Introduction

Molecular gastronomy may be defined as the scientific discipline that explores the phenomena occurring during culinary transformations *(R.Burke 2016).* Molecular gastronomy explores a new way of cooking using chemistry, biology and physics. This method of cooking was first called 'molecular and physical gastronomy' but was then shortened. Regular gastronomy is a word that can be used to cover a wide range of topics in relation to the culinary world , it can be used to cover anything from dining experiences to the study of the history of food , it relates back to the stomach. Meanwhile molecular gastronomy deals with the culinary transformations and the sensory phenomena associated with eating *(This,2006).* It looks deeply into the different properties of foods and how these different properties can be used to give someone a different sensory or taste experience by using science. Sensory analysis plays a major role in the overall food experience, Sensory Analysis is how we analyse reactions to stimuli through our sight, smell, taste, touch and sound. Without the use of our senses we would not be able to perceive the different attributes of food.

Note-by Note cooking on replacing traditional fresh ingredients such as meat, fruit and vegetables with pure chemical compounds. Although it does not sound as appealing, this process could help to improve global food security as it would help with major problems such as food spoilage and food borne illnesses. It is believed if a food crisis was to occur note by note cooking could help to feed more people. Herve seeks to use the technique of deconstructing ingredients back into their original forms for example meat into amino acids and fats such as butter into lipids. Although note-by note cooking seems very similar to molecular gastronomy Herve This claims it is quite different as it relies on using pure chemicals while still using classic and molecular cooking techniques*(Chandran,2020).*

A pure substance, basically composed of two or more elements and chemically combined in a fixed proportion is called a compound *(Toppr-guides, 2020).* Water is an example of a compound as it is made up of two elements hydrogen and oxygen combined at a fixed ratio. Compounds cannot be separated physically, they can only be separated chemically, and for example water can be broken into hydrogen and oxygen by electrolysis.

This assignment will focus on pectin and how it gels with the lowest possible sugar content. Pectin is a soluble fibre found in most plants, examples of plants high in pectin include fruits such as apples, plums and citrus peels, the amount of pectin in fruit can depend on the

ripeness of the fruit. Pectin is made up of long chains of polysaccharide, these long chains act as a wall with a thick paste. Pectin is used in the food industry to make jams and jellies. Due to its high sugar content pectin is beneficial in the preservation of food. There are two main types of pectin High Methoxyl (HM) and Low Methoxyl. HM pectin can be bought as rapid set pectin and requires the presence of sugar and acid, it is most commonly used for fruit preserves and jellies *(Popsci.com, 2020).* LM pectin requires calcium to gel and is used for low sugar jelly products.

Aim

The aim of the project is to create a dish that visually resembles a pizza but sweet in flavour, the pizza will contain a component made from pectin which has gelled at the lowest possible sugar content, the rest of the dish will be made using pure compounds.

Materials and Methods

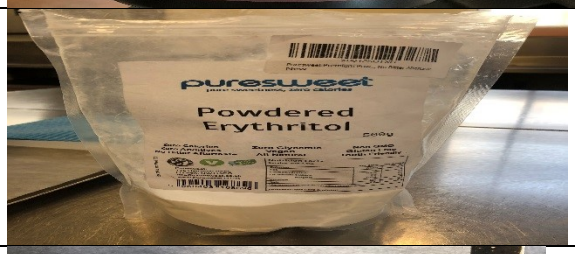
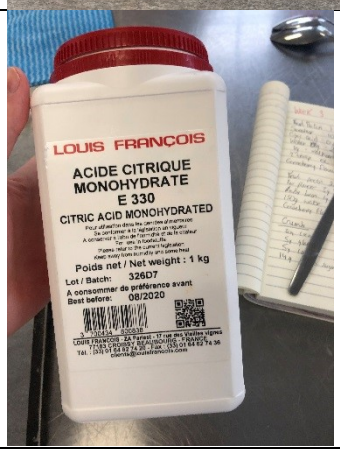
Equipment

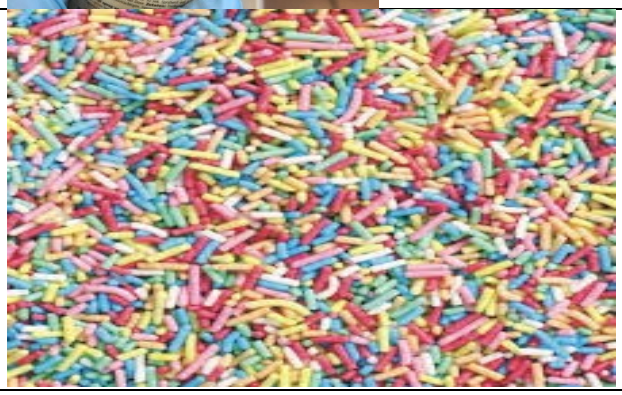
Weighing Scales Salter 1036 BKSSDR	
Saucepan	
Metal Balloon Whisk	
Wooden Spoon	
Parchment Paper	
Measuring Jug Stainless Steal	
Metal Bowls	
Gas Oven Bertos Spa Vilale Spaga 12 35020	

SilverCrest Digital Spoon Scale	
Fan Oven Convotherm	
Baking Tray	
Digital Thermometer LEMEGO	
Metal Cutters	
Disposable Pipette	

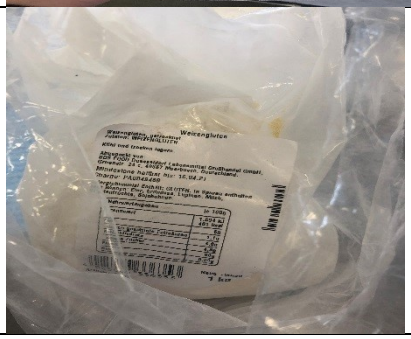
Ingredients:

Pectin Gel Layer

4g Fruit Pectin	
25g Powdered Erythritol Sweetener	
2g Vermell Rojo Red colour powder	
0.3g Citric Acid Louis Francois E330	
1.6g Agar	
6 Drops Amerise Note by Note Flavour Almond , Cherry , Pistacchio	

Edible Lustre Spray	 
Sprinkles	

For Pizza Base *(THIS,2014)*

30g Cornflour	
5g gluten	

5g cocoa	
15g brown sugar	
40ml water	
6 drops Chocolate Fudge Water Soluble Flavour Drops MSK	

Method:

1. To make the gel pectin place water into a pot and begin to heat , then add all powdered ingredients and stir while whisking , allow mixture to reach 100^{oC} , once all powder is dissolved remove from heat.
2. Keep a small amount of the liquid separate without the red powder for toppings later.
3. Place the liquid onto a baking tray to cool.
4. To make the pizza base place all dry ingredients in a bowl together then gradually add water until a paste is formed.
5. Place on a baking tray with parchment paper and place in the oven at 150^{oC} for 4 minutes.
6. Once cooked remove from oven and leave to cool.
7. Once pectin has gelled use a circular cutter to cut into a disc shape, once the base is cool use the cutter a size bigger to cut the base.
8. Place the pectin layer on top of the pizza base.
9. For the yellow and green toppings reheat the gel pectin from earlier and add 1g more of agar to the mixture to make the liquid even thicker.
10. Place liquid into a disposable pipette and place droplets onto a tray and allow to cool.

11. To colour the droplets place onto a flat baking sheet let cool, then use spray paint to colour.
12. Place droplets on top of pectin layer then add sprinkles for decoration.

Results:

The pectin:

By the final week of the practical the correct ingredients were used to get the pectin to gel using no sugar, just sweetener. By adding more pectin to the recipe then previous weeks helped to create a solid jelly consistency, the addition of pectin also helped with the stability. The red powder added the desired bright red colour and the Amerise flavour was used.

Fig 1.0

The gel was then left to cool on a baking sheet where it could then be cut into the desired shape once cooled using a metal cutter. The disc of pectin was then set aside to be used on top of the base.

Fig 1.1 Pectin being left to gel

Pectin Topping:

The idea behind the little colourful pectin bubbles would be that they would resemble pizza toppings such as pineapple and peppers. When making the red pectin disc some of the mixture was set aside before the colouring was added. Later this mixture was reheated and a further 1g of agar was added to the mix to ensure it would set quickly and become very solid.

Once the agar had dissolved and the mix was still quite warm the liquid was placed into a disposable pipette and dropped onto a tray with parchment paper from a height, these gave the effect of loads of little bubbles. Once these bubbles cooled, they were then sprayed with two different colours and placed on top of the red pectin disc.

Fig 1.2

Fig1.3

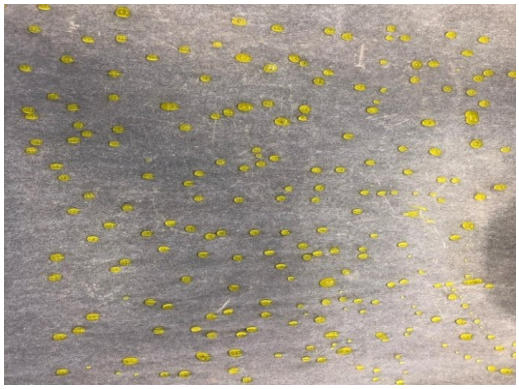


Fig 1.4 Pectin toppings being left to dry after spraying

<u>The base:</u>

The recipe for this was taken from Herve This book Note by Note Cooking. In the recipe quantities of the ingredients were not specified so this took a lot of trial and error. The texture of the base before cooking was like a thick paste, when you placed your finger into the paste it would separate and form back together. Over time it was evident that less liquid worked best when making the base, as it took to long to cook and did not cook even.


Fig1.5 Week two of attempting the base.

By week three the final ingredients were selected, and brown sugar and cocoa powder were added to the recipe to add both flavour and colour, flavour drops were also added to ensure the aim of a sweet pizza was met. The base only took four minutes to cook in the oven and once cooled was cut using a metal cutter a size larger then the one used for cutting the pectin disc.

Fig 1.6 The pizza base before placing in the oven at week four.

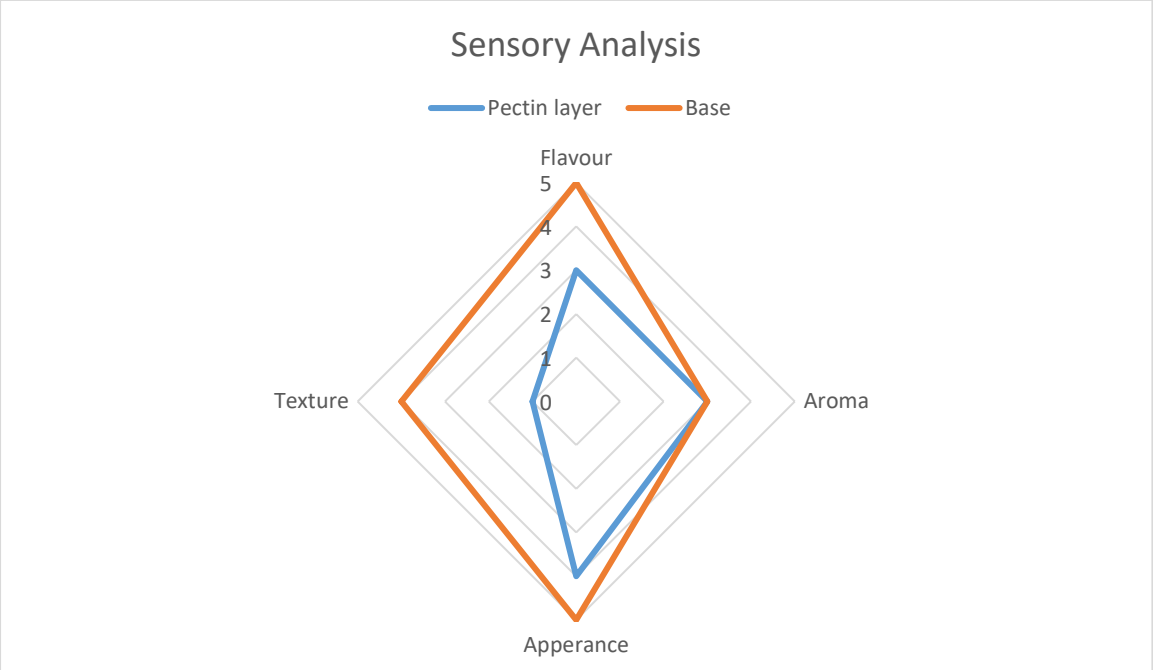
The Result

By the end of the fourth week all the different aspects of the dish had been altered and carefully changed to make the final dish. The aim to make a dish that replicated a pizza but had a sweet taste had been achieved after much trial and error.

Fig 1.7 Week Four final result

Sensory Results:

Based on the average sensory results of 10 people asked to rate the flavour, aroma, appearance and texture of both the topping and base of the sweet pizza.



5= Very good

4= Good

3= Average

2= Bad

1= Very Bad

Discussion

In relation to the sensory tests carried out the judges had very different feedback on both the base and top layer of the sweet pizza. Overall there was a lot more positive feedback given on the base of the pizza. All participants really liked the flavour and described it as having a sweet pleasant flavour , the addition of the sugar , cocoa and chocolate fudge flavour drops gave the sweet cake taste the was desired. The base did not have a very strong aroma. The appearance of the base was a circular dark disc that resembled a little layer of cake or biscuit. The texture of the base was described as a chewy sponge which was pleasant and easy to eat. As for the top layer of pectin the results were quite the opposite. The majority of judges rated the pectin layers texture as very bad describing it as being very slimy in texture and unpleasant to swallow or chew. The flavour was described as average meaning more of the note-by note flavour could have been added to the dish , this could have been resolved if more sensory analysis tests were carried out weekly. The appearance of the gel was good as it had a bright red appealing appearance that would grab someone's attention. The aroma of the gel was also described as average although when cooking in the pot once the flavour drops were added it originally had a very intense appealing smell which must have worn off once it set.

After many weeks of struggling to get the pectin layer to gel a final recipe was then formulated. The type of pectin used was fruit pectin which gelled with the addition of citric acid showing it was a high methoxyl pectin. The sugar content of the pectin was unknown which worked to my disadvantage as I did not know how much to add and underestimated the amount of sweetener needed for the first few classes. This particular type of pectin could also be thermally reversible meaning it could be set, re-melted again and set, this property was beneficial when making the topping of the pectin. It took almost two classes to get a better understanding of how to get the pectin to gel, the first thought was that the less pectin used the less sugar that would be needed to gel. This was in fact not the case and the amount of pectin in the recipe from week 1 to 3 was then doubled. More sweetener was added for gelling affect and flavour. Agar was also added to the recipe later in the weeks as it is a colourless/ flavourless substance used as a thickener and commonly used to replace gelatine in vegetarian dishes, it was guaranteed by using the addition of agar would cause the pectin layer to form a more solid gel that could not be achieved in previous weeks. Although agar can be used to replace gelatine it does not hold the same appealing texture, agar has a more solid slimy texture, resulting in quite the unappealing gel. No sugar was used in the recipe

although it is unknown if there was any in the Fruit Pectin supplied by SOSA. The sweetener chosen was powdered erythritol , this sweetener is 30-40% less sweet then table sugar, with the addition of the flavour drops and sweetener an appealing sweet tasting gel was hoped to be achieved but was not. Erythritol if being used again would work better with an LM pectin as they do not require any sugar to gel. Pectin bonds form as water is bound by sugar and forces pectin strands to stick together *(Pickyourown.org, 2020)*. Citric acid also helps with gelling as its compounds are at even ratio of ions at 1:1, this means when gelling they are easily distributed and hold their structure.

In relation to the not by note flavours used, although they had very strong aromas they did not have very strong flavours once cooked. If doing this again more flavour droplets would need to be added.

For the base not all pure compound ingredients were used. Although the recipe was taking from Note-by Note cooking no exact quantities were listed so it took many tries to get the desired texture and appearance. The compounds used to form the base were a combination of gluten, water and amylase the proteins within these compounds bind together to give the bread like structure. Too much water was causing the bonds to become soggy and break when not cooked enough, this is how over time of trial and error less water was added with 40ml being the end amount used.

Conclusion

In conclusion a sweet pizza was made. The dish visually resembled a savoury pizza although it had a sweet taste. The topping layer of the dish was made using pectin which gelled using no sugar just sweetener. The rest of the dish consisted of different pure compounds although not all the ingredients used were pure compounds. The experiment shows that pectin can gel with no sugar or smaller quantities of sugar once the rest of recipe consists of the correct amounts of acids, pectin and liquid heated to the correct temperatures and allowed time to set.

References

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Appendices

Log Book

Week One: November 15th

Aims

- Experiment with different pectin's to see which gels best with the lowest sugar content.

Objectives

- To carry out a range of different recipes using different pectin's and sugars/sweeteners to see which creates the best gel for the dish.
- To document how long each component of the dish took to make.
- To experiment with a range of different note by note flavour compounds.
- To conduct sensory analysis and apply the findings to next week's class.

Materials

Ingredients

1st attempt at gel

2g	Fruit Pectin NH
100ml	Water
0.5g	Citric Acid
10g	Dextrose
2g	Sweetener

2nd attempt at gel

4g	Fruit Pectin NH
100ml	Water
0.5g	Citric acid
5g	Dextrose
3g	Sweetener

3rd attempt at gel

100ml	Water
2g	Fruit Pectin NH
5g	Dextrose
2g	Sweetener
0.5g	Citric Acid
1g	Agar

Equipment

Weigh Scales Salter 1036 BKSSDR	
Saucepan	
Metal Balloon Whisk	
Wooden Spoon	

Parchment Paper	
Measuring Jug Stainless Steal	
Metal Bowls	
Gas Oven Bertos Spa Vilale Spaga 12 35020	

SilverCrest Digital Spoon Scale	
Digital Thermometer LEMEGO	

Method:

1. The first recipe consisted of a fruit pectin, this pectin was chosen as fruits high in pectin need less sugar to gel.
2. All ingredients were carefully weighed with a standard scale and also the digital spoon scale for accurate measurements.
3. They were then placed into a pot and brought up to boiling point of 100^{oC} while being whisked.
4. Once all the powders were completely dissolved the liquid was then placed into a small bowl and some onto a tray with parchment paper to allow to set.
5. The same method was carried out with the second and third attempt.
6. Different samples of the note by note flavourings were placed into the liquids before being put out to set such as Baliqin and Amerise.

Results:

- None of the three attempts set.
- All had a liquid consistency and did not correctly gel.
- Some of the note by note flavours had very unappealing tastes and smells.

Recommendations for next week

- Carry out more research into pectin's and which works best with a low sugar concentrate.
- Plan how to create base of the sweet pizza.
- Research what else can be added to the recipe to help gelling.
- Choose a note by note flavour to add to the dish.

Week Two: 22nd of November

Aims.

- Create a base for the sweet pizza using pure compounds and use a different recipe to try
- Select a note by note flavour that works best with both the gel and base.
- Ensure gel sets within class time.

Objectives

- Use a different pectin from last week.
- Use different quantities in each recipe.
- Follow the 'Note by Note Pie Crust Recipe' from Herve This , Note by Note Cooking The Future of Food'.
- Work quickly to ensure setting time is within class hours.

Materials

Ingredients

For Base:

30g	Cornstarch
6g	Gluten
2g	Sucrose
-	Colorant Spray

Topping 1st Attempt:

100ml	Water
12g	Dextrose
1.5g	Pectin
1g	Citric Acid

Topping 2nd Attempt:

16g	Fructose
2g	Rapid Set Pectin
0.2g	Agar
100ml	Water

Equipment

Weigh Scales Salter 1036 BKSSDR	
Saucepan	
Metal Balloon Whisk	
Wooden Spoon	

Parchment Paper	
Measuring Jug Stainless Steal	
Metal Bowls	
Gas Oven Bertos Spa Vilale Spaga 12 35020	

SilverCrest Digital Spoon Scale	
Fan Oven Convotherm	
Baking Tray	

Digital Thermometer LEMEGO	

Method:

1. To make the pectin layer which will be used as the topping the same method was repeated as last week using different ingredients and quantities.
2. To make the pie crust corn starch and gluten were added together with water to make the crust, only a small amount of water was needed.
3. The mixture was then placed on a baking sheet, and placed in the oven at 150 for 4minutes.
4. The crust was then removed and let cool and harden.

Results

- Although the pectin topping did gel slightly better than the previous week, the desired consistency was not achieved.
- The pie crust recipe was carried out 2/3 times each using less water to achieve the correct consistency as no amount of water was given in the recipe.
- The third attempt at the pie crust worked best with the least amount of water as it was more solid and avoided a dry soggy texture.

Recommendations for next week:

- Add more agar to recipe to help with the gelling process.
- Add colour to the pie crust to be a desired dark brown colour.
- Shape pie crust into a small circular shape.

Week Three: 29th of November

Aims

- To start to assemble the different components as one dish.
- To flavour the pie crust for the pizza base.
- To achieve the desired consistency in the pectin gel.
- Shape both the pectin top layer and the pie crust base into a pizza like shape.

Objectives

- To increase the amount of pectin in the recipe in hope this will help with the gelling process.
- Increase the amount of sweetener being used to improve flavour and remove dextrose completely.
- Use cutters to shape the pizza.
- Use less water than last week when making the pie crust to achieve the desired consistency in less time.
- Work as quickly as possible to ensure timing is perfect for the final week.

Materials

Ingredients

Topping 1st attempt

4g	Fruit Pectin
25g	Sweetener Powdered Erythitol
0.3g	Citric acid
1.6g	Agar
2g	Red Powder

Base 1st attempt

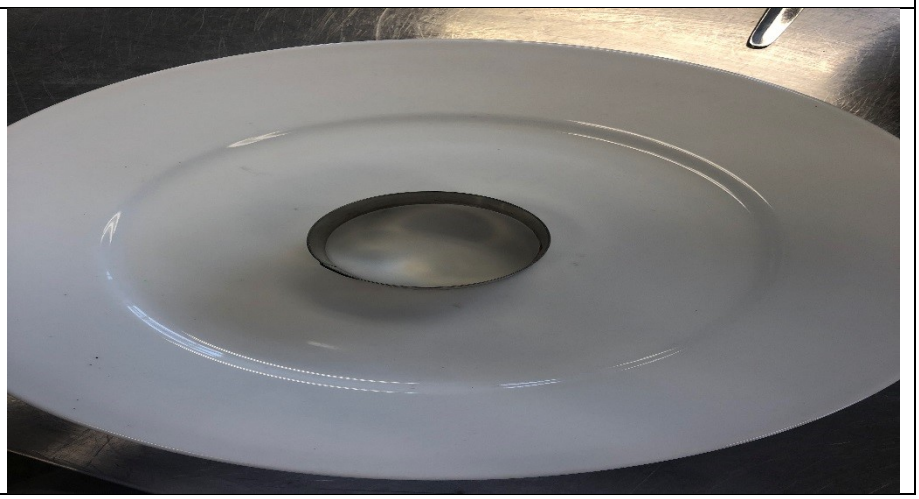
30g	Cornflour
5g	Gluten
5g	Cocoa
15g	Brown Sugar
40ml	water

Equipment

Weigh Scales Salter 1036 BKSSDR	
Saucepan	
Metal Balloon Whisk	
Wooden Spoon	

Parchment Paper	
Measuring Jug Stainless Steal	
Metal Bowls	
Gas Oven Bertos Spa Vilale Spaga 12 35020	

SilverCrest Digital Spoon Scale	
Fan Oven Convotherm	
Baking Tray	

Digital Thermometer LEMEGO	
Metal Cutters	

Method

1. First attempt at making the pectin followed the same method as previous weeks, with the addition of more sweetener, no dextrose, more agar and a tiny amount of red powder to colour the topping.
2. The pectin gel was then placed on a baking tray with parchment paper to set.
3. This attempt set to the desired consistency.
4. The base was made by combining all dry ingredients in a bowl then slowly adding the water bit by bit while stirring.
5. The paste was then placed on a baking tray with parchment paper and placed in the oven for 4 minutes at 150^{oC}.
6. Once removed from the oven the crust was let cool for 10minutes, then using a metal circular cutter was cut into a circle shape for the pizza base.
7. A smaller metal cutter a size down was then used to cut a circle shape for the topping.
8. The pectin gel was then placed onto of the crust to give a layered affect.
9. The pectin gel was flavoured with Amerise note by note flavour while the pie crust was flavoured with Chocolate Fudge water soluble flavour drops.

Recommendations for next week

- Carry out the same recipe for the gel although add more flavouring.

- Ensure the pie crust is completely cooled before cutting and add more flavouring.
- Try to add some sort of topping to the gel for a more appealing appearance.
- Ensure both the gel and crust are cut perfectly.