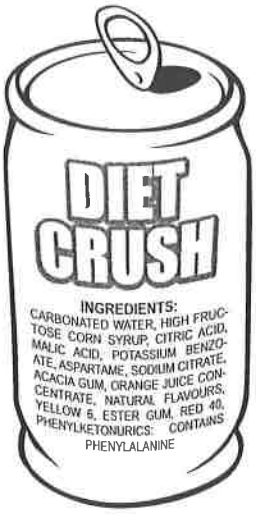
Food Chemistry

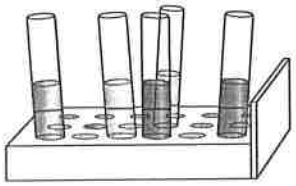


A chef thinks of cooking in terms of the art of putting ingredients together to form a new recipe. But there is more to it than that. There is also the chemistry involved when you mix the ingredients together and increase their temperature by cooking them either on the top of the stove or in the oven. The food reactants undergo changes to form new food products. The rules of chemistry don't change just because you're not in a laboratory setting.

Our food is made up of chemicals. Proteins, carbohydrates and fats are particular types of molecules and amino acids that combine in predictable ways to make up a food. Taste, texture and appearance can be altered by the addition of substitute of chemical food components, like salt, artificial flavours and colours, added sugar, etc. Just check out the ingredient labels of some of the food you eat and you see a cocktail of chemicals that most people are unaware of.

The discipline of food chemistry is concerned with the chemical and microbiological processes of food. There are many different areas of specializations, including food processing, packaging, distribution and storage.

Components of Food



There are three main components studied in food chemistry – ***carbohydrates***, which include simple ones like sugar and complex ones like starch and fiber; ***lipids***, including fats, oils and cholesterol, and ***proteins***, made up of simpler amino acids and an essential part of our diets.

Other components that can be studied include vitamins, minerals, enzymes and water content, as well as food colour, flavour and additives.

Food chemists study how foods change with certain processing techniques and may seek to enhance desirable changes, like increasing sugar content to sweetness, or may seek to prevent undesirable effects, like adding chemicals to slow microbial action.

Other Factors in Food

Besides the actual chemicals in food, there are other factors that make it desirable to eat. Food chemistry also includes testing for aroma, flavour, texture, temperature and calories.

Food chemists analyze the aroma of food using a gas chromatograph. The gas chromatography is used in analytic chemistry for separating and analyzing compounds that can be vaporized without decomposition. Gas chromatography is similar to other forms of chromatography in that different compounds move differently depending on their mass and charge. In food chemistry, the gas chromatograph produces a chart, called a chromatogram, which displays the olfactory properties of food. Some food chemistry properties detected include the minimum concentration of food particles necessary for a human to smell them and the amount of food particles normally produced by an item. Chemicals can be added to enhance or change the odor a food gives off.

For example, a key part of the flavour of a McDonald's french fry comes from its smell. The taste of a McDonald's french fry is largely determined by the cooking oil which is

used. For decades McDonald's cooked its french fries in a mixture of about seven percent cottonseed oil and 93 percent beef tallow. The mixture gave the fries their unique flavor and smell — and gave more saturated beef fat per ounce than a McDonald's hamburger. In 1990, amid a barrage of criticism over the amount of cholesterol in its fries, McDonald's switched to pure vegetable oil. This presented the company with a challenge: how to make fries that subtly taste like beef without cooking them in beef tallow. A look at the ingredients in McDonald's french fries suggests how the problem was solved. Toward the end of the list is a seemingly innocuous yet oddly mysterious phrase: "natural flavor." That ingredient helps to explain not only why the fries taste so good but also why most fast food—indeed, most of the food North Americans eat today—tastes the way it does. And the odor of this oil only lasts for a short time. French fries won't taste as good if they are reheated because all of the odor molecules have already left and there isn't anything left of smell.

Flavour chemists study the taste of food. Flavour chemistry includes both the smell of the food mentioned above and the actual taste. It's a combination of what happens on the tongue and what happens in the nose that creates what we call flavour. Try eating your favorite food while holding your nose and you'll see the importance of smell in the whole flavour equation. The taste of a food once it is in the mouth depends on the stimulation of taste buds on the tongue. There are four basic taste senses: sweet, salt, sour and bitter. Recently another basic taste has been added, umami. MSG has a strong umami flavour. One thing food chemists do is work with both food manufacturers and farmers to ensure that processed food retains its taste. It's better to have natural flavours than to add artificial flavours later.

Food chemists also study the texture of food. Mouthfeel is a food product's physical and chemical interaction with the mouth. Food is studied from first bite through complete chewing, swallowing and aftertaste. Some of the texture qualities that are perceived are density (the compactness of the food when bitten completely through), dryness (degree to which a food feels dry in the mouth), moisture release (amount of water/juiciness that is released) and gumminess (energy required to disintegrate a food so that it's ready to swallow)

Another factor in food chemistry is temperature. A food chemist studies the compounds in the food to determine which temperature best produces the desired chemical reactions. For example, the chemist finds which temperature breaks apart a sugar molecule and causes it to react with proteins in the food to create a "carmelization effect."

Finally, food chemists study the calorie content of food. Food is burned in a calorimeter so chemists know the amount of energy in contains. The calorie content is determined by the mass of various compounds present in the food. The food chemist also tests the digestibility of foods, as some of the materials such as cellulose or dietary fiber, are not digested by humans.

There's a lot more to getting the food to your table and into your mouth than you might first suspect. And a lot of it involves chemistry.