The Creative Longview

Flavors of the Future

Biotechnology, 'intelligent' flavors and beyond

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Why are flavors important? We are familiar with the sweet taste of strawberry ice cream; however, without industrial products that provide smell and taste, this treat would not be so attractive or appetizing.[1]

In the medieval age, monks were the pioneers in the art of capturing natural essences and transforming them into substances capable of flavoring food. They used the distillation method on plants to obtain the first essential oils. Today, through scientific discoveries and technological developments, food science, and especially food flavors, have reached a very significant level of quality and sophistication.

Aromatic Chemistry

Since the end of the 19th century, when vanillin (an aromatic substance present in vanilla pods) was synthesized for first time, flavor technicians from all around the world have synthesized a huge number of molecules with savory properties that are applicable to the food industry.

Photo courtesy of Cosmos Aromaticá International S.A.

Torrell: Flavorists are in the unique position of composing mixtures that enable the elusive capture of the ethereal via artistic and technical means.

Modern techniques of extraction and analysis have played a very important role in the development of this field. Among these techniques, two of the most important are the isolation technique called headspace, and gas chromatography, which is used in conjunction with mass spectrometry.[2]

Each flavor molecule has a threshold value (called sensorial detection limit, usually expressed by mg/L) under which it cannot be identified by a sensory panel. The concentration limits of sensory detection for the aromatic molecules are related to their vapor pressure, which depends on the temperature and the medium in which they are found.

The amount of volatile compounds in food is very low, and not all the volatile molecules in a food product contribute to its flavor. To have some value, one volatile molecule must be present in a higher concentration than its sensorial threshold limit.

When developing a flavor, the selection of the appropriate compounds requires a lot of work as well as creativity. Consequently, it can be said that the job of a flavorist consists of capturing aromatic molecules, selecting them, modifying them and copying them with the objective of developing new flavors. Then these flavors must be tested to verify their adequacy to the flavoring of processed food products. This process enables a soft drink to taste like passion fruit, a soup to taste of chicken with vegetables, and yogurt to taste like raspberry.

The Art of Formulation

Modern flavor formulation employs aromatic science, which is comprised of aromatic compositions, or building blocks, that are designed to be assembled according to several rules. With this methodology flavorists can create any tailor-made taste. Included among these aromatic modules are process flavors (Maillard flavors), nature identical flavors, yeast extracts and natural extracts.

The use of process flavors is very interesting. Often, color is a reliable indicator of the extent to which the food has been cooked. Brownish colors are frequently associated with baked, fried, roasted and toasted foods. This is a result of the Maillard reaction between reducing sugars and amino acids. It is known that individual amino acids brown with sugars at different rates, but it has not yet been possible to account for the considerable synergy between amino acid components that exists when mixtures of amino acids undergo browning.[3] This process enables the aromatic industry to obtain meat flavors of cooked beef or fried chicken.

Using the aromatic modules, the food technician, flavorist or the cook can make any product imaginable. For this purpose they must design an aromatic system according to the rules used for the perfumers. In the final composition there are three main types of notes that must be present: base, medium and volatile notes.

The perfect equilibrium between all components of a flavor will result in a harmonic profile. Of course to achieve this objective creativity is necessary.

"My favourite pictures are those which I have not fully understood while painting them;" said Miquel Barceló, an artist, "they contain something that simply *came out* like that. These pictures are better than I am, in the sense that they possess more intrinsic intelligence than what I have given them."[4]

The philosopher Karl Popper expressed the same opinion when speaking about the need of creativity in the evolution of the species: "Life is never totally satisfied with its conditions and it is very audacious before beginning any adventure."[5]

In Catalonia, Ferran Adriá, the well-known chef at El Bulli, recently experimented with the use of fresh products in order to give a twist to classical Mediterranean preparation. Many of these new variations were achieved with his *foams*. This consisted of aerating ingredients with a siphon, thus introducing minute bubbles to the texture. His philosophy is to provide unexpected contrasts of flavor, temperature and texture; an unconventional lesson from which flavorists can learn. Straying off the prescribed path can reap surprising rewards.

In a novel example of creative inspiration, another Catalan cook, Jordi Roca, has created a surprising dessert matching the perfume Trésor de Lancôme. To reproduce the atmosphere of the related fragance he combined several flavors of vanilla, rose, honey and peach.

Men have always dreamed of capturing the aromatic essence of nature. Flavorists are in the unique position of composing mixtures that enable this elusive capture of the ethereal via artistic and technical means.

Looking to the Future

If we could venture into the future, we would probably find a world full of innovative projects that will drastically change the flavoring industry. These developments will entail the collaboration of several types of scientific techniques such as genetic engineering, biotechnology, enzymology, physics and electronics.[6]

In fact, enzyme technology advancement is the cornerstone of all the current new flavor creation via biotechnology. As it is widely known, enzymes are necessary biological catalysts in all biochemical reactions. However, because they are proteins, they are easily ruined when separated from their natural environment. This natural environment is, in most cases, the cell.

Photo courtesy of Françesc Guillamet

By experimenting with fresh products and techniques, chef Ferran Adriá of El Bulli has created foams — textured ingredients using aeration.

Another adverse factor to enzymes is that they work in optimized temperature and low pH conditions. Thus, their performance (speed of reaction) decreases significantly when placed outside of their natural boundaries. Furthermore, enzymes show their activity on very low concentrations of substrates, and for this reason, their activity can be inhibited by higher concentrations. However, with the help of genetic engineering, some enzymes have been developed with sufficiently powerful properties for industrial usage (i.e. thermo-resistant enzymes stable to pH variations). Yet, though the flavor industry has investigated the enzymatic hydrolysis of vegetable proteins into a corresponding blend of amino acids that have flavoring properties, this process was slow and expensive. Today, new production methods protected by patents have been developed. These methods increase the speed of a reaction while retaining all of its benefits. The future, then, is sure to be marked by innovation.

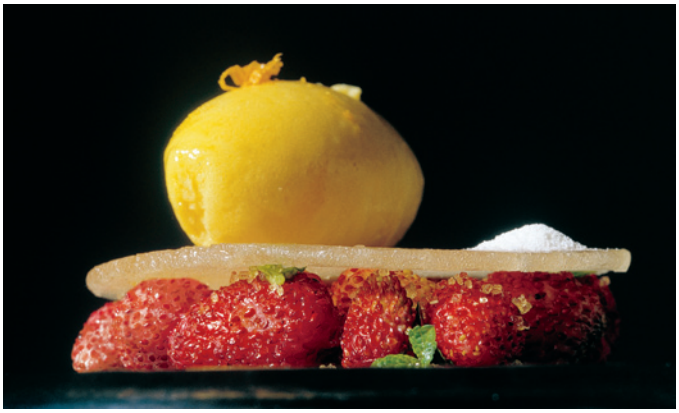

Photo courtesy of Jordi Roca

In a novel example of creative inspiration, Catalan chef Jordi Roca has produced a dessert matching the perfume Trésor de Lancôme.

The loss of intensity when flavors are applied or during their storage has been the subject of many research projects in recent years. Some of these projects have focused on the study of encapsulation, a technique that controls the delivery of the flavoring substances depending on the medium in which they are applied. This allows the flavor to be liberated when a food is prepared or when it is eaten, depending on the temperature or pH of the medium in which it is applied. These are known as *intelligent flavors.*[7]

Analytical Techniques

Recently, scientists have been working on a new instrumental technique that allows the sensorial evaluation of flavors. This technique uses sensors made of organic polymers that are similar to the human olfactive epithelium, which is made of about 10 million receptors. For this reason, this type of flavor detector is known as an *electronic nose*.

Among the possible applications of this new technology are: quality control of raw materials, comparison of products, conservation testing, the evaluation of production batches of flavors, and the release of flavors obtained by the Maillard reaction.

Until the beginning of the 1990s, the main objective of the flavor industry was to find the aromatic secrets of nature and discover, with the aid of complex analytical methods, the chemical structure of a wide variety of aromatic substances. At the same time, by using new technologies, many flavored foods derived from ancient culinary tradition were created. Thus, flavors were developed containing a sensorial profile typical of culinary foods such as meat, vegetables or fish. These are currently used for the preparation of many dishes in any restaurant. In the near future, though, the union of several scientific fields will pave the way to the development of flavors that are able to satisfy the necessities of each moment. Some issues considered science fiction in the past, will come closer to reality. For example, odors and fragrances can be digitalized, allowing for transmission of olfactory information via the internet and opening new fields in the industry.[8]

Beyond Sensory Attributes

A work on the effect of several physiologic stimuli, including flavor, showed that memory can be improved.[9] Studies by Sakurai et al. showed that persons exposed to rosemary and chocolate scents could remember a list of random words better than those who were not exposed.[10] Likewise, Saito et al. demonstrated that saffron improved memory in an experiment conducted with mice.[11] The functional capabilities of flavors seem to promise ever more exciting possibilities, extending functionality beyond simple taste or smell. From the time when the Egyptians began using spices to flavor food (ca. 2600 B.C.), to the creation of intelligent flavors, the technological evolution of flavors and their benefits have gone through an intricate maze of reinterpretation and innovation that is sure to lead to a future filled with fascinating possibilities.

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