Note-By-Note Report

Salted Pistachio-Strawberry-Rose Futuristic Pudding

Advanced Molecular Gastronomy

Module Code: TFCS 9025

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1. Introduction

"What began as an eccentric culinary tendency in France has by now become a global phenomenon: not a day goes by without news of yet another chef who has been converted to this style of innovation. It is evidently the result of applying science to technology. Just the same, one must hope that molecular cooking will soon die out—though not, of course, molecular gastronomy! The obsolescence of molecular cooking would be proof that a decisive technological transition has been accomplished—that the activity of cooking has at last been modernized." (This and DeBevoise, 2014). Indeed, molecular gastronomy, a scientific discipline that explores the physical and chemical transformations of ingredients in cooking is said to be pioneered by Hervé This along with Nicholas Kurti in the late 1980s (This and DeBevoise, 2014). Building on this foundation, note-by-note cooking was created, by preparing dishes exclusively from pure compounds rather than whole foods, aligning with goals of sustainability, efficiency, and nutritional precision (This and DeBevoise, 2014). Note-by-note offers control over texture, flavour, and nutrient content, making it a promising approach for future food systems where resource optimization and personalized nutrition are key (This and DeBevoise, 2014).

2. Aim

The aim of this project was to develop a nutrient-dense, sweet-savoury pudding using only note-by-note ingredients, designed to align with the theme "Food for the Future" by integrating sustainability, sensory appeal, and nutritional density. Rose and pistachio, long celebrated in Middle Eastern and Persian desserts for their floral, nutty elegance, were chosen to offer a tradition-rooted profile (Sassani, 2020). This combination provides a unique sensorial experience that merges nostalgia with novelty, a central goal of molecular gastronomy, which seeks to enhance the art of cooking through scientific understanding of taste, aroma, and texture (This, 2009; van der Linden et al., 2008). Furthermore, the use of pure compounds—such as rose and pistachio flavour compounds, casein proteins, and carbohydrates—instead of traditional whole ingredients directly reflects the principles of note-by-note cooking which enabled full control over the structure, flavour, and nutritional profile of the dish while reducing food waste and improving sustainability (This, 2009). The final product brings together science and creativity, demonstrating the innovative spirit of molecular gastronomy and how note-by-note cooking can truly reshape the way we think about food and cooking.

3. Final Materials and Methods

Here is a detailed list of the ingredients, equipment and processing method for the creation of the final product.

Ingredients – Final Formulation (yields ~200g for 12 tasting portions):

<u>Phase 1: Liquid Base & Structure</u>

- Water – 300g
- Inulin – 30g (prebiotic fiber, adds creaminess)
- Corn flour – 20g (thickener)

- Casein powder – 20g
- Carrageenan iota – 1g (smooth gel structure)
- Lecithin – 2.5g (emulsifier)

Phase 2: Flavour and Sweetness

- Pistachio flavour compound – 2g
- Rose flavour compound – 1g
- Strawberry flavour compound – 2g
- Fructose – 12g
- Salt – 0.5g

Phase 3: Fat & Mouthfeel

- Olive pomace oil – 15g
- Glycerol – 5g

For Decoration: Gelatine sheet

Equipment Used:

- AMPUT Electronic Scale
- Gas Stove
- Pan
- Whisk
- 2 spoons
- 2 bowls
- Martini glass for presentation

Processing Steps:

1. **Mix Dry Ingredients:**
   Combine in a bowl:
   a. Inulin
   b. Corn flour
   c. Iota carrageenan
   d. Lecithin
   e. Salt
   f. Casein protein
2. **Combine Wet Ingredients:**
   In a saucepan, whisk together:
   a. Water
   b. Olive pomace oil
   c. Glycerol
3. **Cook:**
   a. Slowly whisk in the dry mix to the pan mixture
   b. Heat to 85–90°C while stirring constantly
   c. Cook for 5–6 minutes until thickened (do not boil hard)

4. **Divide & Color:**
    a. Let cool to ~60–70°C
    b. Split pudding into two bowls
    c. Add green coloring + pistachio flavor + a pinch of salt to one half (pistachio layer)
    d. Add pink coloring + rose and strawberry flavor + a bit more fructose to the other half (strawberry-rose layer)
5. **Decorate:**
    a. Cut gelatine sheets into triangles "petals"
    b. Dip in colored food dyes
6. **Assemble:**
    a. Layer green and pink pudding in a martini glass
    b. Top with colored gelatine leaves for decoration

4. Results

Visually, the dessert stood out with its eye-catching layers of green and pink pudding, neatly stacked in a martini glass. The striped design gave it a playful yet elegant look, while also representing the two main flavours—pistachio and rose. Topping it off were brightly coloured gelatin sheets, cut into shard-like pieces that looked like edible flower petals. These added a fun, futuristic touch and a chewy contrast to the smooth pudding below, aligning with the molecular gastronomy focus on unexpected textures and creative presentation (This and DeBevoise, 2014).

Figure 1. Final recipe and presentation of the Salted Pistachio-Strawberry-Rose Futuristic Pudding

Sensory analysis was conducted with three respondents. Although the sample size is limited and insufficient for broad generalizations, it provides initial insights. Based on the responses to the questionnaire, the product was positively received in terms of physical appearance, mouthfeel, texture, and taste. The final product achieved a thick, gel-like pudding consistency. While the texture was smooth and cohesive, feedback suggested it may benefit from being slightly thinner for a more pleasant mouthfeel. Also, the aromatic intensity was noted as the weakest sensory aspect, with the scent perceived as too subtle.

Here are the results of the sensory test:

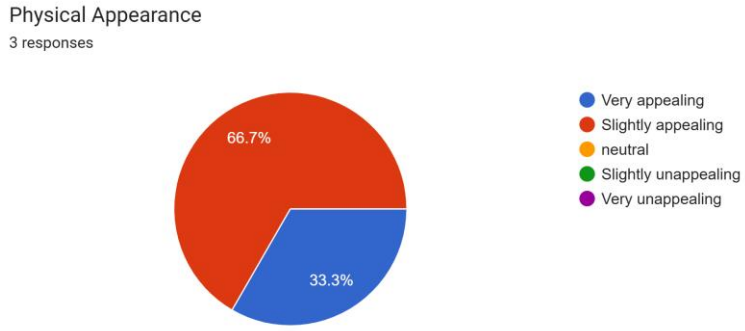

Figure 2. Sensory Analysis – Pie chart on results for the physical appearance of the Note-By-Note Pudding

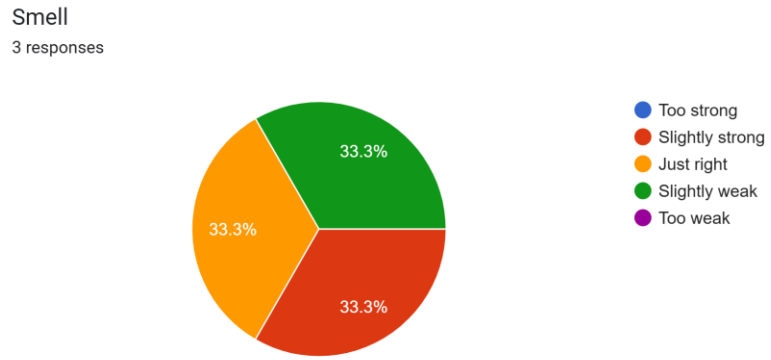

Figure 3. Sensory Analysis – Pie chart on results for the perceived smell of the Note-By-Note Pudding

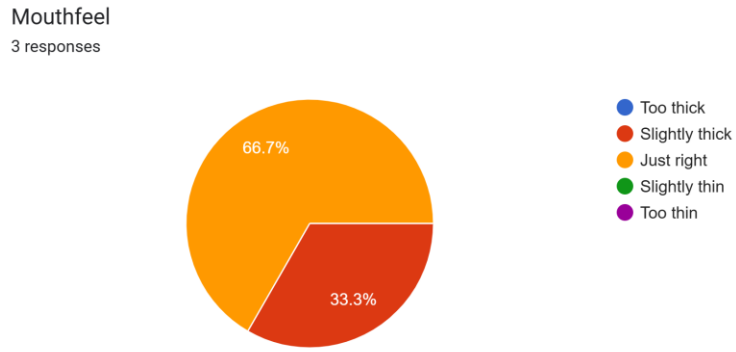

Figure 4. Sensory Analysis – Pie chart on results for the mouthfeel of the Note-By-Note Pudding

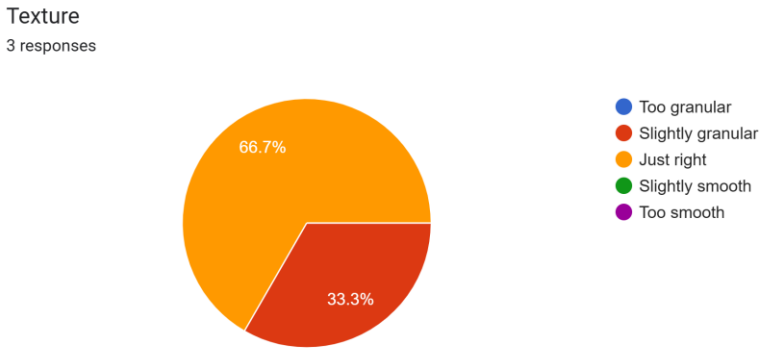

Figure 5. Sensory Analysis – Pie chart on results for the texture of the Note-By-Note Pudding

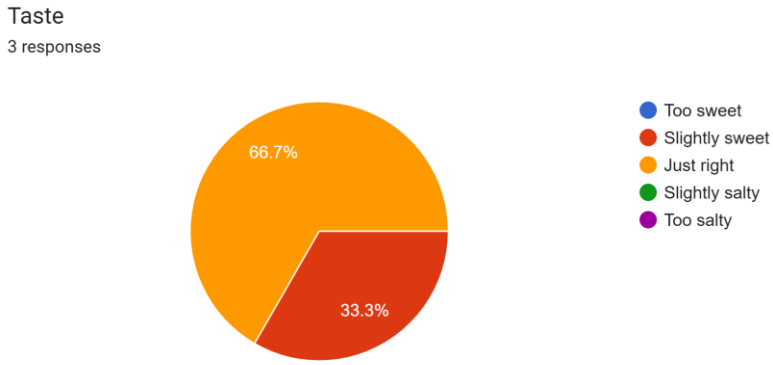

Figure 6. Sensory Analysis – Pie chart on results for the taste of the Note-By-Note Pudding

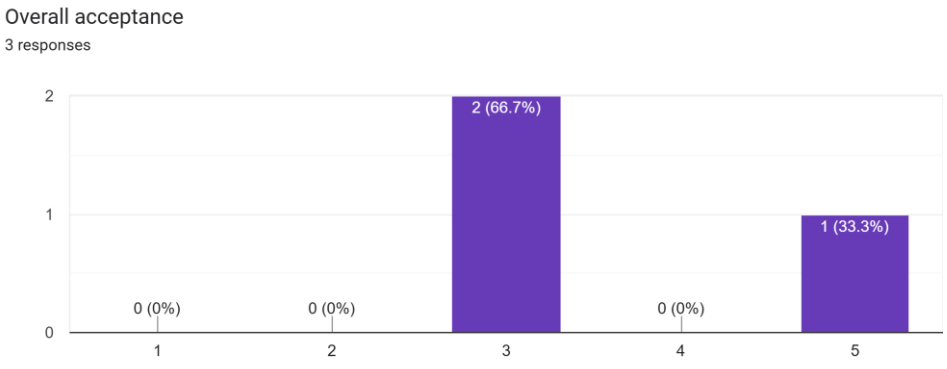

Figure 7. Sensory Analysis – Bar chart on results for the overall acceptance of the Note-By-Note Pudding

5. Discussion

The project began with the goal of developing a note-by-note pudding inspired by salted caramel popcorn, combining creamy and crunchy textures with a sweet-salty contrast. The initial recipe featured popcorn and caramel flavour compounds, corn flour as a thickener, and a combination of maltitol and fructose for sweetness. A separate crunch element was created using maltodextrin and popcorn flavour, aiming to mimic popcorn crisps. However, this first formulation encountered countless issues after several trials; the popcorn flavour was overpowering and left a strong rancid, artificial buttery aftertaste, making the product unpalatable. The crisps lacked structure, were too oily, and disintegrated into an unpleasant powdery texture.

In response, the final formulation took a bold new direction. The concept was reinvented with a pistachio, rose, and strawberry flavour combination—classic in Middle Eastern and Persian desserts, hence rooted in tradition but fitting the theme of "futuristic" with its application method and presentation (Azadmard-Damirchi & Hesari, 2020). This change not only removed the unpleasant artificial taste but gave the pudding an elegant, floral, and nutty profile that resonated more positively with tasters.

Nutritionally, the pudding delivers functional benefits as intended. Casein, a slow-digesting milk protein, supports muscle repair and prolonged satiety, making it a suitable choice for high-protein functional foods (Boirie et al., 1997). Inulin, a prebiotic fiber, not only increases fiber content but also promotes gut health and contributes to a feeling of fullness (Roberfroid, 2007). Fructose, used in moderation, provides sweetness with a lower glycemic index compared to glucose or sucrose, supporting stable blood sugar levels when combined with fiber and protein (Livesey, 2003).

From a textural and sensory perspective, lecithin acts as an emulsifier, improving mouthfeel by creating a creamy and cohesive matrix (Dickinson, 2009). Glycerol helps retain moisture and softens the gel, enhancing the smoothness of the final product (Gounga et al., 2007). Meanwhile, iota-carrageenan, a seaweed-derived hydrocolloid, was used to form a soft, elastic gel that holds its shape when chilled, ideal for pudding-style applications (Saha & Bhattacharya, 2010).

Challenges included balancing sweetness without traditional sugars and avoiding corn off-notes from the flour, which was mitigated by increasing flavour compounds. Also, corn flour was used as the primary thickening agent, but the final texture was still described by some as slightly too thick and granular. To improve smoothness and achieve a thinner consistency, future formulations could consider substituting corn flour with a different starch or flour—such as tapioca or rice starch—which are known for creating more elastic or silky textures in puddings and gels (Wang et al., 2015). Alternatively, adjusting the ratios of the existing ingredients could help fine-tune the viscosity and mouthfeel. Inulin played a positive role by contributing body, fiber, and mild sweetness to the pudding, as well as supporting gut health and satiety (Franck, 2002). Glycerol also enhanced smoothness and helped balance water activity, supporting improved mouthfeel and extended shelf life (Gounga et al., 2007).

All ingredients used in the final pudding formulation are compliant with current EU food additive regulations as defined in Regulation (EC) No 1333/2008 on food additives. For example, iota-carrageenan (E407) is an approved gelling agent permitted for use in desserts

within established safety limits (EFSA, 2018). Lecithin (E322) is an authorized emulsifier, commonly used in confectionery and dairy products without a specific maximum level when used in accordance with Good Manufacturing Practices (GMP) (European Commission, 2024). Additionally, sweeteners like fructose are naturally occurring sugars and do not fall under restricted artificial sweetener categories (European Commission, 2024). Inulin, casein, and glycerol are all recognized as safe food ingredients and are widely used in functional and processed foods across the EU (European Commission, 2024). The product was formulated with attention to both quantity and function to ensure safe consumption and regulatory compliance.

Overall, the final iteration was a clear improvement. The flavour was more balanced, the appearance more refined, and although texture and aroma can still be improved, the product now offered a more cohesive and appealing experience, showcasing how note-by-note cooking can reimagine traditional flavour profiles in novel formats.

6. Conclusion

This project successfully demonstrated the application of note-by-note cooking to create a futuristic, nutrient-dense pudding using a traditional flavor pairing. The product met sensory, nutritional, and regulatory goals and provided a strong case for note-by-note cuisine as a viable path for future food innovation.

7. References

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8. Appendix

Note-By-Note Logbook

Week 1

Aim: To develop a pudding with a sweet-savory profile, combining caramel and popcorn flavors with a focus on high protein content and paired with popcorn-flavored crisps. The concept was to balance smooth and crispy textures while delivering a novel, healthier treat using note-by-note principles.

Objective:

- Identify suitable molecular ingredients for texture (e.g. starches, gums, emulsifiers), flavor, sweetness, and nutrition (e.g. inulin for fiber).
- Begin preliminary formulation testing to evaluate texture, sweetness, and overall feasibility.

Materials & Methods

Ingredients for the Pudding

1. Base for Texture & Structure

• Water – 300g (Main liquid component)

• Inulin – 30g (Adds creaminess, slight sweetness, and prebiotic fiber benefits)

• Corn flour – 20g (Thickens and stabilizes the pudding)

• Carrageenan (iota) – 1g (Creates a smooth, gel-like consistency)

• Lecithin – 2.5g (Enhances emulsification for a rich mouthfeel)

2. Flavoring & Sweetness

• caramel flavor compound – 4g (Gives the signature caramelized taste)

• Popcorn flavor compound – 3g (Adds toasty, buttery popcorn notes)

• Salt – 0.5g (Enhances the salted caramel balance)

• Fructose – 6g (Sweetens)

• Maltitol – 10g (sweetness and cooling effect)

3. Fat & Mouthfeel Enhancement

• Olive pomace oil – 15g

• Glycerol – 5g

Processing Steps

Step 1: Hydrate the Ingredients

1. In a saucepan, add 300g of water and heat to 70°C while stirring.

2. Slowly whisk in inulin (30g), modified corn starch (20g), and iota carrageenan (1g) to prevent clumping.

3. Let hydrate for 5 minutes while stirring continuously.

Step 2: Emulsify & Heat

4. Add lecithin (2.5g), oil (15g), and glycerol (5g) and blend with a whisk.

5. Bring the mixture to 85°C while stirring to activate the thickeners.

Step 3: Add Flavoring & Final Adjustments

6. Reduce heat to low and stir in:

• Salted caramel flavor (8g)

• Popcorn flavor (6g)

• Salt flavor (1g)

• Stevia or sucralose (3g)

7. Keep stirring for 2 minutes to ensure even flavor distribution.

Step 4: Cool & Set

8. Pour the mixture into serving cups and let cool at room temperature for 15 minutes.

9. Transfer to a refrigerator and chill for at least 20 minutes to fully set.

Ingredients for the Crisps

• Maltodextrin – 35g

• Fine salt – 0.5g

• Olive pomace oil – 30g

• Popcorn flavor compound – 1g

Process

1. Heat 30g of olive pomace oil in a non-stick pan over medium heat.

2. Once the oil is warm, add 35g of maltodextrin and stir it continuously. Let it cook for about 3-5 minutes. (The oil should fully coat the maltodextrin, helping it crisp up into a more solid, crunchy texture).

3. After the mixture becomes golden and crispy, add 1g of popcorn flavor compound and 0.5g of fine salt. Stir thoroughly to distribute the flavor evenly.

4. Remove from heat, then spread the mixture on a parchment-lined baking sheet to cool.

5. Once cooled, break the mixture into small pieces and it's ready to be used as a topping.

Discussion

Pudding: The texture was smooth and pleasant (not too thick/runny nor too slimy/granular). However, it had a very unpleasant rancid butter taste from the popcorn flavouring. To improve, for next week, to decrease this unpleasant popcorn flavor, put half the amount, so 1.5g of popcorn flavour, and add vanilla to round out the taste and replace corn flour with potato starch. Also, to get rid of the artificial after taste, eliminate maltitol.

Crisps: Taste-wise, it had a slightly burnt taste (cook for less time next week) and had too much popcorn flavour so do half, 0.5g of the popcorn flavour. The crisps were also too oily, (reduce the oil from 30g to 15g) and it would fall apart into an oily powder in the mouth. For next week, try to bake the crisps mixture to give them that crunch.

Week 2

Aim: To optimize the flavour, texture, and mouthfeel of both the pudding and the crisps by modifying the formulation and process based on sensory feedback from Week 1, focusing on reducing off-flavours, improving crunch, and enhancing overall sensory appeal.

Objectives:

- Reformulate the pudding by:
  - Reducing popcorn flavouring from 3g to 1.5g
  - Adding vanilla for a rounder, more balanced taste
  - Replacing corn flour with potato starch to improve texture and reduce off-notes
  - Eliminating maltitol to avoid an artificial aftertaste
- Adjust the crisp formulation by:
  - Reducing popcorn flavouring from 1g to 0.5g
  - Cutting oil from 30g to 15g to reduce greasiness
  - Modifying the cooking method (test oven baking) to achieve a more pleasant crunch
- Conduct new sensory evaluations to assess improvements in flavour balance, texture, and mouthfeel

Materials & Methods

Ingredients for pudding

• Water – 250g

• Fructose – 15g

• Caramel compound – 3g

• Vanilla compound – 1g

• Popcorn flavor compound– 0.5g (for a subtle hint)

• Fine salt – 0.5g

• Olive pomace oil – 15g

• Potato starch – 12g

• Inulin – 6g

Process

1. Dissolve fructose, salt, caramel compound, vanilla compound, and 0.5g of popcorn flavor compound in water.

2. Whisk in potato starch and inulin until fully dissolved.

3. Heat mixture over medium heat, stirring constantly.

4. Bring just below a boil (~85°C), stirring until thickened.

5. Remove from heat, stir in olive pomace oil for richness and smooth mouthfeel.

6. Pour into serving cups and chill for at least 1 hour.

Ingredients for the Crisps

• Olive pomace oil– 15g

• Potato starch– 30g (instead of maltodextrin)

• Popcorn flavor compound– 0.5g

• Fine salt – 0.5g

Process

1. Warm olive pomace oil in a pan over low heat—don't let it get too hot to prevent the oil from absorbing too much.

2. Gradually sprinkle in potato starch, stirring constantly to ensure the starch evenly absorbs the oil and doesn't clump. You'll get a somewhat sandy texture as the starch absorbs the oil.

3. Remove from heat once it's fully mixed and the texture is consistent (shouldn't be too oily).

4. Spread the mixture evenly on a baking sheet lined with parchment paper.

5. Bake at 100°C for 10–15 minutes, checking frequently to ensure it crisps up without burning. You may want to stir halfway through to ensure even crisping.

6. Allow to cool completely. Once it cools, it should form crunchy bits that are light and crispy.

7. Sprinkle popcorn flavor compound (0.5g) and fine salt over the cooled crisps, then toss gently to evenly coat.

Discussion

Pudding: the texture was more slime-like compared to last week which was unpleasant. Taste-wise, it was still unpleasant from the popcorn flavour.

Crisps: total failure, stayed as paste even after attempting higher temperatures for longer time and higher convection.

Week 4 – Final version

Aim: To completely redefine the flavor profile of the pudding and crisps by replacing the unpleasant and unworkable popcorn flavor with a more harmonious and innovative combination—salty pistachio paired with floral rose and sweet strawberry—while maintaining the sweet-salty contrast and enhancing the product's futuristic appeal and protein content.

Objectives:

- Reformulate the pudding to:
    - Remove popcorn, caramel, and vanilla flavorings
    - Introduce pistachio flavor as the primary salty note
    - Add rose and strawberry flavoring for an elegant, aromatic sweetness
    - Add protein with casein powder for added nutritional benefit
    - Replace the crisps by colorful gelatine leaves (mainly for mainly the visual)
    - Add green (for pistachio) and pink (for rose and strawberry) coloring to make more visually appealing

Materials & Methods

Ingredients for Pudding

1. Liquid Base & Texture

- Water – **157g**
- Inulin – **21g**
- Corn flour – **14g**

- Iota carrageenan – **0.6g**
- Lecithin – **1.75g**
- Olive pomace oil – **10.5g**
- Glycerol – **3.5g**
- Casein (pure) – **10g**

2. Flavoring & Sweetness

- Pistachio flavor compound – **3g**
- Strawberry flavor compound – **3g**
- Rose flavor compound – **3g**
- Fructose – **7.5g**
- Salt –**1g**

Process

1. **Mix Dry Ingredients:**

   Combine in a bowl:

   a. Inulin
   b. Corn flour
   c. Iota carrageenan
   d. Lecithin
   e. Salt
   f. Casein protein
2. **Combine Wet Ingredients:**
   a. In a saucepan, whisk together:
   b. Water
   c. Olive pomace oil
   d. Glycerol
3. **Cook:**
   a. Slowly whisk in the dry mix
   b. Heat to 85–90°C while stirring constantly
   c. Cook for 5–6 minutes until thickened (do not boil hard)
4. **Cool & Flavor:**
   a. Let cool to ~60–70°C
   b. Stir in fructose and all flavorings (pistachio, rose, strawberry)
5. **Divide & Color:**
   a. Split pudding into two bowls
   b. Add green coloring + a pinch of salt to one half (pistachio layer)
   c. Add pink coloring + a bit more fructose to the other half (strawberry-rose layer)
6. **Decorate:**
   a. Cut gelatine sheets into triangle "petals"
   b. Dip in colored food dyes
7. **Assemble:**
   a. Layer green and pink pudding in a champagne glass

b. Top with colored gelatine leaves for decoration

Discussion

This final week showed significantly more positive results following a complete revamp of the formulation. The most notable improvements were in taste and visual appeal. There was no longer a rancid, burnt, unpleasant corn flavour from the popcorn, the texture was not slimy but smooth and the visual was not an unattractive grey pudding but a carefully positioned colourful masterpiece.