Molecular Gastronomy

TFCS4025

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Report

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Background Information

Molecular gastronomy is a scientific discipline that studies the mechanisms of phenomenon occurring in the preparation and consumption of food (This, 2013). Molecular gastronomy is knowledge of culinary transformations and simply acknowledges the knowledge of food rather than just the cooking and preparation of food. Molecular gastronomy and molecular cooking are two distinct disciplines. Molecular gastronomy is the chemistry and physics behind the preparation of foodstuffs (This, 2006) and not just a fancy way of preparing food with liquid nitrogen contrary to what many people believe. Molecular cooking effectively uses these new methods, equipment and produce (Burke, This and Kelly, 2016). Molecular gastronomy is not just a food trend but has and is shaping the world of food science at the moment and over the past decade.

According to Burke, This and Kelly,(2016), molecular gastronomy encompassed both the knowledge of the food scientist and art of the chef. Molecular gastronomy was first formalised by Herve This, a French chemist and the late Nicholas Kurti, a Hungarian physicist. Through this formalisation of this 'new' scientific discipline it became an application of scientific principles in the production of highly innovative and unique dishes. For this reason molecular gastronomy has been used in some of the most high end restaurants in the world e.g. Heston Blumenthal's the Fat Duck.

Note by Note cooking is an application of molecular gastronomy where only pure compounds are used to create food. Therefore note by note cooking uses no meat, fish, fruit or vegetable products when creating foods. Note by Note cooking may be called the future of food according to This, 2016. Note by Note cooking makes food through the utilisation of pure compounds e.g. instead of using fresh eggs, why not use ovalbumin, the main protein found in egg white. Note by Note cooking can provide a solution to the food crisis predicted for 2050 where it is estimated the population of the world will be too large to keep up with current production of food (Hunter et al., 2017). Transportation of foods around the globe mean that a lot of the time water is being transported. Think of fruit and vegetables where up to 90% of it can be simple H_2O. With this in mind Note by Note cooking could be the solution to the world food crisis that is looming in the near future.

One such pure compound that may be utilised in Note by Note cooking is pectin. Pectin is a structural polysaccharide and is found in cell walls of plants. Pectin is used in the food industry as a thickener, gelling agent or as a stabiliser. Pectin is regards as safe for use by the EU and has an e number of E440. Pectin can be extracted from citrus peels through heating or microwaving (Dranca and Oroian, 2018).

Two distinct types of pectin exist; low methoxyl pectin (LMP) and high methoxyl pectin (HMP). HMP is distinct from LMP in the sense that HMP will not dissolve when the percentage of sugar is below 25% and not gel when the sugar content is below 60%. This means that HMP is highly dependant on sugar in order for gelling to occur. For this reason the gelling of strawberries which would be low in pectin, requires large amounts of sugar in order to promote gelling (Lersch, 2014). With this in mind HMP will not be a good choice of pectin for this investigation as high levels of sugar is needed to gel it. LMP is more dependent on calcium content and pH to gel and therefore not dependant on sugar for gelling to occur. Optimum pH for LMP is 2.5 – 5.5 and requires a source of calcium through milk product or calcium lactate, calcium chloride or otherwise. Pectin's gel hydro-colloidally where polymers create a network which traps water.

The aims of this investigation is to create a dish which utilises pectin with a low sugar content.

Aims

The aim of this investigation is to create a dish which utilises pectin and low sugar. A deconstructed ‘apple crumble’ will be produced through the use of a LMP with components of the dish including, a low sugar apple jelly, an apple skin, apple puree, crumble and custard using the sub discipline applications of Note by Note cooking.

Equipment

Week Four		
Equipment List	**Make/Model**	**Picture**
Kitchen Scales	Tiamo KS 900	
Weigh Spoon	Silver Crest (No model no. available)	
Stainless Steel Pots	Vogue	
Stainless Steel Bowls	N/A	

Stainless Steel Jug	N/A	
Balloon Whisk	N/A	
Wooden Spoon	N/A	
Metal Spoons	N/A	

Metal Baking Sheet	N/A	
Combi Oven	Convotherm OEB 6.10	
Steel Frying Pan	Vogue	

Methods

(All ingredient Info can be Viewed in Appendices)

Apple Skin

- Sosa Low Sugar Pectin – 4g
- Louis Francois Citric Acid – 3g
- Water – 100ml
- Sosa Fructose - 10g

- Bulk Powder Stevia - 4g
- Food colouring - 6 drops
- Perqoi (apple) Flavouring – 15 drops

1. Gather all ingredients as above.
2. Add pectin, citric acid, fructose, food colouring and stevia to water in a jug.
3. Using an immersion blender try disperse powders into solution.
4. Once dispersed as best you can heat in a pot until boiled and powders are sufficiently dissolved into the liquid.
5. Add flavouring and mix briefly.
6. Take off the heat and pour onto a tray so that the liquid is evenly distributed over the tray.
7. Place on the middle shelf in the oven at 90°C for 1 hr until the gel resembles apple skins.

Low Sugar Apple Flavoured Gel

- Sosa Low Sugar Pectin – 4g
- Louis Francois Citric Acid – 3g
- Water – 200ml
- Sosa Fructose - 10g
- Bulk Powder Stevia - 4g
- Perqoi (apple) Flavouring – 15 drops

1. Gather all ingredients as above.
2. Add pectin, citric acid, fructose and stevia to water in a jug.
3. Using an immersion blender try disperse powders into solution.

4. Once dispersed as best you can heat in a pot until boiled and powders are sufficiently dissolved into the liquid.
5. Add flavouring and mix briefly.
6. Take of the heat and pour into a bowl to allow cool and set.

Custard

- Corn starch - 7g
- Sugar – 20g
- Tonka Bean Flavouring - 7 drops
- Milk powder - 10g
- Water – 100ml
- Yellow Food Colouring – 5 drops

1. Gather all ingredients
2. Mix milk powder, sugar and water and heat until dissolved.
3. Add cornflour and food colouring.
4. Using a wooden spoon mix the mixture over heat until thickened.
5. Add flavouring and mix together.

Crumble

- Maltodextrin - 50g
- Clarified Butter – 50g
- Sugar – 20g
- Maltodextrin – 30g

1. Gather all ingredients.
2. Make the clarified butter by melting the butter.
3. Continue melting the butter until the milk solids begin to burn so to impart a nutty flavour in the fat.

4. Separate the milk solid and milk fats by leaving a wooden spoon under the pot and leaving the milk solids to settle.
5. Mix all ingredients until a crumble has formed.
6. Heat the crumble on a clean frying pan until the crumble begins to form a paste.
7. Remove from the heat and add remaining 30g of maltodextrin to create a crumble like mixture again.
8. Leave to cool and sieve.

Apple Puree

- Ultratex – 25g
- Water – 100ml
- Perquoi Flavouring – 6 drops
- Sugar -10g
- Malic Acid – 1g

1. Add sugar, and malic acid to water and mix until dissolved.
2. Add ultratex and stir until smooth.
3. Place in a piping bag to plate up

Results

Figure 1.1: showing final dish 'Apple Crumble'

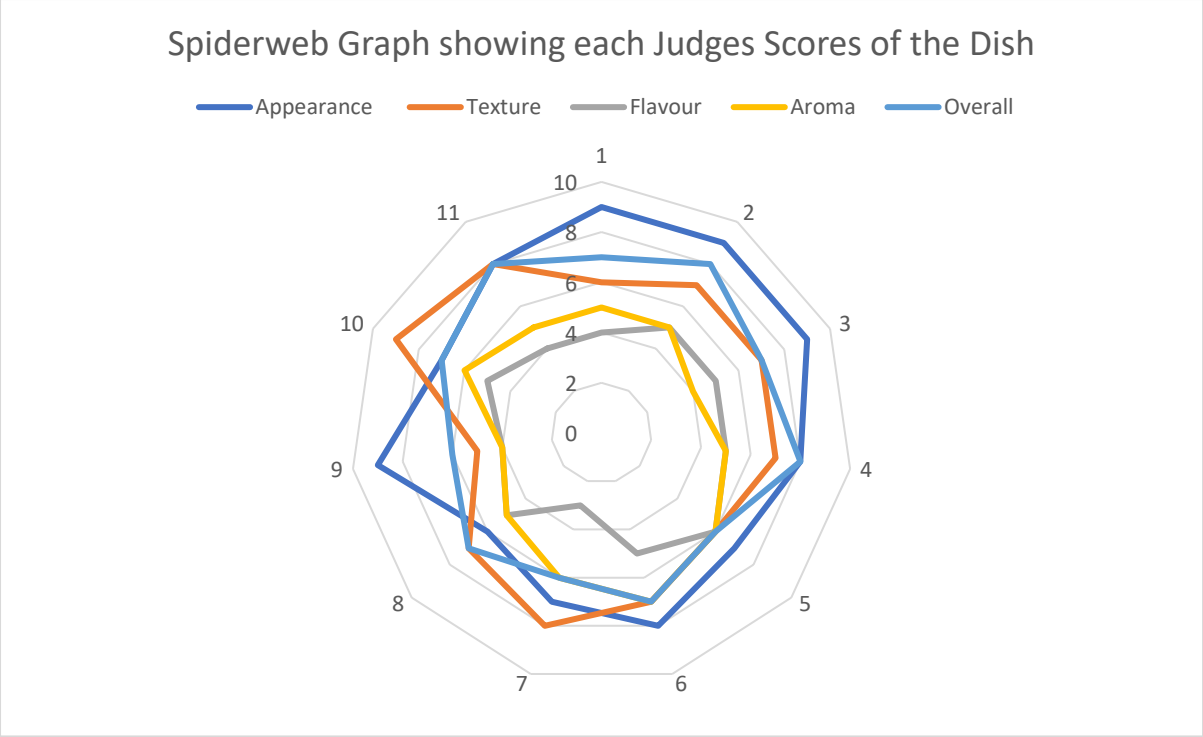

Figure 1.2: spiderweb graph showing scores by each judge with 1 = dislike and 9= really like

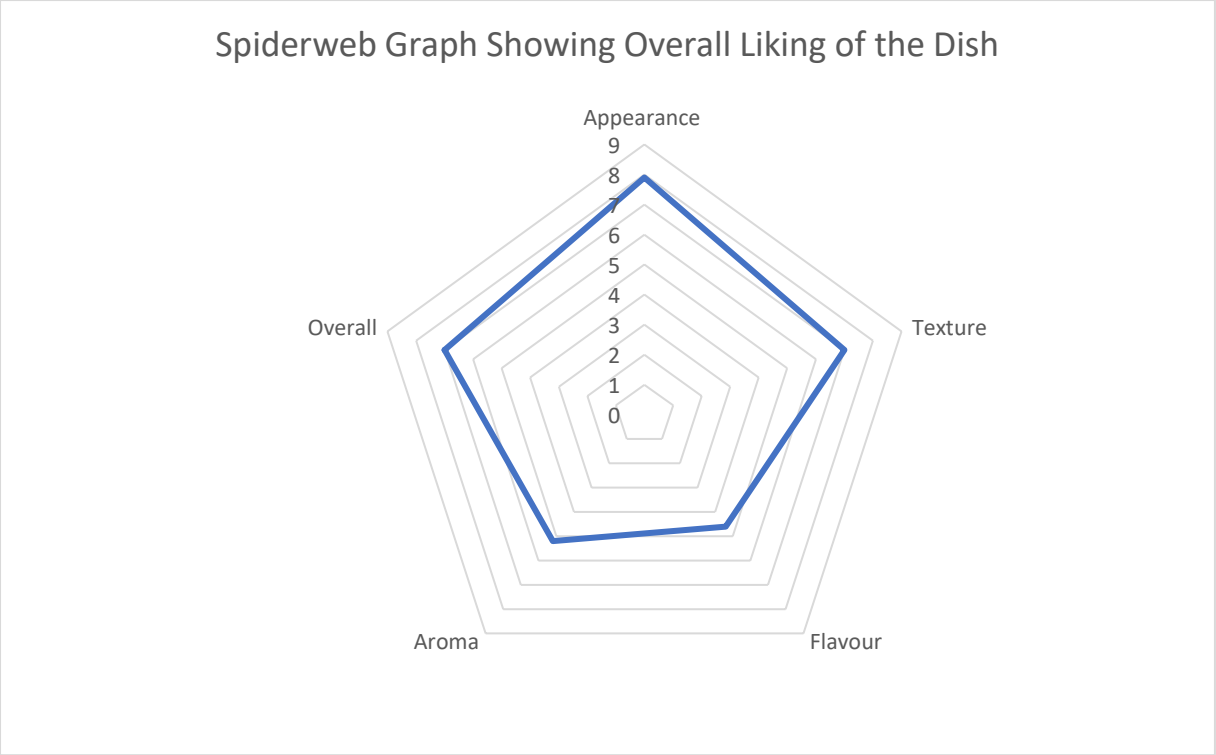

Figure 1.3: showing spiderweb graph of overall average scores for the dish 1 = dislike and 9= really like

Discussion

Note by Note cooking is a discipline of molecular gastronomy where pure compounds are used to create foods. The aim of the investigation was to focus on creating a dish which utilised the gelation of pectin in the dish using low levels of sugar. It was found that LMP had desirable properties in order to gel at low sugar levels as it is dependent on calcium and pH rather than sugar content in order to gel, according to Lersch, (2014). The apple jelly in this dish was incorporated into the dish to be the flesh of the apple. A low sugar gel was obtained using the recipe above. A green apple jelly was also made and dehydrated to signify and apple skin of the apple within the crumlbe. This was also gelled utilising pectin with low sugar levels. An apple puree was created using the recipe above as well as a custard and crumble which did not utilise pectin but added texture, mouthfeel and flavour to create a complete coherent dish.

The pectin used in this investigation contained both a sucrose and a calcium source. Unfortunately the supplier will not disclose this information meaning that the quantities of these ingredient within the pectin are still unknown. Further investigation would need to occur in order to determine how low the sugar content of the pectin is in order to be able to properly conclude the investigation. A refractometer could be simply used in order to give an indication of how much sucrose was contained in the pectin. With this in mind no sugar was added into the gels other than stevia and fructose but they wouldn't have an effect of gelling of the pectin as it was a LMP and is not directly dependent on sugar like its HMP counterpart.

According to This, (2016) Note by Note cooking can be food for the future. This can be seen throughout the utilisation of countless compounds in this investigation through the creation a dish which through informal sensory testing proved to have desirable sensory attributes. When looking at figure 1.2 it can be seen the dishes highlights and pitfalls. It can be seen that the appearance and texture of the dish were scored highly amongst the judges. It was expected that the flavour and aroma of the dish were scored less as it can be difficult to recreate flavours using pure compounds only. Flavour perception is a huge part of eating and if something firstly doesn't look nice one is not going to eat it. Since the dish looked nice in appearance according to the judges, flavour needed to be in line in order for the dish to be a success. The flavour used was 'perqoi' but the specific compound will not be disclosed by the supplier. For this reason trying to make a mixture of compounds can be difficult since one doesn't know how they will react with each other once mixed. When tasting the dish it had both an artificial taste and aroma which may be a reason why judges scored these attributes low. The overall acceptance of the

dish can be seen in figure 1.3 where it scored on average a 7 out of nine. It must be noted that the sensory testing done was conducted in house and informally meaning figure 1.2 and 1.3 are only indicators and not statistically significant.

According to EU regulation 1129/2011 no specific maximum level of any ingredient used on the experiment has been set and all are ‘quatum satis’. For this reason education needs to be given for the future if Note by Note takes off, since it can be dangerous dealing with pure compounds as the likelihood of poisoning could be increased if little education was given on the matter.

Conclusion

Overall the aims and objectives of the experiment were effectively met. A deconstructed apple crumble was created and had sensory properties which an in house, informal panel of judges agreed that the overall coherence of the dish was quite acceptable rating it a 7 out 9 with 9 = really like and 0 = really dislike. For this reason it can be agreed that Note by Note cooking is definitely emerging and is only the tip of the iceberg with regards to food in the future. A gel can effectively made using pectin and utilising low sugar as seen in the apple jelly and apple skin. For this reason the investigation was successful in creating a dish which utilised pectin and low sugar.

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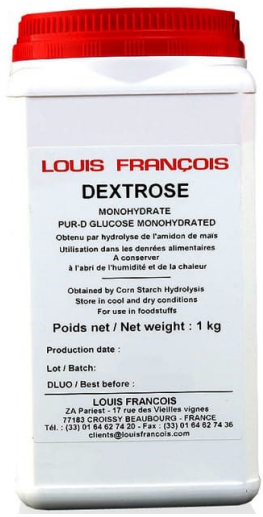
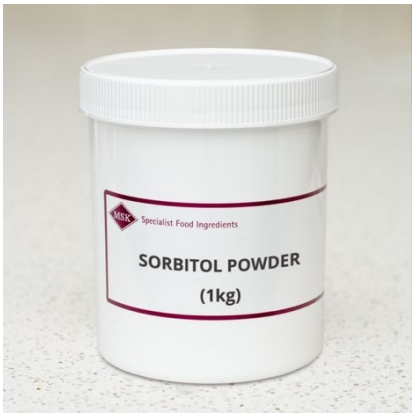
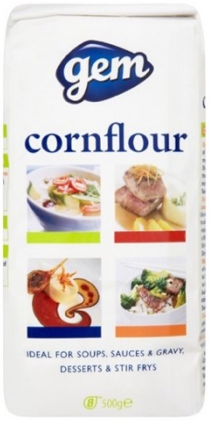
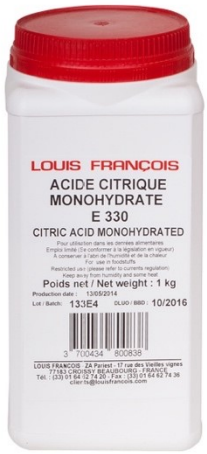
Appendices

Ingredient List	**Pure Compounds**	**Brand**	**Picture**
Low Sugar Pectin	Pectin, Sucrose, Calcium Phosphate	Sosa	
Stevia	Rebaud oxide A Extract	Bulk Powders	
Fructose	Fructose	Sosa	

Dextrose	Dextrose	Louis Francois	
Sorbitol	Sorbitol	MSK	
Ultratex	Not Disclosed	MSK	

Skim Milk Powder with Non - Milk Fat	Skimmed Milk Powder (24%), Lactose (Milk), Whey Powder, Vegetable Oil (Coconut, Palm), Dried Glucose Syrup, Milk Protein, Sugar, Acidity Regulator E340b, Emulsifier E471, Vitamin D	Millac Value	
Green Food Colour	Not Disclosed	Colour Food	
Maltodextrin	Maltodextrin	MSK	

Clarified Butter	Clarified Butter - Milk Fats	Avonmore	
Castor Sugar	Sucrose	Unknown	N/A
Yellow Food Colour	Undisclosed	Mallard Ferriere	
Cornflour	Amylose and Amylopectin	Gem	

Citric Acid	Citric Acid Monohydrate	Louis Francois	
Apple Flavouring (Perquoi)	Undisclosed	IQEMUSU	

Vanilla Flavouring (Monka)	Undisclosed	IQEMUSU	
Malic Acid	Malic Acid	MSK