

Note by Note Cooking: Future of food

Note by note Cooking was proposed as an idea by Hervé This and Nicholas Kurti in 1994 [1]. It can be a potential solution to the problem of food, energy and water crisis as predicted by many research bodies throughout the world[2, 3]. It can also be a proposed solution for preventing food wastage that occurs during the transit of food from farm to fork [4].

This type of Cooking uses pure compounds such as proteins and carbohydrates for cooking rather than using plant and animal tissues.

Note by note cooking as an Art

This describes that the name “Note by note” (NBN) is inspired from the art of creating music using different notes of sounds. It is also a common term used by flavourists in designing flavours. Like music, this type of Cooking uses composing food by combining different notes of flavours and fragrances. According to the blog “finedininglovers”, this is one of the exciting forms of Cooking as it allows the chefs to use their imagination in designing the texture of food using different molecules and molecular cooking techniques [5]. The major difference between molecular Cooking and note by note Cooking is the ingredients used. Molecular Cooking uses plant and cell tissues along with some pure compounds whereas, NBN Cooking uses just pure compounds.

Soylent: Another example of food with animal and plant tissues

“*Soylent*” was developed by a group of Silicon Valley engineers, Rob Rhinehart, Matthew Cauble, John Coogan and David Renteln also uses pure compounds. It is a thick goeey liquid containing all the nutrients that we need to survive. One can argue that there is hardly any art and creativity involved in that and it is rather pramatic. Soylent promotes an idea of not eating food in a traditional way, but rather mixing all the nutrients that we need and just gulp it down. It enables people to save time spent on cooking, eating and cleaning afterwards[6]. But, they are forgetting the fact eating food is not needed just for survival. There is a whole range of emotions associated with eating and it helps in the wellbeing of human beings and this fact is proved by many studies linking human emotions and food[7]. Also, for many people all over the world meals are the only time to spend with their family and to talk about their lives.



FIGURE 1: SOYLENT [8]

Unlike Soylent, NBN Cooking does not promote the renunciation of these values. It rather supports it in a more environment friendly manner. But NBN also has its own share of criticism. World renowned chef Pierre Gagnaire serves some of the NBN dishes in his restaurants [9].



FIGURE 2: NBN DISH, PICTURE BY HERVÉ THIS

Ingredient list

NBN cooking uses pure compounds for cooking, most of them are not commonly known to everyone. I will give a brief description about the compounds that will be used in the recipe discussed in this report.

Protein powder

Proteins are most commonly found in meat products, eggs and milk. They are the building blocks of our muscles and we need proteins for growth and development of our body. Hence, proteins are one of the most important ingredients of NBN Cooking. Some commonly used proteins are whey protein, pea proteins, soy proteins and egg albumin proteins. These protein powders can be made to have a desired texture, colour and flavour.

Gellan

Gellan is a water soluble microbial exopolysaccharide created by the bacteria *Pseudomonas elodea* or *Sphingomonas elodea*. It was first discovered in the labs of Merck and Co., under the Kelco division, in 1978. It was approved for food use in 1992 by the US FDA. Today, C.P. Kelco continues to market the product under a variety of brand names.

Gellan can also be used as a substitute for Agar. The difference between the two is that Gellan can withstand higher temperatures and produces the same viscosity at half the concentration of Agar[10].

Pure Cote- B790

It's a modified food starch derived from corn. It forms liquids with low viscosity that forms a clear flexible film with excellent sheen when it dries. Pure-Cote B790 is also used to thicken juices and a binding agent in cereal and puffed snack coating. Pure Cote also finds application in bakery industry as it aids the glacing for baked goods and confections, forming a smooth and glossy coating.

Pure-Cote B790 is optimized to form clear elastic films when the solution is cast onto a flat surface and dehydrated at low temperatures[11].

Techniques used in Molecular cooking

There are various techniques that are used in molecular cooking and NBN Cooking. I am going to discuss a few of them will be used in the proposed NBN recipe. These techniques are adopted from the website "molecularecipes.com".

Gelatin- filtration technique for making Consommé

Consommé is a clear stock that contains no fat or solid particles. Gelatin filtration method developed by Harold McGee is the molecular cooking method of preparing a consommé. The gelatin filtration method consists of freezing a stock or other solution containing gelatin and then letting it thaw in the fridge in a fine strainer lined with cheesecloth. The resulting liquid is a perfectly clear consommé containing only water and flavor molecules.

Principle

When a liquid such as stock with gelatin is frozen, it converts the bulk water into ice crystals but the water associated with solutes (gelatin, fat and flavor compounds) remains unfrozen due to difference in freezing point.

Upon thawing the frozen gelatin-containing stock in a fridge, the gelatin and other solutes concentrate in the unfrozen water. Gelatin forms a stable network through cross-linking which acts as a filter retaining large particles and molecules such as fats or proteins. This allows water and smaller flavor compounds to pass through the gelatin network.

As the thawing process happens in the fridge, frozen water that forms bulk of the system, melts slowly passing through the gelatin filter which retains the large particles but lets the smaller flavor molecules be carried by the water. The melted water does not dissolve gelatin network because it is never in contact with the gelatin network for long enough.

The resulting liquid is a clarified stock or consommé with just water and flavor molecules without any gelatin.

Methodology

1. Prepare a stock with high gelatin content. Add more gelatin if the gelatin content is not high enough. For liquids with no gelatin, add about 7 g of unflavored gelatin powder for each cup of the liquid. To get even distribution of gelatin, sprinkle the gelatin powder over half of the cold liquid and let it hydrate for 1 minute. Boil rest of the liquid and add it to the cold liquid with gelatin and mix.

Note: Using agar agar instead of gelatin reduces the duration of the filtration process from about 2 days to 8 hour. If using agar agar, simmer the stock, add 0.15% of agar agar by volume and stir to dissolve. Cool this solution in a flat container.

2. Freeze the stock with gelatin or agar agar in a flat container to maintain the depth of the liquid close to about 2 or 3 cm (1 inch).
3. Once the liquid is jellified but not completely frozen, remove the container from the freezer and cut the gel in small 2 or 3 cm (1 inch) cubes. Place these cubes in a larger container or tray so the gel squares are not completely touching each other. The pieces can be conveniently placed in the strainer.
4. Completely freeze these cubes. This may take between 12 to 24 hours depending on your freezer and size of the cubes.
5. Line a large fine strainer with cheese cloth and place it on a container that can hold the volume of consommé you are preparing without touching the bottom of the strainer.
6. Place the frozen stock cubes in the strainer and thaw in the fridge. This process may take up-to 8 hours to 2 days based on the gelling agent (agar agar or gelatin).
7. Collect the resulting consommé and discard the gelatin, fat and larger particles left in the cheese cloth.

Mint Glass

1. In a small pot, mix Pure-Cote B790 and a little water to make a paste.
2. Add green color* (Spinach extract OS 20) and few drops of menthol for mint flavor.
3. Blend in the rest of the water to disperse the starch.
4. To completely hydrate Pure-Cote B790, bring the mixture to a minimum of 71 °C (160°F) on medium heat and hold it for 10 minutes.
5. Add salt or sugar as per taste.
6. Pass through a fine sieve.
7. Pour a small amount of liquid in the center of a glass or acetate sheet and tilt it to spread the liquid close to the edges.
8. Let it dry on a flat surface at room temperature for 12 hours or more if necessary.
9. Carefully peel off the mint sheets from the acetate or glass.



FIGURE 3: PINEAPPLE GLASS WITH CHEESE (MOLECULARRECIPES.COM)

My Recipe

My recipe is inspired from an Asian noodle and spinach soup served with fried egg as seen in the picture.



FIGURE 4: SPINACH AND VERMICELLI SOUP WITH FRIED EGG [12]

The Twist

As my assignment was to develop a NBN recipe, I tried to add a twist to the existing recipe shown above. This is what I did.

Soup broth will be made up of water and chicken flavour. Based on the research from [13], 2-Methyl-3-furanthiol is the major contributor of the taste of chicken broth. To get a typical chicken flavour, this is complemented with other compounds listed in the table below. For this soup, either the chicken flavour or chicken stock can be used.

Rice noodles will be replaced by Saffron Tagliatelle of Consomme by Ferran Adria and El Bulli team (molecularrecipes.com). These will be cut into slices of 2 – 3 mm width.



FIGURE 5: SAFFRON TAGLIATELLE OF CONSOMME (MOLECULARRECIPES.COM)

Pineapple glass recipe from molecular recipes.com will be modified to taste like mint using green colour and menthol. This mint flavoured glass will be folded to make small pouches instead of wrapping it around something like cheese or just making pouches of the mint glass. These crispy pouches will be added to the soup in the end to retain their crispy texture.

Fried egg, egg albumin protein will be used to make the fried egg. For the yolk, the protein can be mixed with carotene to get orange colour and carrot flavor [14].

The pictures below gives an overview of major chemicals found in chicken and beef flavor and some common spices and herbs.

Compounds	Flavour dilution factor		Odour description
	Chicken	Beef	
2-Methyl-3-furanthiol	1,024	512	Meat-like, sweet
bis (2-Methyl-3-furyl) disulphide	<16	2,048	Meat-like
2-furfurylthiol	512	512	Roasty
2,5-dimethyl-3-furanthiol	256	<16	Meaty
3-mercapto-2-pentanone	128	32	Sulphurous
Methionol	128	512	Cooked potato
2,4,5-trimethylthiazole	128	<16	Earthy
2-formyl-5-methylthiophene	64	64	Sulphurous
Phenylacetaldehyde	16	64	Honey-like
2-trans-4-trans-decadienal	2,048	<16	Fatty
2-trans-4-cis-decadienal	128	<16	Fatty, tallowy
2-undecenal	256	<16	Tallowy, sweet
γ -dodecalactone	512	<16	Tallowy, fruity
γ -decalactone	64	<16	Peach-like
Nonanol	64	<16	Tallowy, green
2-trans-nonenal	64	<16	Tallowy, fatty
2-trans-4-trans-nonadienal	64	<16	Fatty
β -ionone	64	<16	Violet-like
p-cresol	64	<16	Phenolic

FIGURE 6: CHEMICAL COMPOUNDS RESPONSIBLE FOR CHICKEN AND BEEF FLAVOR [13]

MAJOR ORGANIC COMPOUNDS IN HERBS & SPICES

The herbs and spices used regularly in cooking are all a complex mix of organic compounds. This highlights some of the main organic compounds found in each herb and spice that contribute to their flavour, aroma, or colour.



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FIGURE 7 : MAJOR ORGANIC COMPOUNDS FOUND IN HERBS AND SPICES [15]

Ingredients:

Ingredients for broth

- Chicken stock or chicken flavour
- Ingredients for Spinach glass
- Spinach extract OS 20 for green colour
- Menthol few drops
- 25 grams Pure-Cote B790

Ingredients for Saffron Tagliatelle of consommé

Ingredients for Consommé

- 500 g of unsalted chicken or vegetable broth
- 14 g of unflavored gelatin powder (if using gelatin filtration)

Ingredients for Saffron Tagliatelle (2 servings)

- 125 g unsalted consommé (preparation is described in “Techniques used in molecular cooking”)
- Saffron flavor (α -Crocine)
- Marigold L 3 for colour (from the table)
- 2.4 g Gellan
- White truffle oil
- White truffle salt

Ingredients for fried egg

- 25 grams of egg albumin protein powder
- β -carotene for colour and flavor
- Salt to taste

Preparation Methodology:

For soup broth:

- Boil 500 mL of water
- Add chicken stock or chicken flavor and salt.
- Keep it aside

Prepare the mint glass as discussed in methodology.

Use this mint glass to make small packets and dehydrate them.

For Saffron Tagliatelle of consommé

- Prepare the consommé using the technique described in methodology
- Combine the consommé, saffron flavor, colour and Gellan in a pot and bring it to boil.
- Pour the liquid on a flat tray and quickly spread it all over the tray. Tilt the tray to get rid of any excess of liquid to obtain a very thin even film of about 1 mm. If not done fast, the liquid will gel before getting rid of the excess liquid.
- Allow the gel to set completely in a flat tray for few minutes.

- Cut into 0.2 cm thick strips with a pasta cutter (roller type) to make tagliatelle.

For Fried egg

- Take 20 grams of protein powder in a bowl and add water and make a paste with the consistency of crepe dough and add salt as per taste. This will form the base.
- With rest of the protein powder make a thicker paste and add β - carotene for colour and taste.
- Heat oil in a pan and pour the base.
- Once it is cooked a little bit, add rest of the protein powder to make it look like fried egg sunny side up.
- Cook for some time, till the protein sets.

Serving the soup

- Take half of the saffron tagliatelle of consomme in a bowl.
- Add 250 mL of the broth.
- Garnish with fried egg and crispy mint glass pouches.
- Serve hot.

References:

1. Lawrence, P.R.K.a.R.Z., *Trade, Jobs and Wages*. Scientific American, 1994.
2. Knabe, J.T.a.F., *CLIMATE CHANGE AND WATERAN OVERVIEW FROM THE WORLD WATER DEVELOPMENT REPORT 3: WATER IN A CHANGING WORLD*. 2009.
3. Vidal, J. *Food shortages could force world into vegetarianism, warn scientists*. 2012; Available from: <http://www.theguardian.com/global-development/2012/aug/26/food-shortages-world-vegetarianism>.
4. Dana, G., *Wasted: How America Is Losing Up to 40 Percent of Its Food from Farm to Fork to Landfill* 2012.
5. King, R. *Chef shorthand and note by note cuisine*. 2012; Available from: <https://www.finedininglovers.com/stories/food-science-herve-this/>.
6. Labs, R. *Soylent*. Available from: <http://www.soylent.me/>.
7. Jager, G., et al., *Temporal dominance of emotions: Measuring dynamics of food-related emotions during consumption*. Food Quality and Preference, 2014. **37**(0): p. 87-99.
8. Heisey, M. *This man think he never has to eat again*. 2013; Available from: http://www.vice.com/en_uk/read/rob-rhinehart-no-longer-requires-food.
9. This, H., *Molecular gastronomy is a scientific discipline, and note by note cuisine is the next culinary trend*. Flavour, 2013. **2**(1): p. 1.
10. *Gellan*. Available from: <http://www.molecularrecipes.com/hydrocolloid-guide/gellan/>.
11. *Pure-Cote B790*. Available from: <http://www.molecularrecipes.com/hydrocolloid-guide/pure-cote-b790-2/>.
12. Sonoma, W., *Recipe Roundups: Noodle Soups*. 2013.
13. Dinesh D. Jayasena, D.U.A., Ki Chang Nam and Cheorun Jo, *Flavour Chemistry of Chicken Meat: A Review*. Asian-Australasian Journal of Animal Sciences, 2013. **26**(5): p. 732-742.
14. News, B., *Is this what we'll eat in the future?* BBC News. Is this what we'll eat in the future? BBC News, 2013.
15. *Chemical compounds in Herbs and spices*. 2014; Available from: <http://www.compoundchem.com/2014/03/13/chemical-compounds-in-herbs-spices/>.

* The food colorants are from “Univar Colours for Food Brochure”.