Exercise 25: what is the proportion of additives which are used by cooks before the food industry?

People usually use additives everyday in the kitchen, such as sugar, vinegar, citric acid from the lemon, salt, etc.

Exercise 26: Using DSF, produce a formula, and invent a recipe based on it?

(G/S)+LσW

PART 2. Note by Note Recipe

Recipe: Mojito Lava Cake

I. Ingredients

The cake:

- 40 g Coconut oil
- 30 g Potato starch
- 15 g Gluten
- 50 g Glucose
- 20 g Egg white powder
- 100 g Water
- Lemon artificial aroma
- Vanilla artificial aroma
- Yellow artificial color

The Lava:

- 70 g Water
- 4 g Gelatin powder
- 75 g Glucose
- 75 ml Ethanol
- Mint artificial aroma
- Green artificial color

The pearls:

- 250 g Lemon-mint artificial juice
    - 200 g Water
    - 50 g Glucose
    - Lemon artificial aroma
    - Mint artificial aroma
    - Green artificial color
- 2 g Sodium alginate
- 500 g Water
- 2.5 g Calcium chloride

II. Preparation

For the cake:

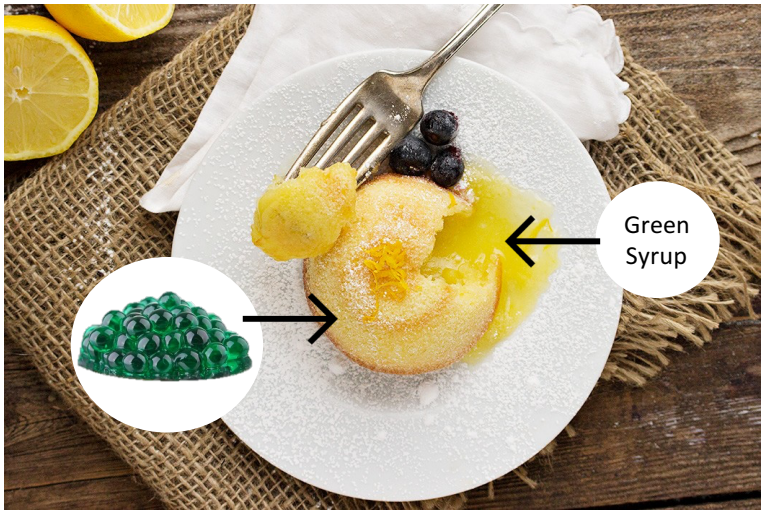
- Preheat the oven to 350 °F (175 °C) and spray two 6-ounce ramekins with some oil.
- In a saucepan, put the potato starch and heat stirring until browning.
- Mix the potato starch in a bowl with the egg white, water, gluten, glucose, coconut oil, lemon aroma, vanilla aroma and yellow artificial color for several minutes.
- Scoop a little more than 1/4 of the batter into each of the prepared ramekins.

For the lava:

- Put in a saucepan the water, gelatin, glucose and ethanol. Bring to simmer on a low heat to dissolve the glucose and gelatin, then boil for 1 minute.
- Set aside, add the mint artificial aroma and green artificial color.
- Allow the syrup to cool.
- Put it into the center of each cake, taking care to keep it in the center (and not spread out) as much as possible.
- Bake for 10 minutes at 200 C.

For the pearls:

- Mix alginate with the lemon-mint artificial juice.
- Dissolve calcium chloride in water.
- Drop droplets (using an eye dropper) of the lemon-mint juice solution into calcium chloride water.
- Use strainer to remove droplets from calcium chloride bath after 1-2 minutes into a separate cold water bath.
- Decorate the top of the volcano with the pearls before serving.



PART 3. Culinary Precision

Tittle of the work: Assessment of the effect of adding salt to boiling water, in the cooking time of pasta.

Name of the scientist: Carla Murillo

Date: 21/09/18

Estimated time for experiment: 2 hours

Goal of the experiment:

- Assess trough scientific methods, if it is true that adding salt to the boiling water reduces the cooking time of pasta.
- Understand and describe the scientific phenomenon behind this culinary precision.

***Reason of the work*:**

Culinary precision are claims, specifications or generally shared knowledge about cooking; these are considered "rules" that people learn by tradition or personal experience. Culinary precision can be true or false, however, usually the science behind the phenomenon is unclear. The reason of this work, is to assess the "social" or "cultural" aspect of cooking with a scientific approach.

Also, pasta is a very important food product in the Mediterranean Diet but it is also very popular worldwide. Identifying strategies to reduce its cooking time might represent an improvement in its processing efficiency & from a consumer point of view, and improvement in its convenience.

Bibliographic research:

Question: Which are the main physical & chemical changes of pasta when it is cooked?

During the cooking time, **water concentration increases** at the boundary of pasta and moves toward internal regions showing a sort of discontinuity in concentration that progressively disappears when the overcooking phase advances (Sicignano, *n.d.*).

As the cooking time proceeds, lots of structural transformations occur, also dependent from those occurred during the previous processing steps; the final structure of pasta is the result of all the changes occurred in pasta making process and this is **mainly affected by the starch and protein fractions** (Sicignano, *n.d.*).

Starch **gelatinization and protein coagulation** are the main events that occur during the cooking time. Protein coagulation and interaction lead to a formation of a **continuous and strengthened network** which traps starch granules while the latter by **swellin**g and gelatinization, occludes all free interspaces giving to pasta its special structure. A decrease of protein solubility in SDS is observed during cooking (Sicignano, *n.d.*).

… Transformations are mediated by **water uptake during cooking**. As the cooking time proceeds, **water absorption rate depends on water ability** to diffuse through the matrix and on the melting kinetics of domains. Water acts as a plasticizer and increases polymer mobility, **penetrates towards the center as the cooking time proceeds** (Sicignano, *n.d.*)**.**

The optimum cooking time for pasta is **determined by water absorption** and starch gelatinization (Cocci *et al,* 2008).

Question: *How to measure the cooking degree in pasta?*

Most of the papers focus on assessing the overall quality of cooked pasta considering texture as the main criteria. Many methods have been developed to assess different factors such as elasticity, firmness, surface stickiness, cooking tolerance, **water absorption** and loss of solids to cooking water (Edwards *et al*, 1993)

Sicignano (n.d.) measured the weigh after cooking at regular time intervals and draining. The author calculated the **water absorption** as the **percentage of weight increase (WI) of the weight before cooking.**

Grzybowski & Donelly (1979) affirmed that cooking quality of spaghetti is measure of **its water absorption capacity (cooked weight)**, cooking loss & cooked firmness or tenderness. In their work, Grzybowski & Donelly also measured the **cooked weight of different types of pasta.**

Cocci *et al* (2008) **weight the cooked pasta** after different lengths of time in order to analyze the cooked quality. The authors calculate the **water absorption** as the **weight increase (WI) and expressed as a percentage of the sample weight before cooking**.

Question: *How much pasta & water & for how long should it be cooked?*

Sicignano (n.d.) cooked the pasta in **1:10 pasta to water ratio.** 50 grams of pasta were cooked in a stainless steel pot using 500 ml of boiling tap water **without adding salt**. The pasta was cooked until the optimum cooking time and immediately drained for 30s just after cooking.

Grzybowski & Donelly (1979) cooked **10g** of pasta in **300 ml** of water. They analyzed the quality of cooking pasta at six different times in boiling water: **5, 10, 15, 20, 25 & 30** minutes. The authors found that, as the **cooking time increases, cooked weight increases** --> which suggests that in fact, there is a correlation between cooking time and water absorption.

In the case of Cocci *et al* (2008), spaghetti was cooked for **different lengths of time** and, at each sampling time, it was removed from the pot, drained for 30 s and **weighed**. The cooking process was repeated twice for each sampling time and cooked spaghetti was analyzed three times except for color analysis which was analyzed 20 times. Each replicate was carried out using spaghetti from the same lot.

Question: *Is there already any possible explanation for this phenomenon?*

The main possible explanation is the **boiling-point elevation**--> The vapor pressure of a solvent decreases when a nonvolatile component is dissolved in the liquid phase. The depression of the vapor pressure of the solution (at constant temperature) results in a rise of the boiling point of the solution (at constant pressure). The degree of the boiling point rise (BPR), being a colligative property, depends on the concentration of the dissolved particles and on the nature of the solvent (Meranda & Furter, 1979).

Temperature of water will be higher when adding the pasta & therefore, it will cook faster?

Meranda & Furter (1979) asses the elevation of the boiling point of water by each of a series of 40 salts, individually present at saturated concentration. The authors concluded that, in general, the degree of dissociation of these salts in boiling, saturated, aqueous solution appears to be sufficiently small that its **effect on the BPR is not significant**. --> **In fact, 1.0 M of NaCl solution increase the boiling point of water in 1°C.**

References

- Cocci, E., Sacchetti, G., Vallicelli, M., Angioloni, A., Dalla Rosa, M. 2008. *Spaghetti cooking by microwave oven: Cooking kinetics and product quality*. *Journal of Food Engineering.* 85: 537–546.
- Edwards, N. M., Izydorczyk, M. S., Dexter, J. E., Biliaderis, C. G. 1993. Cooked Pasta Texture: Comparison of Dynamic Viscoelastic Properties of Instrumental Assessment of Firmness. *Cereal Chem*. 70(2):122-126.
- Grzybowski, R. A., Donelly, B. J. 1979. Cooking Properties of Spaghetti: Factors Affecting Cooking Quality*. J. Agric. Food Chem*., 27(2):380-384.
- Meranda, D., Furter, W. F. 1977. Elevation of the Boiling Point of Water by Salts at Saturation: Data and Correlation. J*ournal of Chemical and Engineering Data*. 22(3).
- Sicignano, A. *n.d.* Università Degli Studi Di Napoli Federico II. Effects of raw material, technological process and cooking procedure on quality of pasta from durum wheat semolina.

Preliminary observations: No preliminary observations

Theoretical assumptions:

- Cooking increase the moisture content of noodles.
- Increasing cooking time led to increase in cooked noodle weight due to water absorption.
- NaCl increases the boiling temperature of water, but 1 M increases only 1 °C.

Experimental method:

- **Overall:** Determine the % of weight increase (WI) with and without the addition of salt, after 5 minutes of cooking in boiling water, as indicator of the cooked level.

- **Detailed method:**

- **Materials:**

Name & brand	Date	Origin	Batch Number
Capellini, Barilla	21.09.18	Italy	135808

- **Hardware:**

Equipment	Model	Experimental conditions
Bartscher	IK 30 TCS	1. Time (t) 2. Temperature (T)
Precisa	LX 320M	1. Weight (m)

Results

Date: 21/09/18

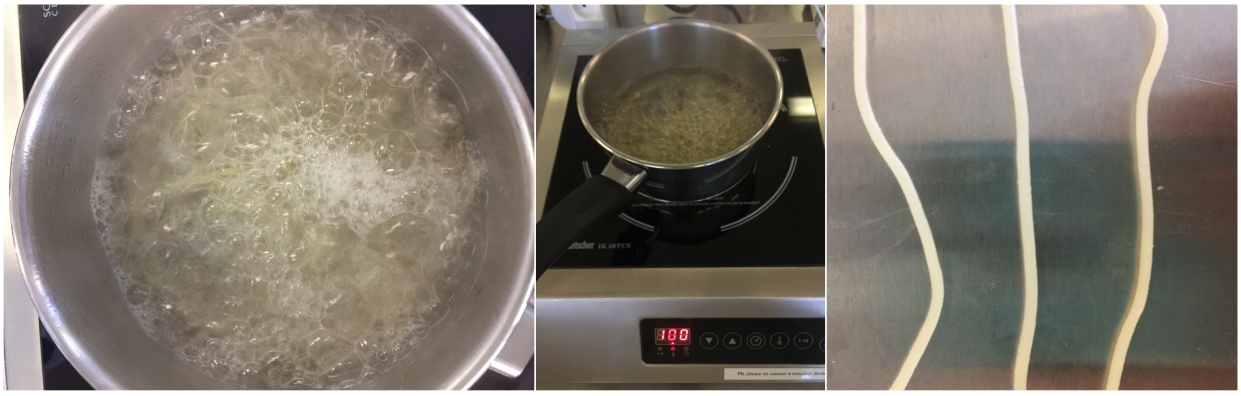
Detailed Results:

	W/ Salt			W/out salt		
	Initial weight (g)	Final weight (g)	% of weight increase	Initial weight (g)	Final weight (g)	% of weight increase
A	10	28	180%	10	26	160%
B	10	30	200%	10	28	180%
C	10	26	160%	10	30	200%
Mean	**10**	**28**	**180%**	**10**	**28**	**180%**
SD	**0**	**2**	**20%**	**0**	**2**	**20%**

Interpretation:

- The average % of WI was exactly the same for the pasta cooked with and without salt.

Pictures:



Needed time: 2.5 hours.