Molecular Gastronomy Report
Dish: The Marine Life
Theme: Food Waste

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MAY 8

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Executive Summary

Molecular Gastronomy is one of the modules offered as a part of the Programme MSc. Culinary Innovation and Food Prototype Development. This report outlines the concept of Note-by-Note cooking, an application of Molecular Gastronomy through my dish 'The Marine Life.' The dish, Marine Life has been conceptualized on the theme Food Waste. It includes dietary fiber, and spirulina as the main waste products and consists of three elements of the marine ecosystem: Coral Pancakes, Strawberry Caviars, and Turtle Shell. The dish represents an ocean floor setting, and symbolizes power, strength, vibrance, and life through these elements, and addresses the food waste issue by their inclusion in a plated dish.

Introduction

Molecular gastronomy is a relatively new term which describes the merging of two core food disciplines namely food science and chef art. The Hungarian physicist Nicholas Kurti and the French chemist Hervé This initially defined the concept of Molecular Gastronomy, which investigates the processes that occur during dish preparation and eating.

Note by Note (NbN) cooking is an application of Molecular Gastronomy. Hervé This, a French physical chemist and Nicholas Kurti, Hungarian Scientist, presented it initially in 1994. In NbN, pure compounds or mixes of pure compounds are utilized to create dishes rather than traditional foods. No fruits, vegetables, meat, fish and other foods are used to prepare dishes NbN dishes. The NbN initiative makes a vital contribution to the fight against wastage while conserving water, energy, food, and the environment.

Nearly one-third of all food produced for human consumption is lost or wasted globally, amounting to 1.3 billion tonnes of food every year (Gustavsson et al. 2016). Scenarios for Europe show significant possibilities for decreasing emissions through food waste reduction (Rutten et al., 2013) at various levels of the food production and consumption chain (Schanes et al., 2016). Food waste is increasingly seen as a serious issue by governments, corporations, NGOs, academia, and the general public as a result of these increasing economic, social, and environmental problems.

Fighting food waste is not easy. In Kitchen, a lot of food waste is generated while cooking. The processing of this waste is a complex method as there are several factors to consider while processing waste. Peeling potatoes, for example, generates waste, but the discarded pieces include glycoalkaloids such as solanine, solanidine, and chalconine, which are hazardous at low levels of limit.

Therefore, converting the waste into wonder is a process of trial and error, taking into account the nutritional aspects as well as the toxicity levels.

Combining the concept of NbN and food waste, my dish 'The Marine Life' was invented. It has three elements namely coral potato pancakes, strawberry caviars, and turtle shells containing dietary fiber and Spirulina as waste products. The idea was to depict a marine ecosystem and through these elements, convey how food waste can be reduced by incorporating them into a dish.

Aims and Objectives

Aim: The report summarizes creation of a note-by-note dish using pure or mixes of pure compounds while incorporating food waste.

Objective:

- To familiarize with the concept of Molecular Gastronomy
- To understand the concept of Note-by-note (NbN) cooking
- To develop a NbN dish by utilizing the learnings

Materials and Methods

Ingredients

For Marine Life, Ingredients used were:

Ingredients	Quantity
Coral Potato Pancakes	
Potato starch	50 g
Cornflour	30 g
Rice starch	20 g
Sodium bicarbonate	2 g
Salt	½ tsp
Sunflower oil	1 tbsp
sugar	2 g
Dietary fiber (waste)	5 g
Green food color	As required
Blue food color	As required
Turtle Shell	
Spirulina (waste)	3 g
Pectin	15 g
Strawberry Caviars	
Strawberry Powder	100 g
Calcium gluconate	10 g
Water	500 g

Sodium Alginate	2.5 g
Castor Sugar	10 g

Equipments used:

Equipment	Quantity
Pan	1
Dropper	1
Bowl	3
Grooved Tray	1
Normal Tray	1

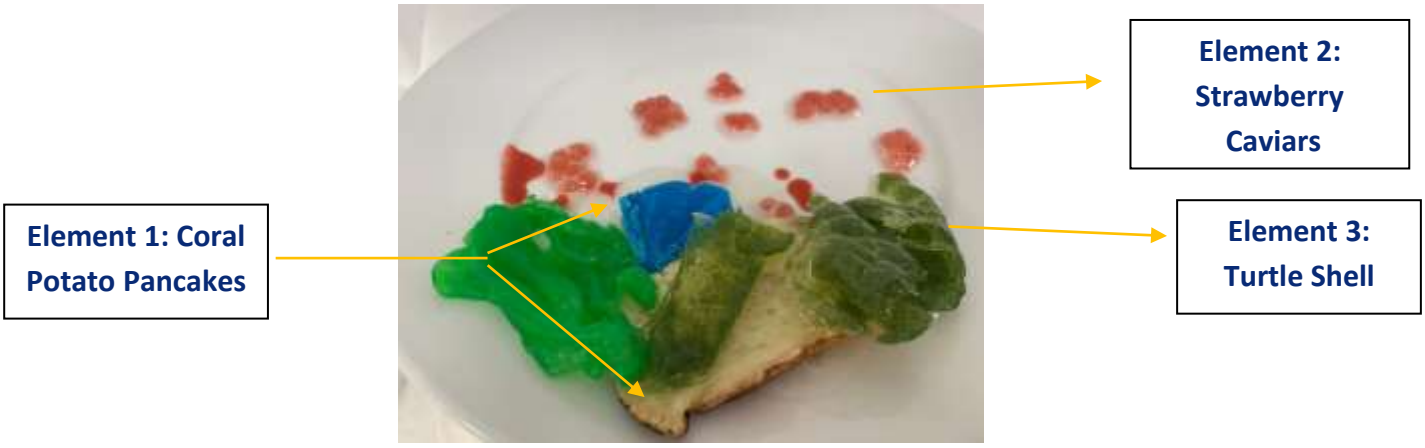

Fig 1: The Marine Life (Lateral view

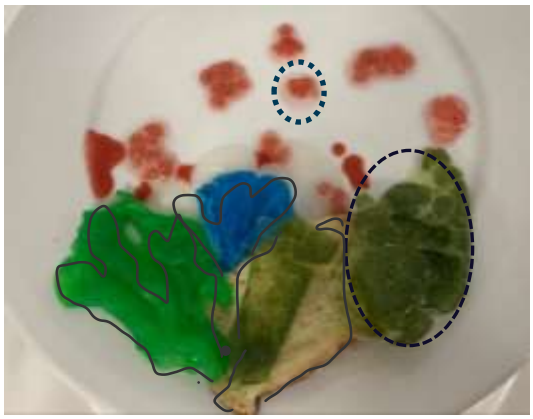

Fig 2: The Marine Life (Top View)

Some of the Ingredients with their brand names

Fig 3: Sosa' Strawberry Powder

Fig 4: Nutn Cology's Dietary Fiber Cellulose

Fig 5: Sosa' Fruit Pectin

Fig 6: Cake's Green Food Color

Fig 7: Gem's Cornflour

Fig 8: bulk's Green Spirulina Powder

Process:

1. For Coral Potato pancakes:
    - Weighed all the ingredients precisely and combined all of them except sunflower oil to form a smooth batter.
    - Divided the batter into three parts, and added the green and blue color into two parts. Heated Sunflower oil in a pan, and poured the batter slowly and cooked until slight brown color appeared. Carved different designs to give a coral-like and plant structures.

2. Turtle Shell
    - Combined spirulina, pectin and cold water and placed the mixture into a 'grooved plate' to set.
    - Removed the grooved structure and let it cool.

3. Strawberry Caviars
    - Dissolved water, calcium gluconate and sugar and heated gently to dissolve gluconate. Added the strawberry powder to it.
    - Created Alginate bath by combining sugar and alginate and whisked continuously to dissolve alginate.
    - Dropped the strawberry mixture into alginate using dropper after two minutes. Created small caviar- shaped balls and let it rest for 5-7 mins until the structure was stable and solidified.
    - Removed the balls from the bath and placed it in a plate

Results and Discussions

A successful NbN dish was created using the theme food waste. My dish 'The Marine Life' puts forward an ocean floor setting consisting of green, blue and white colored corals, turtle shell and fish eggs or caviars. The dish is named so as it depicts a new age creation made using pure or mixed NbN compound with the incorporation of food waste like dietary fiber, and spirulina to create elements of the oceanic floor. Ocean is often seen as a symbol of power, strength, calmness and hope. Therefore, the idea was to address the issue of food waste using a powerful symbol like ocean and achieve its reducing by recycling the waste through food dishes.

Element 1: Green, Blue, and white Coral Depicting Pancakes

Coral is a beautiful and important marine creature that contributes significantly to the ocean ecology. They are renowned for their stunning colors, and intricate shapes, providing shelter to many marine animals. Coral, as a symbol, can symbolize nature's beauty and diversity, as well as the significance of maintaining and protecting the natural environment.

The main waste product used in making pancake corals is dietary fiber.

Dietary Fiber as waste: According to (Kader, 2005), approximately one-third of all fruits and vegetables produced in the world are wasted during the postharvest phase. Furthermore, up to 50% of farmed fruits and vegetables are wasted before they reach the consumer stage.

Fruit and vegetable wastes generated in food processing companies are underused due to a lack of sufficient processing technology required for optimal valorization (Elik et al., 2019). These vegetal wastes and/or by-products are a well-known source of bioactive chemicals, as well as health-beneficial dietary fibers.

Pancakes make an easy, everyday dish that appear on the breakfast table. The idea here was to give a twist to the regular pancakes by using dietary fiber, and play around with its shape to make a coral, thereby symbolizing the marine ecosystem.

Element 2: Strawberry Caviars

Strawberry Caviars represent an important element of Nautical Change signifying the marine life. The pinkish-red fish eggs are a symbol of birth and the circle of life. Female fish lay eggs, which are fertilized by male fish and hatch into new life. This process is a crucial aspect of the ocean's life cycle and is required to keep the ecosystem in balance.

The strawberry Caviars have been made using **Direct Spherification.**

Spherification: Spherification is a culinary technique that includes the development of semi-solid spheres with thin membranes from liquids. As a result, the liquid produces a burst-in-the-mouth sensation. Calcium Gluconate or Calcium Chloride, and Sodium Alginate are the key ingredients for this technique.

Sodium alginate is a thickening and gelling agent which is responsible for making heat stable gels in the presence of calcium. It is made of long strands of carbohydrate units which act as efficient thickening agent at low concentrations (e.g., 1%). When alginate is added to a flavorful liquid, it thickens it. In presence of calcium ions, the liquid containing sodium alginate will form gel. This happens because the calcium ions come in between the sodium alginate strands and interlocks to form the gel. (kitchentherdev, 2023)

In the same manner, for my dish, the flavorful liquid was strawberry puree made using strawberry powder which contained the sodium alginate and the calcium bath was created in which the liquid was dropped using a dropper to form small pinkish red caviars. The spheres had a perfect burst of flavor when put in mouth. The caviars were well formed using the direct spherification technique.

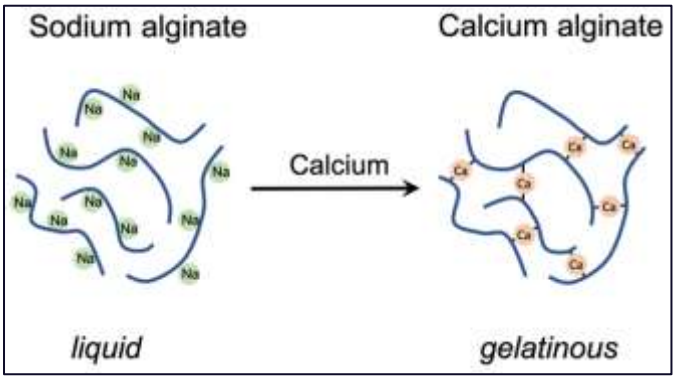

Fig 9: Schematic drawing of the chemical reaction between sodium alginate and calcium chloride

Element 3: Turtle Shell containing Spirulina

Why & How Spirulina a waste product?

Spirulina is a unicellular and filamentous blue green alga that has grown in popularity in the health food business and is increasingly being used as a protein and vitamin supplement in aquaculture diets.

It has an important role to play in environmental protection through wastewater recycling. Microalgae cultivated in sewage water are utilized as animal feed and a source of fine chemicals and fuels. The waste water system is especially useful in densely populated nations like India, where trash is created in large numbers and poses an environmental hazard.

Spirulina has been utilized as a supplementary nutritional food in fish feed. Spirulina, a blue green alga, is thought to be the greatest source of SCP among the different microorganisms employed as sources. The biomass composition, which includes a high protein content, a low nucleic acid content, the presence of high concentrations of vitamins and other growth factors, and the presence of a cell wall that is more easily digestible than that of other microbes, indicate that Spirulina is a promising source of food or feed.

Fig 10: Source-Fabrication of *spirulina* based activated carbons for wastewater treatment

Therefore, Spirulina is not only valuable in the waste water industry, but also in the food industry due to its high nutritive value. Now for the turtle shell, I wanted to create a groovy structure resembling the back of it and give an olive-green tinge. Green spirulina powder was a good option to recreate that look. However, the shape wasn't perfectly emulating the turtle shell, it was an attempt to create a sea-creature keeping a similar color scheme.

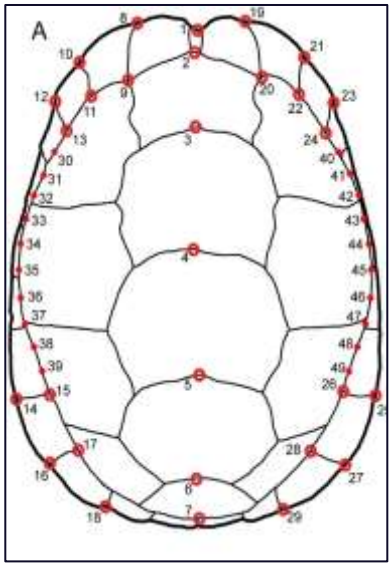

Fig 11: Turtle shells

Fig 12: Cropped section of figure 2

Conclusion & Recommendation

A successful NbN dish was created using pure and mixed compounds revolving around the theme 'Food Waste'. My dish was named 'The Marine Life' symbolizing strength, and power by depicting ocean floor setting with 3 marine elements-corals, caviars and turtle shell. The food waste used was dietary fiber cellulose and spirulina. Brightly colored corals were designed using pan frying method. The strawberry caviars were created using direct spherification method, which rendered small, flavorful spheres. Lastly, the turtle shell was solidified using pectin with addition of spirulina to give an olive brown appearance emulating an actual turtle shell. The shell formed had a broken edge from the top, not giving an oval shaped appearance.

Future Recommendations

- Exploring other alternative waste sources to NbN dishes
- Reading and including the toxicity levels of NbN compounds
- Calculating the Nutritional Value of the NbN compounds to evaluate their safety for consumption

Logbooks

WEEK NO.: 1 DATE: 20/03/2023

Weekly Aims and Objectives

Aim: To create a NbN dish using food waste

Objectives:

- To create NbN savoury pancakes incorporating dietary fibre
- To evaluate the color and texture of the dish

Ingredients

Potato starch	80 g
Cornflour	45 g
Rice starch	40 g
Sodium bicarbonate	3 g
Salt	1 tsp
Sunflower oil	2 tbsp
sugar	2 g
Dietary fiber (waste)	5 g
Blue food color	As required

Equipments:

- Pan
- Bowls

Method:

- Weighed all the ingredients precisely and combined all of them except sunflower oil to form a smooth batter.
- Divided the batter into two parts, and added blue color into one part.
- Shallow fried the pancakes until done.
- Carved different shapes
- Removed from heat

Results and Discussion:

Potato pancakes were created. The batter was slightly thick forming a tough pancake. The pancakes were of prominent blue color, rendering an unacceptable appearance too it. This is due to the higher amounts of the food color in the dish. There was scope of improvement on the shape of pancakes.

Conclusions

Savory Pancakes were formed with the need to improve the color and texture.

Recommendations for following week.

- Carefully consider the amount of food color into the dish
- Consider the consistency of the batter

WEEK NO.: 2 DATE: 27/03/2023

Weekly Aims and Objectives

Aim: To create a NbN dish using food waste

Objectives:

- To create a meringue
- To evaluate the color and texture of the dish

Ingredients

Egg White Powder	50 g
Castor Sugar	60 g
Vanilla Essence	1 drop
Water	120 ml

Equipments:

- Whisker
- Baking Tray

- Parchment Paper
- Oven
- Bowls

Method:

1. Weighed all the ingredients precisely and combined all of them in a bowl and beat them at a high speed until the meringue is fluffy, but not dry
2. Poured small amount of batter on parchment paper lined tray
3. Set the oven for pre-heat at 110 degree C
4. Placed the baking tray in oven for 45 mins while intermittently checking in between
5. Removed the tray when a nice brown color developed

Results and Discussion:

Meringues were developed with a nice brown color. The texture, however was found to be on the softer side indicating the need for higher baking time. The taste was good. The overall product was found to be satisfactory.

Conclusions

Meringues were created with a scope to improve the texture.

Recommendations for following week.

Consider the time-temperature combination while working with ovens

WEEK NO.: 3 DATE: 17/04/2023

Weekly Aims and Objectives

Aim: To create a side element for the main NbN dish

Objectives:

- To create strawberry flavored caviars using basic specification
- To evaluate the color and texture of the dish

Ingredients

Strawberry Caviars	
Strawberry Powder	100 g
Calcium gluconate	10 g
Water	500 g
Sodium Alginate	2.5 g
Castor Sugar	10 g

Equipments:

- Whisker
- Dropper
- Bowls

Method:

- Dissolved water, calcium gluconate and sugar and heated gently to dissolve gluconate. Added the strawberry powder to it.
- Created Alginate bath by combining sugar and alginate and whisked continuously to dissolve alginate.
- Dropped the strawberry mixture into alginate using dropper after two minutes. Created small caviar- shaped balls and let it rest for 5-7 mins until the structure was stable and solidified.
- Removed the balls from the bath and placed it in a plate

Results and Discussion:

Brightly colored strawberry spheres/caviars were formed using direct specification. The spheres were stable and solid. The overall size, and texture were good. However, the size could be bigger.

Conclusions

Strawberry spheres/caviars were made using the technique of direct spherification. The color, texture and size were found to be appropriate with a scope to increase the size of the spheres.

Recommendations for following week.

Carefully consider the size of the spheres for the final dish

WEEK NO.: 4 DATE: 20/04/2023

It was the final week, therefore aim, objective, materials and method and the discussions have been done in length in the corresponding sections. Therefore, refer to those sections.

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