough foam
7. Using a tablespoon, add soy lecithin foam to top of cocktail
8. Serve cocktail

Recommendations for next week

Focus on creating a dirac using a protein powder which is a complete protein with all 20 amino acids. Create dirac using 25 percent protein and 75 percent water.

Week 4

Edible Wallet Case

Ingredients

85g Riviena balsamic vinegar
2g Textura agar
30ml water
45g Maskelmän Organic rice protein

Equipment

Copper Pot
Table spoon
Plate
Kitchen Knife

Process

1. Add ingredients to copper pot and bring to a boil
2. Take of heat and pour onto plate
3. Let cool and refrigerate for 15 minutes
4. Cut in rectangle shape

Dirac

Ingredients

60g Maskelmän Organic rice protein
40g water
20g sucrose
30g corn flour

5g sodium chloride
40g egg white
1.42g soda bicarbonate

Equipment

Bowl
Table fork
Rational SelfCooking Centre SCC101E
Baker & Salt Non-Stick 12 Cup Muffin Tin

Process

1. Add all ingredients to bowl
2. Whisk ingredients
3. Grease muffin tin with frylight coconut flavour cooking oil spray
4. Add to mix to muffin tin
5. Bake in the oven at 190 degrees celsius for 15 minutes
6. Remove from oven and let cool

Appendices II

Brown rice Amino Acids

Alanine	5.8
Arginine	8.2
Aspartic Acid	9
Cystine	2.2
Glutamic Acid	18
Glycine	4.6

Histidine*	2.4
Isoleucine*	4.5
Leucine*	8.3
Lysine*	3.1
Methionine*	2.9
Phenylalanine*	5.7
Proline	3.7
Serine	5.1
Threonine*	3.8
Tryptophan*	1.5
Tyrosine	5.5
Valine*	5.9