Molecular Gastronomy

TFCS4025

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Playing with pectin's and a minimum content of sugar

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Background

Molecular Gastronomy

Molecular Gastronomy is the scientific study of the phenomena that occur when we cook. Cooking is the preparation of food and the physiochemical systems intended for human consumption. It identifies an observable fact, quantitates a characterization, gathers data, researches mechanisms and experiments theoretical estimations or proposals.

It stems from Gastronomy, the intelligent knowledge of what is consumed, ie, the history, physics and chemistry, practice, business and politics of food. Molecular is the defining part, specifying the focus on the science and practices associated with understanding what is happening to foods on a molecular scale. In essence, it is the understanding and application of a theory on a given food item.

Note By Note

Note by Note cooking, is an extension of molecular gastronomy, where foods and dishes are developed from the combinations of pure compounds. The name is derived from the same way a composer can build the music for a symphony with individual notes, a cook can build a dish with pure compounds, note by note.

Gelling

And the utilisation of gels is common practice in the culinary field of dining. A gel can be either solid or firm in consistency, or loose and utilised as a way of thickening a fluid. These properties are obtained through the 3D networking within the fluid. More of a network and specific interactions can determine the strength of said gelling or thickening action, along with other properties.

Gelling is focused on the trapping of water within its 3D structured network. The structure network provides a texture and thickening property to the liquid, forming the gel.

Gelling is conducted through the introduction, integration or the dispersion of the gelling agent, into the liquid, followed by the activation or hydration of the gelling agent. There a number of different triggers, such as heating, chemical interactions or agitation. A culinary example of each of these triggers can be seen with eggs. Under heat, an egg in custard will thicken due to the proteins unfurling and “networking”. When a strong acid is added to an egg, proteins become denatured, interact and coagulate. Similarly when shear force is added to an

egg, the proteins are physically being stretched and interaction can occur between said proteins. Each of these cause a gelling, thickening or solidifying effect.

An egg is not the best example of a gelling agent, as over time, the water trapped in the network can leech out of the structure. This is called syneresis. If a food product needs to be of a more solid nature, gelling agents can be added and activated. Examples of gelling agents include Agar, Alginates, Carrageenan, Gelatine, and Pectin's. each of these have different gelling strengths, different applications and utilities.

Pectin is a gelling agent, naturally found in citrus peel and apple pomace. It is commonly used as a gelling agent is such products as jams, jellies and preserves. In conjunction with the sugar, it is a water retaining compound, making less water availability for bacterial growth as well as giving a more solid structure to the food item. Jams or jellies tend to have a high percentage of sugar. HM pectin (High Methoxyl) is the preferred pectin to use in this application. LM pectin (Low Methoxyl) is preferred in the application of the presence of calcium. Spherification can be achieved through the efficient use of this gelling agent.

Aim

To form a dish with the consideration of utilising the least amount of sugar in conjunction with pectin.

To observe the different gelling effects due to different sugars, different pectin's and different quantities affecting a structure or gel.

To investigate difference uses of pectin's other than in gel production.

Materials and Methods

Equipment	Photo	Name and Model
Silicon Mould		Happyflex, 6 Half Sphere Mould Plaque: 300 x 175 mm Ø cad. 70 mm / H cad. 35 mm
Flower Syringe		3D Art Tools, Set of Stainless Steel Needles and 10 ml Syringe
Weighing Scales		Salter Disc Kitchen Scale, 1036 BKSSDA
Pot		Stainless Steel Pot, 1000ml capacity

Jug		Stainless Steel Jug, 500ml
Blast Chiller		Mercatus, Blast Chiller Y2-3
Spoon		Stainless Steel
Bowls		Stainless Steel Bowls, Ranging between 500ml to 2000ml in size.

Rolling Pin		
Oven		Convotherm, GYT4P2FB
Thermometer		Genware, Pocket Thermometer, THERM-POC
Whipping Siphon		iSi Gourmet Whip

N_2O Cartridge		iSi ISI0017, Steel, Silver,
Paper Cup		
Microwave		PANASONIC N N-DS596BBPQ Combination Microwave
Hand Blender		

Gas Stove Top		
Parchment Paper		Vogue Baking Parchment Paper

Ingredients

Cornflour	(Amylopectin)
Pectin	(NH (Amidated Pectin, Disodium Diphosphate, Dextrose, Tricalcium Phosphate), X58 (Pectin, Sucrose, Disodium Diphosphate, Tricalcium Phosphate)
Water	
Sucrose	
Egg White Powder	(Egg Albumin, Citric Acid, Triethyl Citrate)
Dextrose	
Salt	
Milk Powder	(Whey Protein, Lactose, Calcium)
Gluten	(Wheat Gluten)
Baking Powder	(Sodium Bicarbonate, Potassium Bitartrate, Amylopectin)
Hydrofoamer	(Hydrolysed Milk Protein)
Oil	(Linoleic Acid, Oleic Acid)
Clarified Butter	(Conjugated Linoleic Acid, Palmitic Acid, Myristic Acid, Stearic Acid)
Flavouring	(Iqemusu: Monka, Amerise, Citral, Menthol, Carez)
Colour	(Sosa Red: Sodium Chloride and Punceau, Sosa Kiwi Green: Sodium Chloride Tartazine and Blue Patent V)
Gelatine Leaf	(Gelatine)
Citric Acid	

*Note, when ingredients mentioned, here are the pure compounds

Recipe

Berry Crisp

Ingredients

Cornflour	40g
Pectin	0.7g
Water	45g
Sugar	15g
Icing Sugar	100g
Carez	0.5g
Sosa Red	0.5g

Method

Weigh out all ingredients into a pot and place on stove top. Cook until paste like. Place dough in between 2 pieces of parchment and using rolling pin, roll until 2mm thick. Place into oven set at 80°C until dry and cracking. Remove from oven and allow to cool. Using a pot, heat oil to 180°C on stove top. Break up crisp to 3cm x 1cm in size and place into oil. Cook until bubbling subsides remove from oil and immediately drain of excess oil from crisp. Toss in flavoured coloured sugar. Reserve.

Siphon Moss Sponge

Ingredients

Egg White Powder	20g
Water	20g
Sugar	40g
Salt	2g
Milk Powder	15g
Cornflour	100g
Gluten	5g

Baking Powder	5g
Hydrofoamer	1g
Pectin	0.5g
Oil	10g
Clarified Butter	85g
Menthol	0.5g
Sosa Green	0.5g

Method

Using the oil, grease two paper cups. Add the remaining ingredients to a metal jug and using the hand blender, blend until completely smooth. Pour batter into whipping siphon and charge with 1 N_2O cartridge. Shake well to incorporate gas into the batter. Invert the siphon and expel the batter in the cups evenly. Place the cups in the microwave, set at high for 1 minute. Remove from the cup immediately and remove the dense base. Tear the aerated sponge and place into an oven set at 80°C to dehydrate. Reserve.

<u>Teardrop Cake</u>

Ingredients

Water	1000g
Gelatine Leaf	12g
Sugar	300g
Citric Acid	2g
Monka	0.2g

Method

Bloom 6 sheets (12g) of Bronze Gelatine in some of the cold water. Boil 500g of water with the remaining ingredients. Once the gelatine is bloomed, dissolve it in the sugar mixture. Stir to incorporate. Add remaining cold water. Stir to incorporate. Pour into half sphere moulds and set in blast chiller.

Design Gel

Water	100g
Milk Powder	25g
Dextrose	10g
Pectin (X 58)	2g
Citric Acid	1g
Sosa Red	0.5g
Sosa Kiwi Green	0.5g
Monka	0.5g
Amerise	0.5g

Bring water, milk powder, dextrose, pectin, flavourings and citric acid to the boil. Split mixture in two. In half add Sosa Red and in the other Sosa Kiwi Green.

Assembly

Once the Teardrop Cake is set firmly, using the petal syringe, inject the design gel in the floral pattern. Once flower is formed, inject leaf shape on exterior base. Melt some excess gelatine mixture an d pour on base, allowing to set solid.

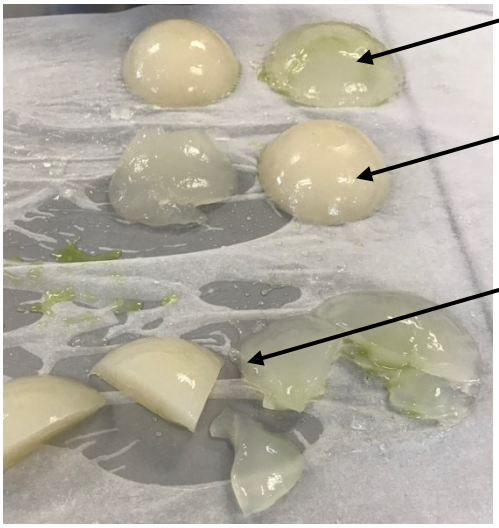
Remove the teardrop cake from mould, and place on plate. Arrange dehydrated siphon cake around and place crisp shards on top.

Results

Week 1

No Images were taken in week 1

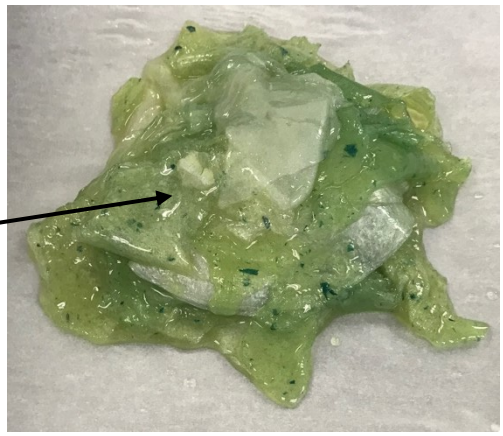
Week 2



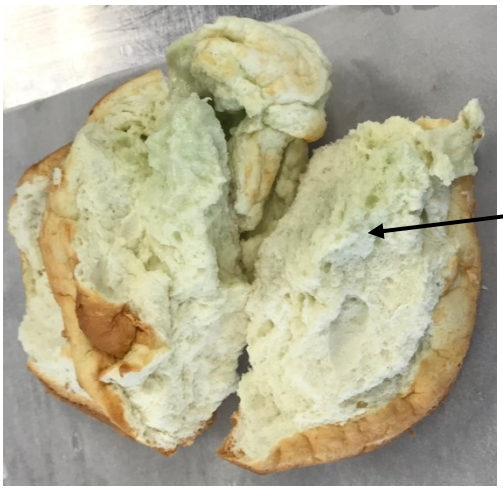
Agar and Pectin

Gelatine and Pectin

Cross Section of Moulds

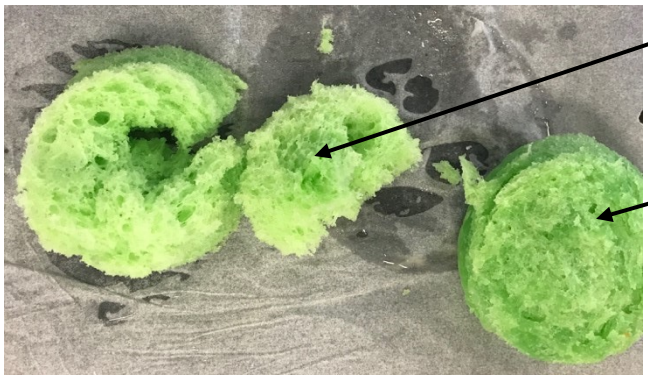


Pectin and Agar “Lettuce”



Aerated Cake

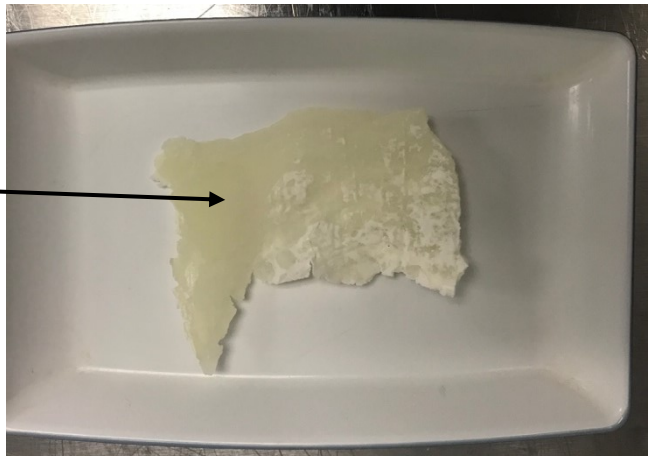
Week 3



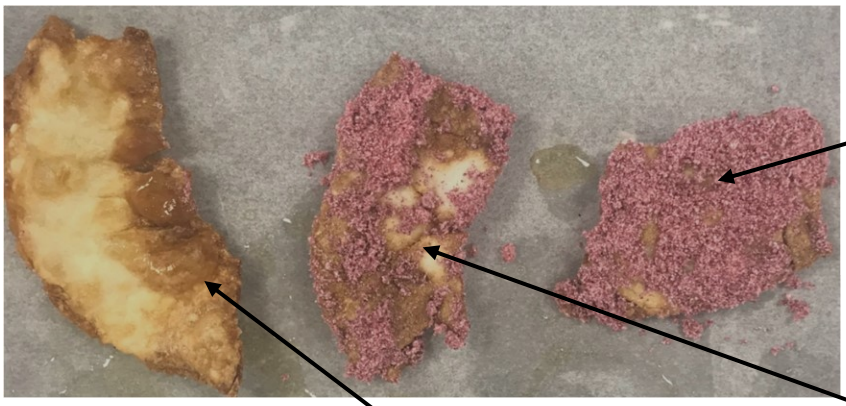
Aerated Siphon Cake

Dense Siphon Cake

Dehydrated Pre Cooked Crisp



Week 4



Heavily Seasoned Cooked Crisp

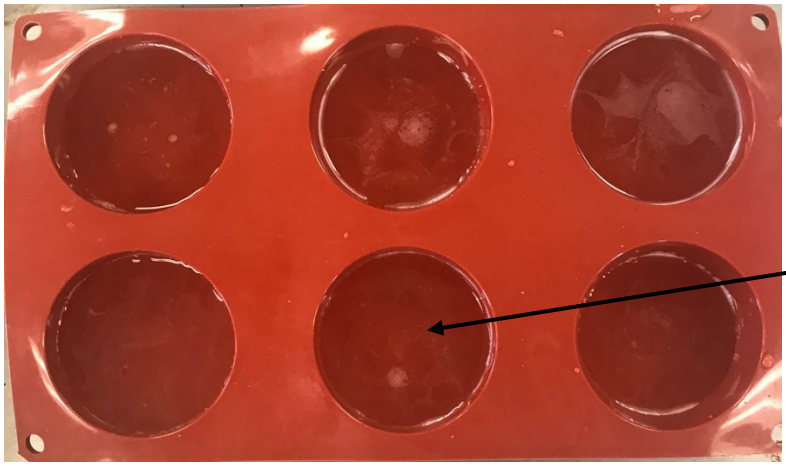
Berry Crisp

Cooked Crisp

Lightly seasoned Cooked Crisp

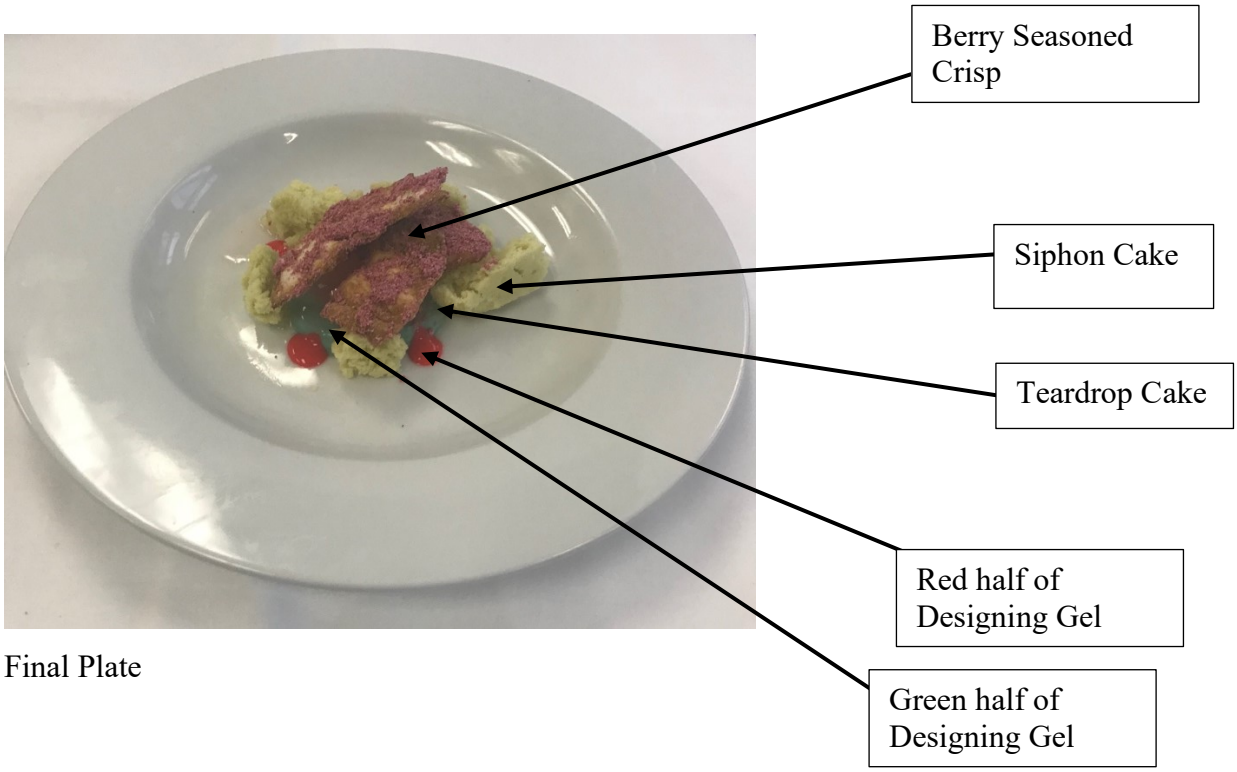
Dehydrated Siphon Cake

Siphon Cake



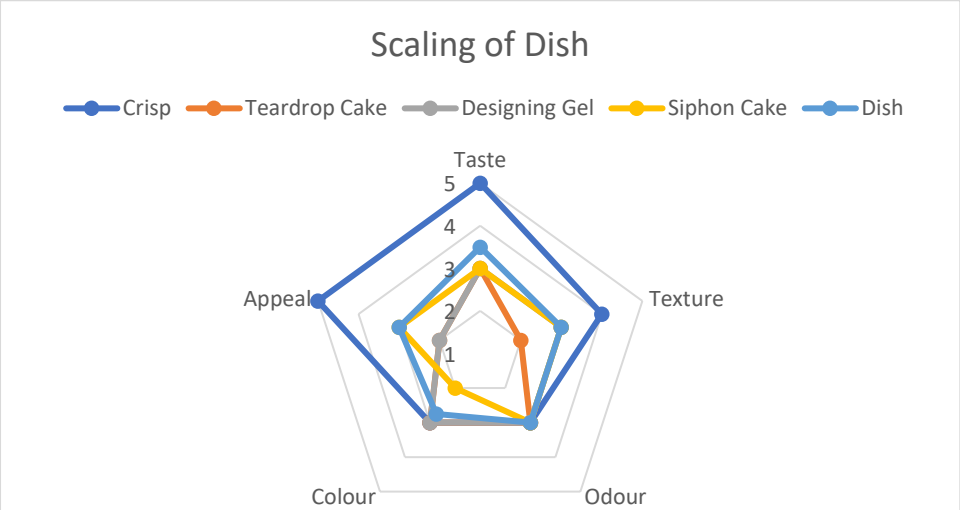
Teardrop Cake in Mould

Designing Gels


Berry Seasoned Crisp
Siphon Cake
Teardrop Cake
Red half of Designing Gel
Green half of Designing Gel

Final Plate

Sensory Analysis



1=Really Dislike 2=Dislike 3=Indifferent 4=Like 5=Really Like

Shown is a spider graph from the average Sensory Analysis result from a Scaling Test.

Discussion

Through the course of the 4 weeks of work, it was noted that gelling in certain conditions can be difficult. If to specific attributes are desired and conditions are not met, the ultimate achieved goal may not be possible. Through reviewing the work that was previously done, it is clear that there was learning about the behaviour of the gelling agents, different applications and options in how to use them.

Week one was where initial understanding of pectin was attempted to be instigated, however, due to the time restraints in the practical, this idea could only stay as one. More of a practical, on site learning approach was conducted. Some pectins and some sugars were investigated.

Week two trialled an idea of different setting times of a gelling agent and formation or shaping of a food, much in a similar fashion to wax replicas. This idea, again, stayed as an idea, as the gelling and solidification was occurring too quickly, and the gel was breaking on moulding. The end piece of the product just looked like a ball of jelly. This week showed that pectin is a controllable gelling agent. Even though the end product did not work, the idea could be work and improved upon potentially.

This week also had the initial siphon cake trialled. This was a terrible recipe as it was the first attempt in note-by-note cooking. Previous knowledge in the culinary field could give an indication on how to change the recipe depending on the outcome of the previous product. The initial recipe was extremely pungent due to the amount of egg white powder utilised and to much water was in the batter. This was noted and adapted for the next weeks. It was also noted to increase the amount of pectin in the batter with the intention that pectin could be utilised well in the structing of a solid like a sponge.

This week was also where the teardrop cake was trialled. The “cake” is a generic set jelly, lightly flavoured and completely transparent and colourless. Again, to much of an ingredient was used, and combinations of ingredients were not giving sufficient end products. The jellies produced were extremely hard, had a strong lingering aftertaste and were completely opaque. This was not what was wanted (a soft, clear and colourless jelly). Even though no element was perfected, a lot was learned and recipes were revised.

Week 3 had new elements introduced, in the style of texture to the proposed dish, as well as a new method for aerating and cooking a cake. A slurry was prepared and then dehydrated. This was then deep fried and coated in a flavoured sugar. The thickness of the crisp was the only minor issue with the element, and no other changes were made. The siphon cake was prepared and cooked in the microwave. This had unexpected results of semi-cooking, or cooking and immediately collapsing, or an uneven cook occurred. This ultimately was not an issue as the

cake gets torn and dehydrated, however, if it was to be replicated on a large scale, there would be a large amount of waste. During the sensory analysis it was noted that the sponge tasted savoury/umami or resembled mushroom. This showed that the flavouring used was affected by the microwave/cooking as mint was the flavouring of the sponge. More fat was added to the recipe in an attempt to protect the flavour compounds.

Week 4 had a tweaking of all elements in the dish. The design gel was the item which was specifically designed for the brief, using the least amount of sugar with the pectin. On hindsight, it is noted that the wrong pectin (X58) was utilised, or a preferred pectin (LM) would have been more suited for the brief. The LM would have interacted with the calcium in the milk powder causing a stronger gel.

The mould was a failure, however, it would have worked with time. At the time of plating, a gelling had occurred, however it was extremely weak. This caused the design gel to just be utilised in decorating another loose gel, rather than be incorporated in to the food.

Conclusion

Some of the elements of the dish were conceived to investigate different application of pectin, ie utilised as more than a gel for the likes of a sauce or confectionary. However, some of the elements are not extremely low in sugar.

At the end of plating, the crisp has ~27% sugar content (since all the water is removed), the siphon cake has ~13% sugar content and the designing gel has ~ 7% sugar content. Sugar was removed or reduced from recipes, however, it was noted that the sugar had specific reason for being present. It too provides structure in the same way the gel does. This was evident with the siphon cake, collapsing after cooking.

References

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