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MOLECULAR GASTRONOMY: NOTE-BY-NOTE COOKING

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PRODUCT NAME: ABC (Apple, Beetroot, Carrot) Skewers

MODULE CODE: TFCS-9025

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1) INTRODUCTION:

Molecular gastronomy is a branch of food science that focus on the physical and chemical processes that arise when cooking. Molecular gastronomy may be defined as the scientific discipline that explores the phenomena occurring during culinary transformations (DIT,2016). These processes and interactions are explored and manipulated to yield flavorful, functional, and artistic results.

Molecular gastronomy techniques are usually applied by restaurants. Hungarian physicist, Nicholas Kurti, and French chemist, Herve This, coined the term "molecular gastronomy." While acknowledging that the natural study of cooking is a time-old practice, they urged for an organized and separate discipline to study cooking within the larger discipline of food science, which mainly dealt with large-scale food processing. Molecular gastronomy is important because it bridges the social, artistic, and technical ramifications of food and food preparation. Molecular gastronomy can also confirm or refute consequential traditional culinary theories. In the module, culinary precisions, colloidal systems, thermal treatments and DSF are covered. **Note by note cooking** is a style of cooking in molecular gastronomy introduced in 1994 by Herve This where the goal is no longer to make food with new tools and techniques for transforming traditional food (Inicon, 2016) but to make food with pure compounds as ingredients (INRA, France, 2016).

The aim is not to re-create foods which already exist but to create new foods and potentially new flavors. The shapes, colors, textures, consistency, odors, temperatures and trigeminal stimulation can all be designed by the chef (This, 2013). In note-by-note cooking, a dish must be constructed in such a way that its sensory effects will be registered over a succession of moments since perception of flavor is an enduring sensation-or should be one if it is not (This, 2014).

For the note-by-note cooking, the food produced is ABC (Apple, Beetroot and Carrot) juice skewers. Apple, beet, carrot juice, aside from being delicious, is known for being nutrient-dense, low-glycemic, and supporting liver detox. This particular product is chosen to exhibit the nutritional benefits of ABC juice like gluten-free with micronutrients like manganese, folate, calcium, beta carotene, potassium and possess health properties like natural antioxidant to combat free radicals in the body, Immune booster as it contains Vitamin A and C, Detox as beetroot has the ability to detoxify the liver to activate critical enzymes (Nutrients,2015). It is also a great source of dietary fiber which reduces the risk of cardiovascular diseases, hypertension, diabetes, obesity and certain gastrointestinal diseases (Nutrition review, 2009).

2) AIM:

The aim is to produce ABC (Apple, Beetroot and Carrot) skewers with incorporation of dietary fibers made with pure compounds to obtain an appealing cubical structure, tricolor (green, red and orange), gel texture and a sour taste.

3) MATERIALS AND METHODS:

INGREDIENTS:

- Msk Pectin (4g)
- Water (100ml)
- Msk Green Apple powder (1g)
- Msk-0978 Beetroot powder (2g)
- Sosa aroma natural Carrot powder (4g)
- Able West Chem Citric acid (1g)
- Salt (500mg)
- NutriCology insoluble cellulose Dietary fiber (4g)
- Sosa Flavors: Green apple (0.06ml), Beetroot (0.06ml), Carrot (0.06ml), Lemon (0.06ml)

EQUIPMENT:

- L. Tellier Hand blender
- Electrolux Gas stove
- Sogi Freezer DF series

METHOD:

- 4g of Pectin, 4g dietary fiber, 0.5g salt and 1g of citric acid are diluted in 100ml of water and boiled for 7 minutes.
- The pectin mixture is divided into 3 batches for three flavors.
- 1g green apple powder and 0.06ml of green apple flavor are added to the first batch and mixed well for 4 mins using a hand blender.
- The green apple mixture is poured into the mold and set to freeze at -20°C for 10 mins.
- 2g of beetroot powder and 0.06ml of beetroot flavor are added to the second batch and mixed well for 4 mins using a hand blender.
- The beetroot mixture is poured into the same mold and set to freeze at -20°C for 10 mins after the green apple gel is set.
- 4g of carrot powder and 0.06ml of carrot flavor are added to the third batch and mixed well for 4 mins using a hand blender.
- The carrot mixture is poured into the same mold and set to freeze at -20°C for 10 mins after the green apple and beetroot gels are set.
- Once the gels are set, they are cut and set as skewers, a tricolor delight.

4) RESULTS:

The sensory analysis has been performed considering the appearance, texture and the overall acceptability of the product. The total number of participants is 13.

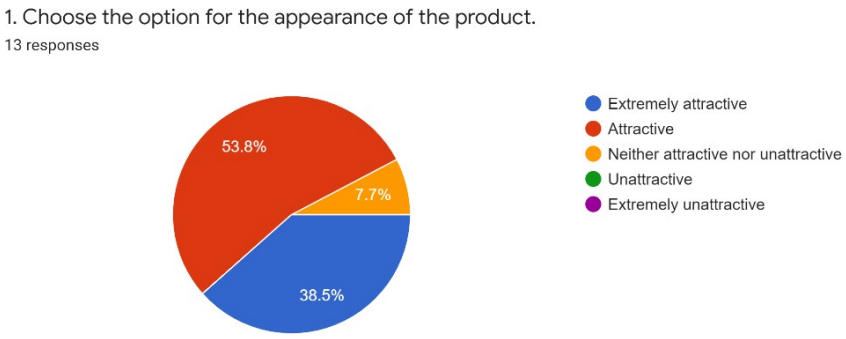

Figure 1: Sensory analysis on the appearance of the product

Out of 13 participants, 53.8% agreed the product to be attractive and 38.5% said the product is extremely attractive. But only 7.7% marked the product to be neither attractive nor unattractive and no participant has mentioned the product to be unattractive or extremely unattractive.

The appearance of the product is expected to be colorful and appealing. With the results expressed, it can be concluded that the expectations have been met.

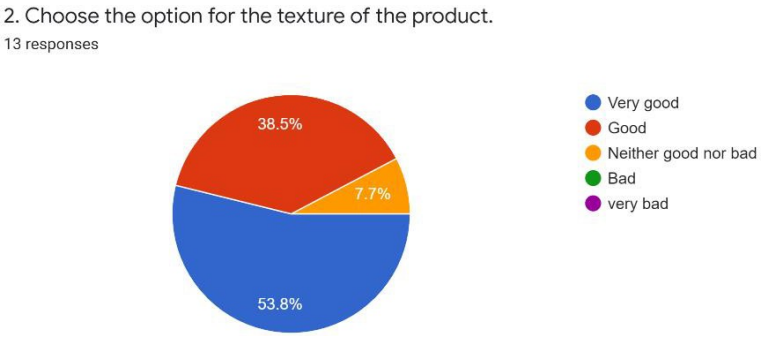

Figure 2: Sensory analysis on the texture of the product

Out of 13 participants, 53.8% agreed the product has a very good texture and 38.5% said that the product has a good texture. But 7.7% said the product has neither good nor bad texture and no participant mentioned the product to have a bad texture.

The texture of the product is required to be thick, gelatinized and the three colors to be properly set together. With the results expressed after viewing the product, it can be concluded that the requirements have been met.

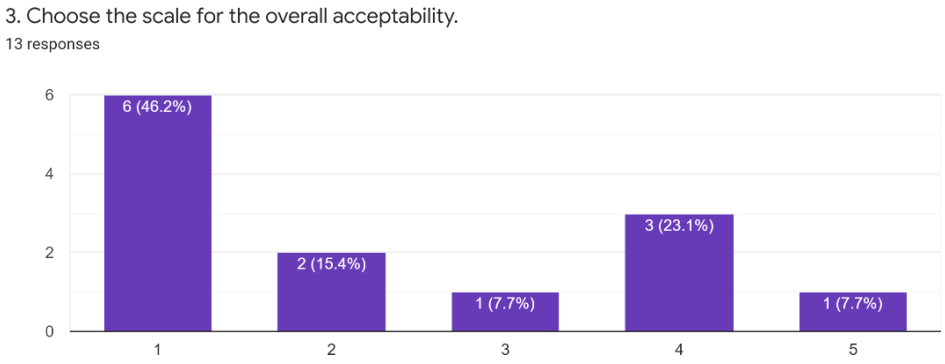

Figure 3; Sensory analysis on the overall acceptability of the product

Out of 13 participants, considering the overall acceptability where 1 being extremely acceptable and 5 being unacceptable, major percentage have agreed the product to be acceptable and only 1 participant stated the product to be unacceptable.

The product acceptability is evaluated based on the appearance and the texture of the product as the other attributed were not considered.

5) DISCUSSION:

The results at the end of experimental trials shows that the overall acceptability of the product is very good considering the appearance and texture of the product. The product is Apple, beetroot and carrot skewers in a cubical shape. The idea behind choosing the product is to exhibit the importance and health benefits behind the original ABC (apple, beetroot and carrot) juice and incorporating dietary fiber to add value to the product and also to meet the requirements of the project.

The European Commission defines fiber as saccharides polymers with three or more monomeric units. These polymers are neither digested nor absorbed in the small intestine. Dietary fiber consists of one or more of:

1. edible carbohydrate polymers naturally occurring in the food as consumed.
2. carbohydrate polymers that have been obtained from raw food material by physical.
3. enzymatic or chemical means and which have a beneficial physiological effect demonstrated by generally accepted scientific evidence.

4. synthetic carbohydrate polymers which have a beneficial physiological effect demonstrated by generally accepted scientific evidence.

The dietary fibers also have many health benefits like it normalizes bowel movements, helps maintain bowel health, lowers cholesterol level, helps control blood sugar level and aids in achieving healthy weight. There are various types of fiber, some of which are almost completely fermented by gut bacteria, whereas others are less fermentable. The source of dietary fibers used for the pure note-by-note cooking is from cellulose.

Cellulose is a thick, strong fiber that that gives vegetables and fruits their structural integrity. It is one type of dietary fiber that can be eaten but is not digested. Many fruits and vegetables are rich sources of cellulose. Interestingly, cellulose in the form of wood pulp is sometimes added to processed foods to increase their fiber content of the product. Cellulose is found in abundance in nature in virtually all plant tissues and is therefore a common component of human diet. Dietary cellulose is thought not to be digested in the stomach and small intestine, 85% being recoverable in ileostomy contents from subjects fed diets containing usually eaten foods. In the large intestine however, it is fermented 3-5 by the microflora with the ultimate production of short chain fatty acids, hydrogen, carbon dioxide and methane (Gut, 1984, 25, 805-810). The brand supplied the dietary fiber is NutriCology and according to their product description, it is a non-fermentable, insoluble fiber which does not feed undesirable bacteria.

Dietary Fiber Cellulose is microcrystalline cellulose, and encourages healthy bowel motility and more complete elimination. The base to prepare a gelatinized structure was Pectin. Initially, the agar-agar was used but later in the experimental trails, it is replaced by pectin to intensify the sourness of the product. Pectin is a type of starch, called a heteropolysaccharide, that occurs naturally in the cell walls of fruits and vegetables and gives them structure. When combined with sugar and acid, it is what makes jams and jellies develop a semisolid texture when they cool. Commercial pectin is usually made from citrus rinds. It is sold as a dry powder and in liquid form. The brand providing pectin was Sosa which is made of Amidated Low Methoxyl (LMA) with added calcium and the property description of the product is that it is a thickener specially indicated for the fermented products.

Citric acid is naturally concentrated in a variety of fruits and vegetables, particularly lemons and limes. As with most organic acids, citric acid is a weak acid, with a pH level between 3 and 6. Citric acid can be added to processed and packaged foods and drinks such as ice cream, sorbets, sodas and wine. It is added as a preservative, emulsifying agent and for flavoring. Citric acid is also added to many canned and jarred foods to help prevent botulism.

For the product, citric acid is used to intensify the acidic flavor of the product. The green apple, beetroot and carrot powders are added to incorporate the flavor and also it gives an attractive color to the product without addition of food colors. The process involved in producing the product is called gelification.

Gelification is defined as the process of turning a substance into a gelatinous form. With this process, liquid substances are converted into solids with the help of a gelling agent. Common gelling agents come from natural sources and include agar-agar, gelatin, Carrageenan, Gellan gum, pectin and methylcellulose. More often than not, these gelling agents are presented in a dry, solid form which needs to be hydrated. All of these are hydrocolloids and react when dispersed in liquids. Gels resulting from this process may range from tough and hard to weak and soft. Gels are characterized by having a viscous property when heated and becoming solid or jelly like once cooled. Melting and cooling points for gelling agents may differ according to type. It can serve to stabilize liquids without affecting taste. It may also be used for suspending food particles and creating various shapes for aesthetic purposes. Lastly, it can also be used to create various textures and improve dining experiences.

With the help of the necessary and available ingredients and the process of gelification, the ABC skewers has been developed at TU Dublin, Ireland considering all the dimensions in note-by-note cooking.

6) CONCLUSION:

To summarize, ABC (Apple, beetroot and carrot) skewers was developed with an idea to exhibit the importance of the ABC juice. The dietary fiber from cellulose has been added to the product to add value to the product and also to meet the requirement of the project. Pectin is used as the base to prepare the gel and it is chosen to intensify the flavor of the product. The other ingredients like green apple powder, carrot powder and beetroot powder are added to incorporate the flavor and color. With the help of the available and necessary ingredients, the ABC skewers was developed and sensory analysis was performed at the end of the cooking trials. According to the sensory analysis, most of the participants found the product to be attractive and agreed that the product possess a good texture. Further experimental analysis on color and texture can be performed. The product also met the requirement of the project and there is a scope of development in flavor.

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8) LOGBOOK:

WEEK 1:

Aim and Objectives of the class:

Aim:

The aim of the class is to prepare ABC (Apple, beetroot and carrot) gelatinized cube with a sour taste.

Objectives:

- To produce ABC jelly with agar-agar as a base
- To incorporate dietary fiber to meet the requirement of the project

Materials and methods:

Ingredients:

- Sosa Agar-agar (4g)
- Water (100ml)
- Msk Green Apple powder (1g)
- Msk-0978 Beetroot powder (2g)
- Sosa aroma natural Carrot powder (4g)
- Salt (500mg)
- NutriCology Dietary fibre (4g)
- Sosa Flavors: Green apple (0.06ml), Beetroot (0.06ml), Carrot (0.06ml), Lemon (0.06ml)

Equipment:

- L. Tellier Hand blender
- Electrolux Gas stove
- Sagi Freezer DF series

Methods:

1. 4g of agar-agar, 4g dietary fiber and 0.5g salt and are diluted in 100ml of water and boiled for 7 minutes.
2. To the mixture, 1g of green apple powder, 2g of beetroot powder and 4g of carrot powder are added and mixed well using a hand mixer.
3. Finally, the flavors of green apple, beetroot and carrot are added to the mixer and poured into the mold.
4. The mixture has been frozen for 20 mins at -20°C for setting of gel.

Results:

The gel has not been become solid properly as the outer layer has become a gel but the inner part remained partially liquid and so the structure deformation happened. This leads to the failure of the experiment. The color was very dark due to the mixture of three colors which turned out to be unappealing. The taste was very blunt and could not sense any flavor during the tasting session as all the flavors produced a neutral note.

Conclusion and Recommendation:

Conclusion:

Overall acceptability was below average and so needs development in texture, color and flavor of the product.

Recommendation:

In the next class, it is recommended to work on the three flavors separately and then combining it to single structure instead of mixing everything together. It is recommended because there are good chances to experience the flavors of the individual compounds and also the structure will have layers of three colors which can be attractive.

Additional ingredients for future: Citric Acid (3g)

WEEK 2:

Aim and Objectives of the class:

Aim:

To produce Apple, beetroot and carrot cubes individually and presenting it together as a single cube by placing them in order so that individual flavors can be experienced in tasting.

Objectives:

- To produce individual cubes of apple, beetroot and carrot to experience individual flavors.
- To place them together without disturbing the individual structure of the cubes.

Materials and Methods:

Ingredients:

- Sosa Agar-agar (12g)
- Water (300ml)
- Msk Green Apple powder (1g)
- Msk-0978 Beetroot powder (2g)

- Sosa aroma natural Carrot powder (4g)
- Salt (1500mg)
- NutriCology Dietary fibre (12g)
- Sosa Flavors: Green apple (0.06ml), Beetroot (0.06ml), Carrot (0.06ml), Lemon (0.06ml)
- Citric acid (3g)

Equipment:

- L. Tellier Hand blender
- Electrolux Gas stove
- Sagi Freezer DF series

Method:

1. 4g of agar-agar, 4g dietary fiber, 1g citric acid and 0.5g salt and are diluted in 100ml of water and boiled for 7 minutes and repeated two times for three flavors.
2. To the first batch of agar-agar mixture, add 1g green apple powder, 0.06ml green apple flavor and mix well with the help of hand mixer.
3. To the second batch of agar-agar mixture, add 2g beetroot powder, 0.06ml beetroot flavor and mix well with the use of hand mixer.
4. To the third batch of agar-agar mixture, add 4g carrot powder, 0.06ml carrot flavor and mix well with the help of hand mixer.
5. All three batches of different flavors are poured into separate molds and placed in the freezer for 20 mins at -20°C.
6. They are racked with tricolor and flavor, with green apple being the top layer, beetroot being the middle layer and carrot being the bottom layer.

Results:

Figure 4: Product of week 2

With the above figure, it is clear that the structure has been destroyed during the racking process due to unbalance of the weight. Also, the bottom layer carrot cube has not set into a gel properly. The texture did not turn out as expected and so it became a failure in attaining the cubical structure. But the individual flavors are experienced while tasting when they are made this way. Citric acid flavor gave an acidic note which can be reduced in the future.

Conclusion and Recommendation:

Conclusion:

Overall acceptability of the product is average but there is development needed in the texture and presentation of the product. The taste is better than week 1 and the color of the individual compounds are also visible and attractive.

Recommendation:

The recommendation for the next week is that the usage of single mold and setting the individual flavors one after the other to get a single structure which can prevent structure deformation but at the same looks attractive and individual flavors can be experienced during the tasting session. And also, the freezing time can be increased for proper setting of the compounds.

WEEK 3:

Aim and Objectives of the class:

Aim:

The aim is to produce ABC (Apple, Beetroot and Carrot) cube with incorporation of dietary fibers made with pure compounds to obtain an appealing cubical structure, tricolor (green, red and orange) and a gel texture.

Objectives:

- To produce a single cube with the tricolor of green apple, beetroot and carrot differentiation.
- To produce a single cube with experiencing individual flavors of the compounds during the tasting.

Materials and methods:

INGREDIENTS:

- Sosa Agar-agar (4g)
- Water (100ml)
- Msk Green Apple powder (1g)

- Msk-0978 Beetroot powder (2g)
- Sosa aroma natural Carrot powder (4g)
- Able west chem Citric acid (1g)
- Salt (500mg)
- NutriCology Dietary fiber (4g)
- Sosa Flavors: Green apple (0.06ml), Beetroot (0.06ml), Carrot (0.06ml), Lemon (0.06ml)

EQUIPMENTS:

- L. Tellier Hand blender
- Electrolux Gas stove
- Sogi Freezer DF series

METHOD:

- 4g of agar-agar, 4g dietary fiber, 0.5g salt and 1g of citric acid are diluted in 100ml of water and boiled for 7 minutes.
- The pectin mixture is divided into 3 batches for three flavors.
- 1g green apple powder and 0.06ml of green apple flavor are added to the first batch and mixed well for 4 mins using a hand blender.
- The green apple mixture is poured into the mold and set to freeze at -20°C for 10 mins.
- 2g of beetroot powder and 0.06ml of beetroot flavor are added to the second batch and mixed well for 4 mins using a hand blender.
- The beetroot mixture is poured into the same mold and set to freeze at -20°C for 10 mins after the green apple gel is set.
- 4g of carrot powder and 0.06ml of carrot flavor are added to the third batch and mixed well for 4 mins using a hand blender.
- The carrot mixture is poured into the same mold and set to freeze at -20°C for 20 mins after the green apple and beetroot gels are set.

Results:

The gel formed is a homogenous structure with differentiation of the three colors which looked attractive. The citric acid flavor was reduced and the taste was perfect and each flavor was experienced individually during the tasting. The texture was also improved by increasing the freezing time and so the gel had perfectly set.

Conclusion and Recommendations:

Conclusion:

Overall acceptability of the product was good when the flavor, texture, appearance and the overall texture was concerned. But the development can be made in the flavor of the product by increasing the intensity of the flavors.

Recommendations:

The recommendation for the future is that to use pectin in the place of agar-agar to increase the intensity of the flavor. The pectin is recommended as it is naturally present in fruits and so it can intensify the sourness in the product. Agar-agar gives a blunt flavor and so replacing with pectin will be a good choice to improve the flavor of the product.

WEEK 4:

Aim and Objectives:

Aim:

The aim is to produce ABC (Apple, Beetroot and Carrot) skewers with incorporation of dietary fibers made with pure compounds to obtain an appealing cubical structure, tricolor (green, red and orange), gel texture and a sour taste.

Objectives:

- To produce a single cube with the tricolor of green apple, beetroot and carrot differentiation.
- To produce a single cube with experiencing individual flavors of the compounds during the tasting.
- To intensify the sourness of the product by using pectin as base for the gel.

Materials and methods:

INGREDIENTS:

- Agar-agar (4g)
- Water (100ml)
- Msk Green Apple powder (1g)
- Msk-0978 Beetroot powder (2g)
- Sosa aroma natural Carrot powder (4g)
- Able west chem Citric acid (1g)
- Salt (500mg)
- NutriCology Dietary fiber (4g)

- Sosa Flavors: Green apple (0.06ml), Beetroot (0.06ml), Carrot (0.06ml), Lemon (0.06ml)

EQUIPMENTS:

- L. Tellier Hand blender
- Electrolux Gas stove
- Sogi Freezer DF series

METHOD:

- 4g of pectin, 4g dietary fiber, 0.5g salt and 1g of citric acid are diluted in 100ml of water and boiled for 7 minutes.
- The pectin mixture is divided into 3 batches for three flavors.
- 1g green apple powder and 0.06ml of green apple flavor are added to the first batch and mixed well for 4 mins using a hand blender.
- The green apple mixture is poured into the mold and set to freeze at -20°C for 10 mins.
- 2g of beetroot powder and 0.06ml of beetroot flavor are added to the second batch and mixed well for 4 mins using a hand blender.
- The beetroot mixture is poured into the same mold and set to freeze at -20°C for 10 mins after the green apple gel is set.
- 4g of carrot powder and 0.06ml of carrot flavor are added to the third batch and mixed well for 4 mins using a hand blender.
- The carrot mixture is poured into the same mold and set to freeze at -20°C for 10 mins after the green apple and beetroot gels are set.
- Once the gels are set, they are cut and set as skewers, a tricolor delight.

Results:

Figure 5: Product of week 4

With the above figure, it is clear that the texture is properly set and a gelatinized structure is obtained with differentiation of three layers. The structure is homogenized and properly set by balancing the freezing time. Also, the sensory analysis has been performed with 13 participants

considering the appearance, texture and overall acceptability of the product. Most of the participants has agreed the texture to be good and the appearance of the product to be attractive. The overall acceptability was very good when the sensory analysis was observed and taken into consideration.

Conclusion:

The overall acceptability of the product was very good at the end of the experimental trials considering the texture and appearance of the product. Also, the taste of the product was balanced and corrected after altering the sourness of the product by addition of pectin instead of agar-agar.