

Note by Note Report



Theme: Food Waste
Dish Name: Summer with Sustainability

8

Submitted by:

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1. Introduction

In light of population growth, urbanisation, and climate change, one of a nation's main economic pillars is food production, which has grown to be a major issue in modern society. Additionally, food waste has increased and is now a significant factor in climate change. In the EU, food waste totals about 88 million metric tonnes per year across all industries (Vittuari et al., 2016). According to studies, 14% of waste in homes and 30% of waste in commercial settings in Ireland is made up of food waste, which means that this waste doesn't get donated or diverted to a better use before it ends up in the landfill (Broderick and Gibson, 2019). As a result, it is clear that reducing food waste is critical to establishing a sustainable and resource-effective food chain, as food requires a significant amount of energy to produce (Wikström et al., 2018).

Molecular gastronomy, a brand-new branch of science, was coined in 1988 with the mission of "looking for the mechanisms of events taking place while dish preparation and consumption." The chance to talk about the specifics of molecular gastronomy and how it relates to other fields of science was provided by this new definition (This, 2013). Hervé This developed the idea of "note-by-note cooking" in the year 1994 and first proposed it in Scientific American magazine. Note-by-note cooking is a method of food preparation that begins with molecular gastronomy. This idea is the most recent branch of molecular gastronomy and is concerned with making foods and dishes without using the tissues of meat, fish, vegetables, or fruits. Instead, it uses pure compounds or mixtures of them. Hervé This suggested that this idea could be used to end world hunger (Precup et al., 2021). Utilizing different molecular gastronomy techniques, it is possible to reformulate the structure and texture of food using fruit and vegetable by-products and innovative food production methods. A new perspective on food preparations can be obtained using molecular gastronomy techniques like lyophilization, spherification, gelling, and sous-vide cooking (Precup et al., 2017).

The theme of this year's Note-by-note cooking contest was **Food waste**. Food waste is a sensitive topic in today's society, and research in biotechnology and gastronomy could potentially be able to provide solutions by repurposing the food that is thrown away. From various plant tissues, different compounds could be extracted and used to make new food products, including proteins, carbohydrates, lipids, and phytochemicals (polyphenols and carotenoids) (Precup et al., 2021). In keeping with the contest's theme, a dish called "**Summer with Sustainability**" was created. The elements of summer that make us all adore it served as the inspiration for this dish. Growing up in a tropical country (India), for me summer was also about eating mangoes, drinking lemonade, or having coke and tasty watermelon a beach with my family.

This component consisted of watermelon discs and film, beachy cola petals, spirulina lemonade noodles and mango pudding made with note-by-note milk. This dish combines the concepts of food waste and summer with sustainability by using ingredients like more whey protein, carrageenan and corn flour in the pudding, spirulina and agar-agar in the noodles, agar-agar and

dietary fiber cellulose in the watermelon discs and film, and agar-agar in the beachy petals. Through the use of particular techniques, the agro-industrial secondary products and natural polymers are combined to give this dish nutritional and bioactive qualities.

2. Aim

To develop a note-by-note dish with the theme of food waste and incorporate the concept of summer with sustainability.

3. Objective

The objective is to create following things within a span of four weeks with intense research and trials.

- 1) Note by note milk
- 2) Mango pudding using note by note milk, corn starch and k-carrageenan.
- 3) Spirulina lemonade noodles using spirulina powder and agar-agar.
- 4) Watermelon discs and film using agar-agar, dietary fiber cellulose, red/ orange colour and watermelon aroma
- 5) Petals using agar-agar, blue colour and cola aroma.

4. Final Materials and Method

4.1 Note-by-note milk

4.1.1 *Ingredients for Note-by-note milk*

For dairy cows, water makes up about 87% of milk, which is more than any other element. In water, the other components are dissolved, colloiddally distributed, and emulsified. Depending on the specific animal, its breed, lactation stage, age, and health status, the amounts of the major milk constituents may differ greatly. Cow's milk typically contains 87% water, 4% fat, 3.4% protein, and 4.8% lactose. Casein in roughly 81% (2.7% of total milk) and whey 19% (0.6% of total milk) of total protein (GroupeESA, n.d.). About 65% of the fat in milk is saturated, 30% is monounsaturated, and 5% is polyunsaturated (Milkfacts, 2020). Linoleic acid (18:2 omega-6) and alpha-linolenic acid (18:3 omega-3) are the two main PUFA found in milk (Haug, Høstmark and Harstad, 2007).

Considering all these things calculation was made to make note-by-note milk. Sunflower oil was used as a source of fat. Since, with regard to fatty acids, sunflower oil has an approximate 15% saturated fat content, 85% unsaturated fat content, and a composition of 14-43% oleic and 44-75% linoleic acids (Akkaya, 2018).

Total 200 ml of note-by-note milk was made. 2.3 g of more whey was added in the end in order to make note by note pudding using this milk which is little higher and rich in protein as compared to other puddings.

Ingredient	Ingredient description/photo	Quantity
Water (H₂O)	Tap water used	174g
Casein protein (unflavoured)	Casein powder by “Myprotein” 	5.4g
Whey protein (unflavoured)	Pure whey Protein by “Bulk” 	3.5g
Lactose Powder	Lactose Powder by “MSK” 	9.6g
Refined Sunflower oil	Sunflower Oil by “Mediterani” 	8g

4.1.2 Equipment for note-by-note milk

Bowls, weighing scale, whisk, hand blender, spoons, jug.

4.1.3 Method for note-by-note milk

- a) Weigh the water in a jug and add it too bowl.
- b) Weight casein powder, lactose powder, and whey powder and add it to the water.
- c) Mix everything with the help of whisk.
- d) Weigh for add sunflower oil and blend it using hand blender for 1 minute.

4.2 Note-by-note Mango Pudding

The note-by-note mango pudding was made using note by note milk. The recipe of mango pudding was slightly inspired by the method followed by Emmons, Beckett and Larmond (1972) for their experiment and recipe of “Vanilla pudding” given in Texture (2014).

4.2.1 Ingredients for note-by-note mango pudding

Ingredient	Ingredient description/photo	Quantity
Sucrose (Table sugar)	Table sugar was used as sucrose (mixture of glucose and fructose in 1:1 ratio) 	30g
Note-by-note milk	The one made in 4.1 section	200g
Corn starch	Corn flour by “gem” was used. 	20g
k-carrageenan	k-carrageenan by “MSK” was used	0.2g

		
Mango powder	Mango powder by “SOSA” was used 	8g
Yellow colour	Yellow colour Gel colouring by “Punto Italiana” 	0.2g
Orange colour	Orange colour Gel colouring by “Punto Italiana” 	0.05g
Mango aroma	Mango aroma by “Sosa” 	0.5g

4.2.2 Equipment for note-by-note mango pudding
Sauce Pan, Gas stove, moulds, spoon, bowl, refrigerator.

4.2.3 Method for note-by-note mango pudding.

- Stir corn starch and k-carrageenan into 50g of note-by-note milk.
- Into remaining milk add sucrose and mango powder and bring it to boil.
- Remove from heat and stir corn starch and k-carrageenan mixture into hot milk.
- Start heating again and stir constantly. Let it heat for 3 minutes and remove from heat. Add mango aroma and mix.
- Pour into the moulds and leave it to set in refrigerator at minimum 4°C for half an hour.

4.3 Note by note spirulina lemonade noodles.

The base for the technique of Spirulina lemonade noodles was of “Tomato Agar Spaghetti” done by Molecular recipes (2010). The attempt was to replicate the authentic street style Indian lemonade with the addition of Spirulina powder in noodle form.

4.3.1 Ingredients for note-by-note Spirulina lemonade noodles

Ingredients	Ingredient description/photo	Quantity
Spirulina powder	Spirulina powder by “Bulk” 	0.5 g
Citric acid	Citric acid Monohydrated by “Louis Francois” 	0.5g
Water	Tap water used	140g
Salt	Table salt was used	1g
Sucrose	Table sugar was used	3g

Agar-Agar	Agar-Agar by “Sosa” 	2.4g
Green colour	Green colour Gel colouring by “Punto Italiana” 	0.2g
Lemon skin natural aroma	Lemon skin natural aroma by “Sosa” 	0.5g

4.3.2 *Equipment for note-by-note Spirulina Lemonade noodles*

Sauce pan, weighing scale, Jug, spoon, bowl, Gas Stove, whisk, ice-water bath

4.3.3 *Method for note-by-note Spirulina Lemonade noodles*

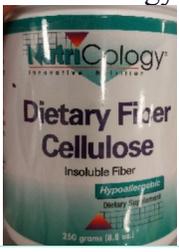
- Weigh spirulina powder, citric acid, salt and sugar and mix in its water.
- Stir everything and add it to saucepan. Dissolve agar-agar and start heating.
- Keep stirring while heating the mixture and bring it to boil.
- Take off the heat and add green colour and lemon aroma and mix it again.

- e) Fill the syringe and with it fill the silicone tubes. Submerge the full tubes in ice-water bath and let the mixture set for few minutes.
- f) With an empty syringe, inject air into the tube to get the noodle out of the tube.

4.4 Note-by-Note watermelon discs and film.

The note-by-note watermelon discs were made using agar-agar and dietary fiber cellulose. The technique was based on the recipe of “Agar gel cubes” mentioned in Texture (2014).

4.4.1 *Ingredients of watermelon discs and film.*

Ingredient	Ingredient description/ photo	Quantity
Water	Tap water used	100g
Agar-agar	Agar-Agar by “Sosa” 	1.5g
Dietary fiber cellulose	Dietary Fiber Cellulose (Insoluble) by “NutriCology” 	2g
Orange food colour	Orange colour Gel colouring by “Punto Italiana” 	0.2g
Watermelon aroma	Watermelon aroma by “Sosa”	0.5g

		
Sucrose	Table sugar	10g

4.4.2 *Equipment for note-by-note watermelon discs and film.*

Sauce pan, weighing scale, Gas stove, measuring spoon set of 4 (½ and 1 teaspoon and ½ and 1 tablespoon) in increasing size order, spoon, bowl.

4.4.3 *Method for note-by-note watermelon discs and film.*

- Add dietary fiber cellulose, orange food colour, sugar and agar-agar to water. Mix well.
- Bring it to boil. Stir well. Take out from heat and add watermelon aroma.
- Pour into Measuring spoon set of 4 and also and a plate (spread evenly).
- Set aside and let it cool down.
- After half an hour, demould from spoons and cut the film on a plate.

4.5 Note-by-note beachy cola petals

The note-by-note beachy cola petals were made using agar-agar. The technique was based on the recipe of “Agar gel cubes” mentioned in Texture (2014).

4.5.1 *Ingredients of note-by-note beachy cola petals*

Ingredients	Ingredient description/ photo	Quantity
Water	Tap water used	100g
Sucrose	Table sugar used	10g
Salt	Table salt used	2g
Citric acid	Citric Acid Monohydrated by “Louis Francois” 	0.3g
Agar-Agar	Agar-Agar by “Sosa”	1.5g

		
Blue colour	Blue colour Gel colouring by “Punto Italiana”	0.2g
Cola aroma	Cola Aroma by ‘Sosa’ 	0.5g

4.5.2 *Equipment for note-by-note beachy cola petals*

Gas stove, weighing scale, sauce pan, bowl, small plastic spoons, spoon.

4.5.3 *Method for note-by-note beachy cola petals*

- Add citric acid, sugar, salt, blue food colour and agar-agar to water. Mix well.
- Bring it to boil. Stir well. Take out from heat and add cola aroma.
- Pour into 8-10 small plastic spoons.
- Set aside and let it cool down.
- After half an hour, demould from spoons.

5. Results

In order to create a note-by-note milk that will serve as the foundation for the mango pudding, the various milk ingredients were first combined to create this dish's first step. Luckily, the note-by-note milk was created right away during the first attempt. Reverse engineering can be linked to the creation of note-by-note milk. Although the term "reverse engineering" has applications across a number of industries, it most often refers to the process of designing manufacturing conditions in accordance with desired end product properties (rather than the opposite) (Thomopoulos et al., 2019).

The note-by-note milk was made by combining casein, lactose, whey protein, sunflower oil and water. For the note-by-note milk recipe the casein protein and whey protein act synergistically to create a foam in milk. During the combining on these elements and blending them together with hand blender it was observed that a little amount of foam is formed as well.

The note-by-note dessert, “Mango Pudding”, was created by restructuring its molecular components with the help of polymers and molecular gastronomy techniques (gelation) but also using and increasing the amount of by-product of cheese industry that is, whey protein. The natural mango in the dish of mango pudding was substituted by freeze dried mango powder and mango aroma along with a hint of mango and yellow colour. The elements used to set this pudding up include k-carrageenan and corn starch. The synergy between these two compounds resulted in the formation of firm yet smooth pudding with rich mouthfeel. According to Lin, Liang and Chang (2016), starch increases the gel strength and decreases carrageenan syneresis in carrageenan dispersion. Additionally, the rigidity of gelatinized starch granules and the amylose content of starch both significantly influence the gel characteristics of carrageenan-starch dispersions.

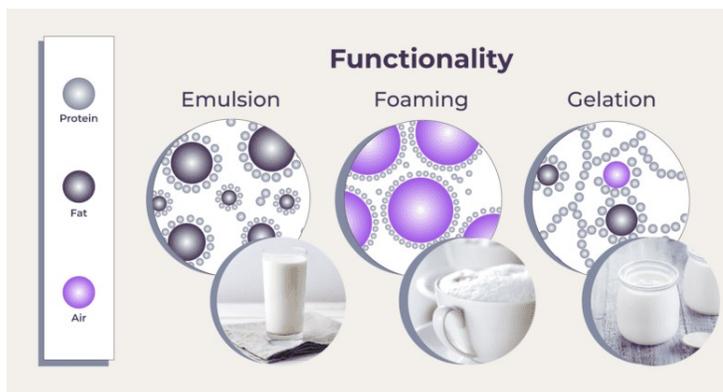


Fig 1: Functionality of the constituents present in milk (Kathleen Nay, 2021)

The interactions that occur between the various ingredients lead to the structural arrangement and rheological characteristics of the dessert. Due to what is known as "milk reactivity," which is thought to be the result of an electrostatic interaction between the positively charged part of "casein" and the negatively charged sulphate groups of "carrageenan," the substance is frequently used as a gelling agent in milk desserts (Snoeren et al., 1975). It's believed that the exclusion effect of swollen granules, which leads to greater carrageenan levels in the continuous water phase, is what primarily controls the gel properties of -carrageenan—starch composites (Lai, Huang and Lii, 1999, Tecante and Doublier, 1999).

The second component of "Summer with sustainability" was spirulina lemonade noodles. It was



Fig 2: Spirulina powder

noted that the spirulina powder's colour slightly changed and turned a little bit brownish during the step of heating when these noodles were being developed. Additionally, one of the dish's drawbacks is the spirulina's unpleasant fishy smell. The lemon aroma was used as an odour and green food colouring was used to maintain the dish's green colour in order to overcome this drawback. Citric acid, sugar, and salt balance out well with the spirulina, and surprisingly, the spirulina lemonade noodles taste better than expected.

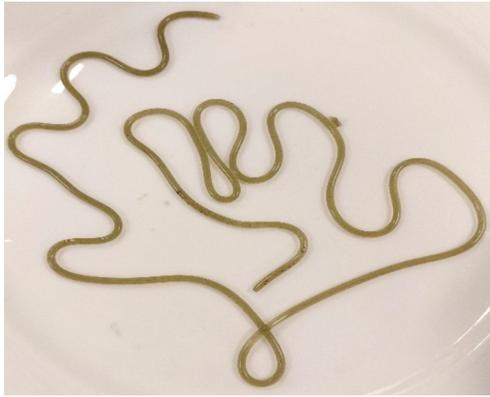


Fig 3: Spirulina lemonade noodle

Agar- agar was used while making this noodle. Agarose (70%) and agarpectin (30%) are the two polysaccharides that make up agar. Agarose, the substance responsible for the gel's creation, is a type of polymer made of agarobiose repeating units. Furthermore, the gelling ability of agarose is caused by hydrogen atoms, which force the molecule to form a helix. The molecule looks like having a double helical structure. When agar-agar solution is heated to 90 °C and then allowed to cool, helices form with an association and reorganisation of the helices. At a temperature of about 40 °C, these helical bundles form a

three-dimensional network. The thermoreversibility of this phase change. When the agar is allowed to cool in a tube, straight fibres, spaghetti, or noodles can be produced (D'Angelo et al., 2022).

"Watermelon disc and watermelon film" made up the dish's third element. The same ingredients were used to make these two components, but their shape was altered to allow for smart plating. To give the watermelon gel a spherical disc-like shape, measuring spoons were used as a mould, as shown in figure 4. The gel was evenly spread on the plate in order to create a thin film of watermelon agar, and cuts were made just prior to plating. Because of agar's ability to gel and the proper concentration, the film and discs smoothly took on the shape of the container and the desired texture. In terms of sensory of the discs and film the watermelon aroma was added to the mixture along with bright orange colour that gave it watermelon feel. The sugar addition gave the discs and film watermelon jelly feeling.



Fig 4: Watermelon disc gel in ½ and 1 teaspoon and ½ and 1 tablespoon.

Dietary fibre cellulose was also added while making these discs. The concept behind it was to make use of watermelon rind, since the rind of watermelon is a great source of bioactive compounds and dietary fibre (Naknaen et al., 2016). Although the dietary fibre cellulose used was insoluble in water, it did not affect the gelation process of the discs or film.

The last component made was beachy cola petals. These petals represented the feeling on having coke sitting on beach to feel fresh during scorching heat of summer. This component was also made using star ingredient of this dish that is agar-agar. To mould them into the shape of petals use of mini plastic transparent spoons as shown in figure 5 was done. The addition of citric acid, sugar and



Fig 5: Mini plastic transparent spoon was moulding beachy cola petals.

salt gave it a basic sour-sweet taste. Addition of blue colour and cola aroma was done to enhance sensory property of the petals.

The final plate with all of these components is shown in figure 6 after creation. The mango pudding had a sun-shaped cut-out in it to fit the 'Summer with Sustainability' theme. It was covered with the watermelon film. Spirulina noodles were arranged behind the mango pudding sun, and watermelon discs and beachy cola petals were displayed on the lower side of the plate. To give it a slightly artistic appearance, small pieces of watermelon film were cut and arranged above the spirulina noodles as well as in the spaces between the petals.

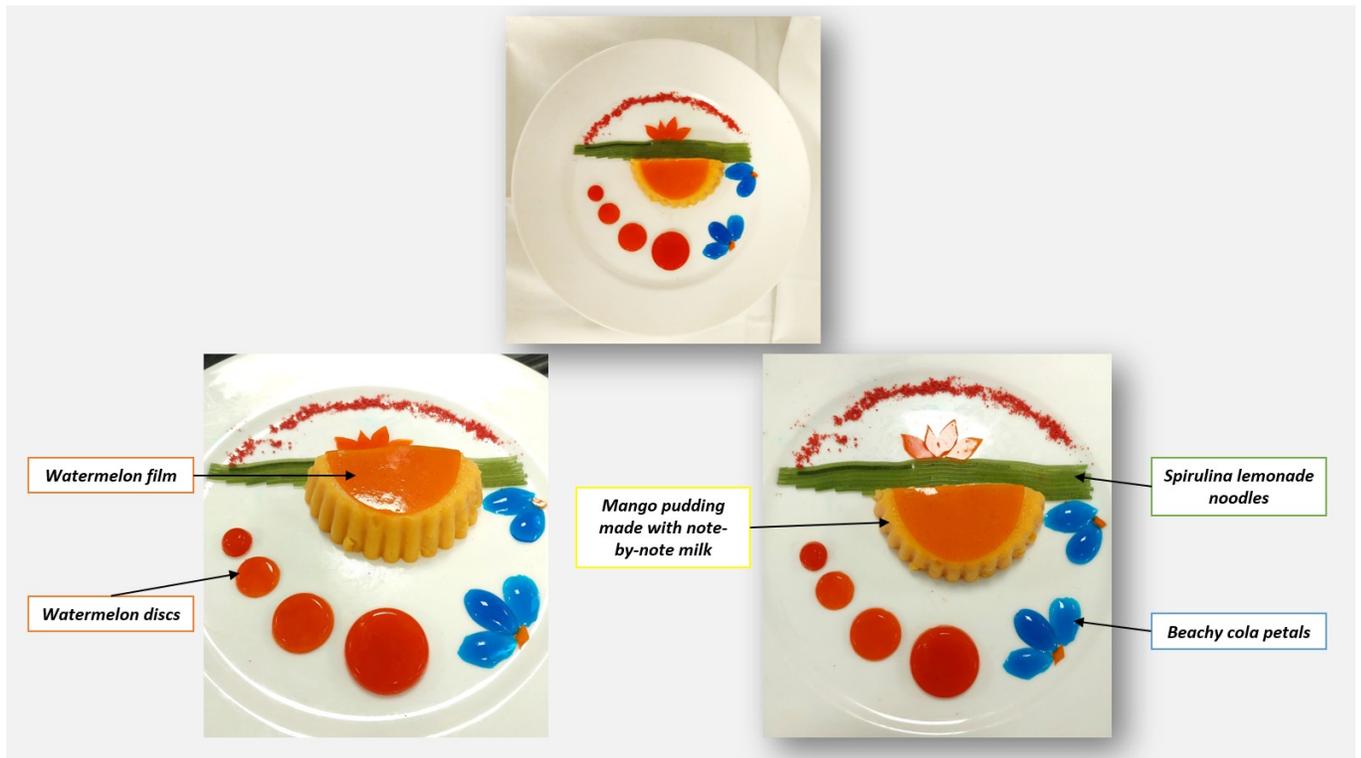


Fig 6: Final resultant Note by note “Summer with Sustainability” plate combining all the elements.

6. Discussion

An increased demand for food production appears to be necessary in order to meet the growing world population's dietary needs. Finding sustainable means of production that can, on the one hand, satisfy the standards of safety and quality while, on the other, meeting the rising demand, is a challenge that must be overcome. Reducing waste along the food supply chain, which

involves making sure that the majority of the produced food reaches the population in conditions suitable for consumption, is one way to accomplish this goal.

Food additives help manufacturers get around the issue of limited amounts of natural ingredients, extend the shelf life of food, and streamline the complicated cooking processes. As a result, they reduce waste and help ensure that the world's population is fed sustainably (Gomes, Simões and Silva, 2020).

The dish made “Summer with sustainability” is based on combining the theme of summer and food waste together. Two main star ingredients of this dish are note-by-note mango pudding which is higher in whey protein as compared to normal puddings and other important star ingredient is Agar-Agar. Agar-Agar is used in the making of spirulina-lemonade noodles, watermelon discs and film and beachy cola petals as well. Each and every element in this dish comes with its own story and represent reduction of food waste in different ways.

The mango pudding made using note-by-note milk, corn starch and kappa-carrageenan represents sunny days and you eating mango. From food waste point of view the major three ingredients used in this that represent their take on food waste are whey protein and corn starch.

Starting with whey protein, the purification and fractionation of whey protein from waste streams produced during the production of cheese, casein, and yoghurt is the best illustration of the value-added reusing of food processing waste streams. While whey protein is a great example of valuing food waste, whey permeate and acid whey (from the production of strained yoghurt) are still significant dairy waste streams because they are full of lactose, a milk sugar that is an essential substrate for enzymatic upcycling (European whey products association, 2001).

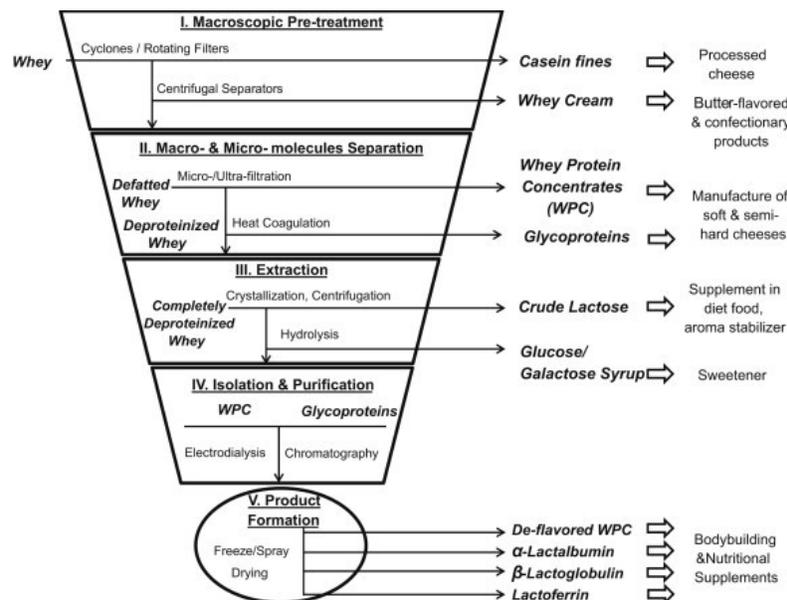


Fig 7: Recovery and valorization of high-added value components from cheese whey.

The chemical oxygen demand (COD) of corn starch wastewater (CSW), which contains simple sugar, starch, protein, traces of vitamins, and inorganic salts, is high. As a result, it is suggested as the best feedstock for providing the nutrients required for microbial growth and metabolism. It is efficient and appealing to use CSW as a substrate for the production of bio-hydrogen in order to treat wastewater and create sustainable bioenergy (Li et al., 2008).

Another important ingredient present in all the other dishes in Agar-agar. Agarophytes algae have agar in their cell walls. It is a structural polymer that is only partially ionised, most likely in the form of a salt mixture of calcium and/or magnesium. Agarose and agaropectin are two of the polysaccharide mixtures that make up this substance chemically. The neutral polymer agarose and the ionised sulphated polymer agaropectin are different types of polymers. Agar-agar contains at least 2/3 of agarose, but the proportions of these two polymers vary depending on the type of algae (Glicksman, 1983).

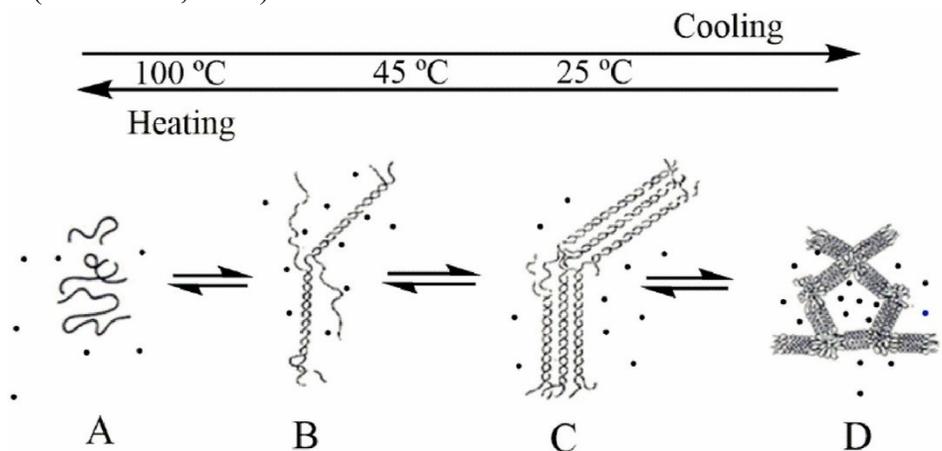


Fig 8: Agar-Agar gelation scheme

During the preparation of noodles, film, discs and petals the agar follows the process of gelation. Although agar-agar is insoluble in cold water, it absorbs water up to 20 times its own weight in its interstices. When water is heated to a high temperature (between 95 °C and 100 °C), dry powdered agar dissolves quickly. The source of the feedstock has a significant impact on the viscosity of the agar solutions, which varies widely. In the pH range of 6.0 to 8.0, the viscosity of an agar solution is relatively stable at temperatures above its gelation point and is not significantly affected over time. But once the gelation process has begun, the viscosity rises gradually at a constant temperature (Gomes, Simões and Silva, 2020).

Different steps are involved in the agar-agar solution's (colloidal sol) gelation process. Agar-agar concentrations as low as 0.50% form a firm gel after cooling. As was done in step A, the agar-agar must first be dissolved in water and allowed to cool. The agar-agar now displays a haphazard coil chain. The agar-agar gelling component of the mixture forms a double helical structure as the mixture begins to cool. This structure will serve as the foundation for the

subsequent macrostructure, which will determine the gel's rigidity. A double levogyre helix formed by hydrogen bonds between the hydroxyl groups of 3,6-anhydro-L-galactose and the random mesh holds the mesh in place (Letherby and Young, 1981).

The reason behind addition of spirulina into the noodles was to represent the ability of spirulina grow and cultivate in both fresh water and waste water. Spirulina has a significant impact on energy conservation, environmental protection through wastewater recycling, and human and animal nutrition. The various properties of *Spirulina platensis* were the main focus of the current review. Spirulina is an excellent source of proteins (60–70%), vitamins, and minerals that are added to the diets of malnourished children in developing nations. A kilogramme of different vegetables is equal to one gramme of Spirulina protein. More so than that of soya beans, the amino acid profile of spirulina protein is among the best in the plant kingdom. Spirulina is successfully grown in large quantities in both freshwater and wastewater. Spirulina can be used for human nutrition if it is grown in clear waters and under strict supervision. In addition to being used as animal feed, the microalga that is grown in waste water serves as a source of fine chemicals and fuels (Saranraj, P. and Sivasakthi, S., 2014).

The idea behind watermelon discs and watermelon film was to represent the food waste that happens in the form of wastage of watermelon rind. The watermelon rind, which is discarded in large quantities, is made up of low molecular weight compounds like amino acids, citrulline, and other phytochemicals as well as carbonaceous materials like carotenoids and polysaccharides like cellulose, pectin, and others (Bhattacharjee, Dutta, and Saxena, 2020). Due to the presence of hydroxyl (cellulose) and carboxyl (pectin) groups, the watermelon rind may prove to be an effective heavy metal binding agent (Reddy, Lakshmi pathy, and Sarada, 2014). Watermelon rind has a variety of uses. After processing, which includes drying and grinding the mesocarp, a thick, white intermediate layer, dietary fibre that is neutral in nature can be extracted for use in the pharmaceutical industry, the creation of flours enriched with nutraceuticals for use in the production of baked goods like pasta, pastries, and ice cream, as well as a product for innovative packaging materials (Maletti et al., 2022).

In this way after combining all the elements together the note-by-note “Summer with Sustainability” dish was prepared.

7. Conclusion

To sum up, the goal of creating a note-by-note dish in accordance with the food waste brief provided was accomplished. On the last day, a dish called "Summer with Sustainability" was served. The agenda was finished because each component attempted to share its personal experience with food waste. Whether it was the mango pudding, watermelon discs or spirulina lemonade noodles, every component of the dish had some connection to reducing food waste and promoting sustainability. The main ingredients in the dishes were agro-industrial waste and functional ingredients. There was no injustice in the dish's flavour even after it had been broken

down note by note. The presentation included a tasty dessert, lemonade in the shape of noodles, coke in the shape of petals, and watermelon fresh feel in the shape of a disc and a movie. Today, there is a significant problem with food waste, and molecular gastronomy, note-by-note biotechnology, can all work together to solve this problem till certain extent.

8. References

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9. Appendix (Log Book)

9.1 Week 2

Date: 27/03/2023

Aim: To develop note-by-note milk and pudding out it, also trial of lemonade noodles.

Objective: The goal is to try and create note-by-note milk using components found in cow's milk. If the milk is fully developed, making pudding with it. Making of noodles with a lemon aroma and using agar-agar for gelation.

Materials and Method:

1. Note-by-note milk:

Ingredient	Ingredient description/photo	Quantity
Water (H₂O)	Tap water used	174g
Casein protein (unflavoured)	Casein powder by “Myprotein”	5.4g
Whey protein (unflavoured)	Pure whey Protein by “Bulk”	3.5g
Lactose Powder	Lactose Powder by “MSK”	9.6g
Refined Sunflower oil	Sunflower Oil by “Mediterani”	8g

Method for note-by-note milk

- a) Weigh the water in a jug and add it too bowl.
- b) Weight casein powder, lactose powder, and whey powder and add it to the water.
- c) Mix everything with the help of whisk.
- d) Weigh for add sunflower oil and blend it using hand blender for 1 minute.

2. Note-by-note pudding with note-by-note milk

Ingredient	Ingredient description/photo	Quantity
Note-by-note milk	Note-by-note milk made above	200g
Corn starch	Corn flour by “gem” was used.	20g
Mango powder	Mango powder by “SOSA” was used	4g
Sucrose	Table sugar used	20g
Mango aroma	Mango aroma by “Sosa”	0.5g

Method for note-by-note pudding with note-by-note milk

- a) Stir corn starch into 50g of note-by-note milk.

- b) Into the remaining note-by-note milk add sucrose and mango powder and bring it to boil.
- c) Remove from heat and stir corn starch into hot milk.
- d) Start heating again and stir constantly. Let it heat for 3 minutes and remove from heat. Add mango aroma and mix.

3. Note-by-note lemonade noodles:

Ingredients	Ingredient description/photo	Quantity
Citric acid	Citric acid Monohydrated by “Louis Francois”	0.5g
Water	Tap water used	140g
Salt	Table salt was used	1g
Sucrose	Table sugar was used	3g
Agar-Agar	Agar-Agar by “Sosa”	2.4g
Green colour	Green colour Gel colouring by “Punto Italiana”	0.05g
Lemon skin natural aroma	Lemon skin natural aroma by “Sosa”	0.5g

Method for lemonade noodles:

- a) Weigh citric acid, salt and sugar and mix it in water.
- b) Stir everything and add it to saucepan. Dissolve agar-agar and start heating.
- c) Keep stirring while heating the mixture and bring it to boil.
- d) Take off the heat and add green colour and lemon aroma and mix it again.
- e) Fill the syringe and with it fill the silicone tubes. Submerge the full tubes in ice-water bath and let the mixture set for 1 minute.
- f) With an empty syringe, inject air into the tube to get the noodle out of the tube.

Result and discussion:

The note-by-note milk was made in the first attempt. The consistency, texture and smell were similar to that of cow milk and thus, it further processed to make a mango pudding.

For the mango pudding, the pudding was also chilled, but the texture and clear cut were not what was anticipated. Demoulding it from the mould revealed that it was unable to maintain its shape for an extended period of time, instead ending up slightly flowy and watery. Additionally, it was found that the mango powder used had little impact on the pudding's colour or flavour. It tasted more like a basic milk pudding than mango pudding. Sweetness was also less. According to the mango pudding's results, more thickening agents, more mango powder, and yellow food

colouring are all necessary to properly set the pudding. In this instance, corn starch alone at the specified concentration is not functioning properly to produce the desired outcomes.

Although the flavour of the lemonade noodles was wonderful, there is little need in the addition of more amount of green food colour. The noodle that had formed was beginning to break a little, possibly due to the short trial period of immersion in the ice bath.

The result of first week trial is shown in the figure below:



Fig 9: Result of week 2 trial.

Recommendation for next trial:

In the upcoming trial addition of k-carrageenan can be done in addition to corn starch in the pudding mixture which will help it to set quickly. Along with that increase in mango powder and addition of yellow food colour would be done. In the lemonade noodle to make it spirulina-based noodle addition of spirulina powder can be done along with balancing it with green food colour.

9.2 Week 3

Date: 17/04/2023

Aim: To develop mango pudding by addition of k-carrageenan to first trials mixture and, also trial of spirulina lemonade noodles and watermelon film.

Objective: The goal is to set the mango pudding with the help of k-carrageenan and corn starch. Along with that mango powder amount will be increased and yellow food colour would be added

to increase sensorial property of pudding. Addition of spirulina powder would be done to the first trials lemonade noodles to make it spirulina lemonade noodle. The green colour in the noodles would be balanced accordingly and also the tubes will be immersed in ice water bath for more time during the trial. Development of watermelon film using agar-agar and dietary fiber cellulose to be done as well.

Materials and Method:

1. Note-by-note pudding with note-by-note milk

Ingredient	Ingredient description/photo	Quantity
Note-by-note milk	Note-by-note milk made above	200g
Corn starch	Corn flour by “gem” was used.	20g
K-carrageenan	k-carrageenan by “MSK” used	0.2g
Mango powder	Mango powder by “SOSA” was used	8g
Sucrose	Table sugar used	40g
Yellow colour	Yellow colour Gel colouring by “Punto Italiana”	0.3g
Mango aroma	Mango aroma by “Sosa”	0.5g

Method for note-by-note pudding with note-by-note milk

- a) Stir corn starch and k-carrageenan into 50g of note-by-note milk.
- b) Into the remaining note-by-note milk add sucrose and mango powder and bring it to boil.
- c) Remove from heat and stir corn starch and k-carrageenan into hot milk.
- d) Start heating again and stir constantly. Let it heat for 3 minutes and remove from heat. Add mango aroma and mix.

2. Note-by-note lemonade noodles:

Ingredients	Ingredient description/photo	Quantity
Citric acid	Citric acid Monohydrated by “Louis Francois”	0.5g
Spirulina powder	Spirulina powder by “Bulk” was used	0.5g
Water	Tap water used	140g
Salt	Table salt was used	1g
Sucrose	Table sugar was used	3g
Agar-Agar	Agar-Agar by “Sosa”	2.4g

Green colour	Green colour Gel colouring by “Punto Italiana”	0.1g
Lemon skin natural aroma	Lemon skin natural aroma by “Sosa”	0.5g

Method for lemonade noodles:

- Weigh spirulina powder, citric acid, salt and sugar and mix it in water.
- Stir everything and add it to saucepan. Dissolve agar-agar and start heating.
- Keep stirring while heating the mixture and bring it to boil.
- Take off the heat and add green colour and lemon aroma and mix it again.
- Fill the syringe and with it fill the silicone tubes. Submerge the full tubes in ice-water bath and let the mixture set for 5 minutes.
- With an empty syringe, inject air into the tube to get the noodle out of the tube.

3. Note-by-note watermelon film:

Ingredient	Ingredient description/ photo	Quantity
Water	Tap water used	100g
Agar-agar	Agar-Agar by “Sosa”	1.5g
Dietary fiber cellulose	Dietary Fiber Cellulose (Insoluble) by “NutriCology”	2g
Orange food colour	Orange colour Gel colouring by “Punto Italiana”	0.2g
Watermelon aroma	Watermelon aroma by “Sosa”	0.5g
Sucrose	Table sugar	10g

Method for note-by-note watermelon discs and film.

- Add dietary fiber cellulose, orange food colour, sugar and agar-agar to water. Mix well.
- Bring it to boil. Stir well. Take out from heat and add watermelon aroma.
- Pour into plate (spread evenly).
- Set aside and let it cool down.
- After half an hour cut the film on a plate.

Result and discussion:

K-carrageenan was successfully added to the pudding mixture, resulting in the development of properly set mango pudding with clear cut. The sensory qualities of the mango pudding were maintained with the addition of more mango powder. Although the pudding's increased sugar content didn't go well with it, the pudding ultimately came out to be too sweet. With the addition of yellow food colouring, the pudding took on a very vivid yellow appearance and began to resemble turmeric rather than mango.

Spirulina powder went well with the lemonade noodles. When heated with the other mixture, it was noticed that the spirulina powder slightly turned brown. The addition of 0.1 g of green food colouring was made to counteract it, but it was insufficient. In terms of the flavour, taste, and aroma of the noodles, the addition of lemon peel aroma successfully covered up the spirulina's fishy odour, and the addition of citric acid, salt, and sugar helped maintain the flavour of the noodles even after the spirulina powder had been added.

Agar-agar was used to create the watermelon film, and the dietary fibre cellulose was added to it. The texture of the overall film was not significantly changed by the addition of insoluble dietary fibre. Agar-agar gelation was accomplished effectively.



Fig 10: Result of week 3 trial.

Recommendation for next trial:

In the upcoming trial addition of orange colour can be done in addition to yellow colour in the pudding mixture. Along with that little decrease in sugar would be done. In the spirulina lemonade noodles balance of spirulina powder colour and green food colouring would be done. Final making beachy cola petals can be done keeping the base recipe similar to that of watermelon film.

9.3 Week 4

Date: 21/04/2023

Aim: To develop final note-by-note dish doing little modification the components made it the trials done earlier.

Objective: The goal is to create a successful note-by-note dish following the brief of food waste and going with the name of dish that is “Summer with Sustainability”

Materials and Method:

1. Note-by-note mango pudding with note-by-note milk

Ingredient	Ingredient description/photo	Quantity
Sucrose (Table sugar)	Table sugar was used as sucrose (mixture of glucose and fructose in 1:1 ratio)	30g
Note-by-note milk	The one made in 9.1 section	200g
Corn starch	Corn flour by “gem” was used.	20g
k-carrageenan	k-carrageenan by “MSK” was used	0.2g
Mango powder	Mango powder by “SOSA” was used	8g
Yellow colour	Yellow colour Gel colouring by “Punto Italiana”	0.2g
Orange colour	Orange colour Gel colouring by “Punto Italiana”	0.05g
Mango aroma	Mango aroma by “Sosa”	0.5g

Method:

- a) Stir corn starch and k-carrageenan into 50g of note-by-note milk.
- b) Into remaining milk add sucrose and mango powder and bring it to boil.
- c) Remove from heat and stir corn starch and k-carrageenan mixture into hot milk.
- d) Start heating again and stir constantly. Let it heat for 3 minutes and remove from heat. Add mango aroma and mix.

2. Note-by-note spirulina lemonade noodles

Ingredients	Ingredient description/photo	Quantity
Spirulina powder	Spirulina powder by “Bulk”	0.5 g
Citric acid	Citric acid Monohydrated by “Louis Francois”	0.5g
Water	Tap water used	140g
Salt	Table salt was used	1g
Sucrose	Table sugar was used	3g
Agar-Agar	Agar-Agar by “Sosa”	2.4g
Green colour	Green colour Gel colouring by “Punto Italiana”	0.2g
Lemon skin natural aroma	Lemon skin natural aroma by “Sosa”	0.5g

Method:

- a) Weigh spirulina powder, citric acid, salt and sugar and mix in its water.

- b) Stir everything and add it to saucepan. Dissolve agar-agar and start heating.
- c) Keep stirring while heating the mixture and bring it to boil.
- d) Take off the heat and add green colour and lemon aroma and mix it again.
- e) Fill the syringe and with it fill the silicone tubes. Submerge the full tubes in ice-water bath and let the mixture set for few minutes.
- f) With an empty syringe, inject air into the tube to get the noodle out of the tube.

3. Note-by-note watermelon discs and film

Ingredient	Ingredient description/ photo	Quantity
Water	Tap water used	100g
Agar-agar	Agar-Agar by “Sosa”	1.5g
Dietary fiber cellulose	Dietary Fiber Cellulose (Insoluble) by “NutriCology”	2g
Orange food colour	Orange colour Gel colouring by “Punto Italiana”	0.2g
Watermelon aroma	Watermelon aroma by “Sosa”	0.5g
Sucrose	Table sugar	10g

Method:

- a) Add dietary fiber cellulose, orange food colour, sugar and agar-agar to water. Mix well.
- b) Bring it to boil. Stir well. Take out from heat and add watermelon aroma.
- c) Pour into Measuring spoon set of 4 and also and a plate (spread evenly).
- d) Set aside and let it cool down.
- e) After half an hour, demould from spoons and cut the film on a plate.

4. Note-by-note beachy cola petals

Ingredients	Ingredient description/ photo	Quantity
Water	Tap water used	100g
Sucrose	Table sugar used	10g
Salt	Table salt used	2g
Citric acid	Citric Acid Monohydrated by “Louis Francois”	0.3g
Agar-Agar	Agar-Agar by “Sosa”	1.5g
Blue colour	Blue colour Gel colouring by “Punto Italiana”	0.2g
Cola aroma	Cola Aroma by ‘Sosa”	0.5g

Method:

- a) Add citric acid, sugar, salt, blue food colour and agar-agar to water. Mix well.
- b) Bring it to boil. Stir well. Take out from heat and add cola aroma.
- c) Pour into 8-10 small plastic spoons.

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- d) Set aside and let it cool down.
 - e) After half an hour, demould from spoons.

Result and Discussion:

The final note-by-note dish was plated with all the components. All the components had desired textural and sensorial properties.