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Everday's Application of Chemistry in Food

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Abstract:

Food Chemistry is the study of chemical processes and interactions of all biological and non-biological components of foods. It covers the basic composition, structure and properties of food.The study of chemical reactions and interactions between all biological and non-biological components of food is known as food chemistry. As examples of biological substances, consider foods like beef, poultry, lettuce, beer and milk. In terms of its primary constituents, such as carbs, lipids and protein, it is comparable to biochemistry; however, it also encompasses elements like water, vitamins, minerals, enzymes, food additives, tastes and colours. This field of study also includes measures to improve or prevent the way products change when subjected to specific food processing methods. Allowing dairy products to ferment with bacteria that turn lactose into lactic acid is an example of improving a process; inhibiting a process would be to halt the browning of newly cut fruit and vegetables.

Keywords: Food chemicals,additives,enzymes,Nutrition,Nutrients,Biology,Agriculture

Introduction

Food chemistry is one of the many subfields of food science that examines how foods and food products' chemical, physical and functional qualities change throughout the course of various processing steps and storage intervals. Based on contemporary chemistry and biology, the study of food chemistry has advanced quickly in recent years. Recent improvements have mostly been made in the chemical properties of food additives and food components in the context of food quality and safety. Nutraceuticals and functional foods will be included in the development of food chemistry in the future . Foods are a concoction of elements that can provide the body with nutrients that, once metabolised, are primarily utilised to produce energy, heat, replenishment and material for organs and tissues to grow. This ensures the regular performance of critical processes required for the human body's growth. In order to describe foods' nutritional and market values, it is important to understand their chemical makeup and the characteristics of the components that make up each one.

Chemicals are the fundamental building blocks of the entire universe. Chemicals make up all living things, including people, animals and plants. Chemical components make up every food item. Chemicals included in food are generally safe and are frequently beneficial; for instance, nutrients like carbs, protein, fat and fibre are made up of chemical compounds. Many of these come in their natural forms and enhance both our dining pleasure and a well-rounded diet. But chemicals can have a range

of toxicological characteristics, some of which could have an impact on both people and animals. Unless we are exposed to them at high quantities and over an extended period of time, these are often not dangerous. By identifying safe levels, scientists contribute to protecting against these negative impacts. Decision-makers are informed by this scientific guidance.

Chemicals like plastic that can leach into food can be found in food packaging materials and containers like bottles, cups and plates that are meant to ease food handling and transportation. Other chemicals may be used to treat crops or farm animals for diseases, or they may occasionally end up in food due to production procedures like heating, cooking, or decontamination. Natural poisons produced by some plants and fungi have the potential to contaminate crops and pose a risk to both human and animal health. Additionally, both naturally occurring and artificial chemical substances that are present in the environment at different concentrations, such as in the soil, water and atmosphere, might expose people. Industrial contaminants like dioxins and PCBs are two examples. Various quantities of naturally occurring chemical substances, such as metals and nitrates, can be found in the soil, water and atmosphere. Because of their prevalence as environmental contaminants, as a result of human activities like farming, industry, or car exhausts, or as a result of food production like high-temperature cooking, they can also appear as residues in food. They can be picked up from the environment or consumed through tainted food or drink .

Concepts from rheology, theories of transport processes, physical and mathematical chemical reaction kinetics, quantum mechanics and chemical bonding and interaction forces. Colloidal interactions, disordered/noncrystalline solids, glass transitions, freezing and biopolymer science are among examples. Numerous methods, including dynamic rheometry, optical microscopy and electron MRI, spectroscopy (NMR, FTNIR/IR, NIRS, Raman, ESR and EPR, Fluorescence, FCS, HPLC, microscopy, AFM, light scattering, X-ray diffraction/ neutron diffraction GC-MS and other similar analytical methods, as well as knowledge of food attributes and food processing demands understanding of physical chemistry and how it relates to particular foods and food processes. Because chemistry is crucial for enhancing food quality, stability and product development.

The study of chemical reactions and interactions between all biological and non-biological components of food is known as food chemistry. As examples of biological substances, consider foods like beef, poultry, lettuce, beer and milk. In terms of its primary constituents, such as carbs, lipids and protein, it is comparable to biochemistry; however, it also encompasses elements like water, vitamins, minerals, enzymes, food additives, tastes and colours

What is Food Chemistry?

As the name implies, food chemistry is the branch of chemistry that deals with the chemistry behind the biochemical nature of food, its properties and how they are processed in the body. It involves the study of chemical components from proteins to carbohydrates and more. In food chemistry, we learn how different processing techniques affect a certain type of food and also ways to enhance the quality of food.

There are certain food technologies which we experience in our daily lives which we do not know are the results of innovations in food chemistry. Some examples are:

1. **Fermentation of dairy products:** Apart from natural fermentation, to speed up the process we use microorganisms which aid the process of conversion from lactose to lactic acid.
2. **Fat & Sugar Substitutes:** We know how fat & sugar cause different ailments, but with the help of food chemistry, chemists are coming up with substitutes which offer the same taste without the bad effects.

Components of the Food we eat

Water

Water is a major component of almost every type of food we eat. But water also provides a place for bacterial growth which leads to food spoilage. Thus measuring the amount of water in a food item can be used to measure the shell life of an object.

The shelf life can be altered by different methods such as:

- Refrigeration\Freezing
- Dehydration

Percentage of water in food:

- Meat – 50%
- Eggs – 75%
- Watermelon – 92%
- Lettuce – 95%
- Cucumber – 96%

Carbohydrates

A carbohydrate is a biomolecule which is responsible for providing energy for most organisms. They are also known as saccharides. They are found in white bread, sugars, candies, fruits, vegetables, pulses, and wholemeal pasta.

Some examples of Carbohydrates are:

Glucose, galactose, fructose, glucose, galactose, fructose,

General Formula – Cx(H2O)y

Carbohydrates can be classified as:

- Monosaccharides
- Disaccharides
- Polysaccharides

Lipids

The term lipids refer to "non-polar" compounds or water-insoluble compounds of biological origin. The main functions of lipids are:

- Storing energy
- Signalling
- As structural components of cell membranes

Types of lipids

- Fatty acids
- Glycerolipids
- Glycerophospholipids
- Sphingolipids
- Sterol lipids
- Prenol lipids
- Saccharolipids
- Polyketides

Proteins

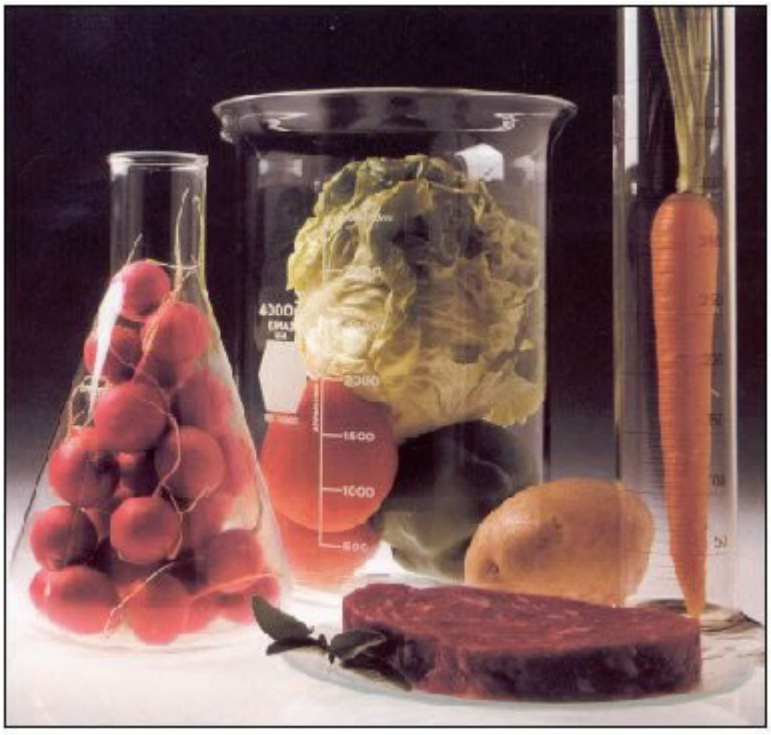
Proteins play a fundamental role in the structure and functioning of a cell. Proteins in food are important for the survival and growth of a human being. They are essential building blocks of human tissue and in extreme cases serve as a fuel source. Some common sources of proteins through food are:

- Meat
- Milk
- Eggs

How is chemistry used in food?

In food processing and storage, chemical substances may play an important role. For example, food additives can extend the shelf life of foods; others can make food more enticing, such as colours. To make foods tastier, flavourings are used. Health supplements are used as energy sources.

Chemicals are the basic building blocks of everything. All food is made of chemical compounds, including carbohydrates, vitamins, fats, proteins, and fibre, all of which are safe and frequently seen as desirable.



Chemicals have a significant role in the production and storage of food. Chemicals used in food preservation have greatly benefited in keeping food fresher for longer. Meals can be made better and more filling by using cans of food additives, flavourings, and nutritional supplements.

1. **Artificial Sweetening Agents** – Since sucrose increases calorie consumption, many people choose to use artificial sweeteners instead. Saccharin, also known as ortho-sulphobenzimide, was the first widely used artificial sweetening ingredient. Since it was discovered in 1879, it has been employed as a sweetening agent. It has 550 times the sweetness of cane sugar. It is eliminated from the body unchanged through the urine. When consumed, it seems completely safe and inert. Its use is very beneficial for diabetics and others who must limit their calorie intake. Some other commonly marketed artificial sweeteners are Sucralose, Aspartame, and Alitame.
2. **Food preservatives** – Food preservation agents stop microbial growth from causing food to spoil. The most often used preservatives are sodium benzoate (C6H5COONa), sugar, vegetable oils, and table salt. In small doses, sodium benzoate is used; it is also metabolised by the body. As preservatives, sorbic acid and propanoic acid salts are also employed.
3. **Antioxidants** – These stop food from oxidising, which stops food from going bad. For example, butylated hydroxyl anisole and butylated hydroxyl tolerance (BHA).

Let's see some of the chemicals in everyday life:

Common Name/Product	Chemical	Use/Property of the Chemical
Food Preservatives	Sulphites, Nitrites, Benzoates	These are the chemical classes that are most frequently employed as food preservatives. They prolong the shelf life of grains and food items and prevent the formation of microorganisms.
Detergent	Sodium sulphate, Sodium hydroxide, and Phosphate compounds	These are cleansing surfactants that become active when they are diluted. They are surface-cleaning foaming agents that can combine with water to hold oil and debris.
Dyes and Cosmetics	Esters	It belong to a group of organic substances that react with water to create alcohol and acids (organic or inorganic). These are utilised in medicinal, cosmetic, and colouring products .
Baking Powder	$NaHCO_3$: Sodium bicarbonate (and one or	It is a leavening or raising agent used in cookery to give baked goods more volume and a lighter

Common Name/Product	Chemical	Use/Property of the Chemical
	more weak acid)	texture. An acid-base reaction, causes the batter to generate carbon dioxide.
Toothpaste	Calcium carbonate and Sodium fluoride	Used for cleaning teeth and maintaining oral health.
Common Salt	NaCl	The table salt that we use for seasoning and cooking. Additionally, it is an excellent food preservative.
Sugar	$C_{12}H_{22}O_{11}$	Sugar is used as a sweetener for edibles.
Bleach	NaOCl	Utilised as household bleach for cleaning. It is a powerful anti-microbial and disinfectant. Additionally, it is applied to clothing as a bleaching agent.

Common Name/Product	Chemical	Use/Property of the Chemical
Vinegar	$C_2H_4O_2$: acetic acid, ethanoic acid	Commonly used in homes as a seasoning and preservative. For some surfaces, it is also employed as a household cleaning agent.
Graphite	Carbon	It is an allotrope of carbon that is most widely found as pencil lead. In addition to several additional residential and industrial uses, it is a crucial component of the batteries we use for a variety of functions.
Aspirin	$C_9H_8O_4$: acetylsalicylic acid	Aspirin is most frequently used in over-the-counter medications for pain, inflammation, and fever.
Epsom salt	$MgSO_4$: Magnesium	To calm the body and ease muscle tension, it

Common Name/Product	Chemical	Use/Property of the Chemical
	sulfate	is used as a bath salt.
Hydrogen Peroxide	H_2O_2	There are various industrial uses for hydrogen peroxide. Hydrogen peroxide is a substance that is utilised in personal hygiene products for home usage. Additionally, it is used to bleach hair and treat acne.
Toilet Cleaner	HCl: Hydrochloric acid	It is a widely popular acid that is used as a cleaning agent, particularly in bathrooms and toilets.
Caustic Soda	NaOH: Sodium hydroxide	Since caustic soda is a very corrosive alkali, it is used to unclog sinks, toilets, and drains.
Mothballs	$C_6H_4C_{12}$	It is a chemical that smells strongly stinky. It is used to protect clothing and materials from fabric bugs and clothes moths

Common Name/Product	Chemical	Use/Property of the Chemical
Hand Sanitizer	Isopropyl alcohol	A chemical that kills germs and bacteria from our hands and saves us from many diseases.
Insect Repellent (to be applied on the skin)	Diethyltoluamide	Keeps us safe from bug bites, most commonly mosquito bites.
Rodent and Pests Killer	Arsenic	Arsenic is a poisonous chemical that is used to wipe off rats, cockroaches, and such pests in our homes.
Deodorants / Anti-perspirant	Aluminum chlorohydrate	It is a substance that is used to regulate sweating and stop body odour.
Chalk	$CaCO_3$	Used for writing on blackboards.
MSG	$C_5H_8NO_4Na$: Monosodium glutamate	This name can be seen on the label of any packaged food that is ready to eat or prepare quickly. This substance is intended to

Common Name/Product	Chemical	Use/Property of the Chemical
		improve flavour and leave you wanting more.

Why is food chemistry important?

As a major division of food science, food chemistry deals with the structure and properties of foods and the chemical modifications they face. In order to ensure the food manufactured is healthy and of good quality, food chemists often play a significant role.

How is chemistry used in everyday life?

Chemistry can be found in the foods we consume, the air we breathe, the cleansing of toxins, our feelings, and practically anything we can see or touch in everyday life. There may be some typical chemistry that is evident, but others may surprise us. Our body consists of chemical compounds which are ingredient combinations.

How is chemistry used in cosmetics?

To have an enticing scent, chemicals, both natural and synthetic, are applied to cosmetics. To mask the smell of other chemicals, including 'unscented' items can contain masking fragrances. There are over 3,000 ingredients used globally to manufacture the vast variety of fragrances used in consumer goods.

How is chemistry used in agriculture?

Scores of herbicides, insecticides, fungicides, and other pesticides, plant growth inhibitors, fertilizers, and animal feed supplements include chemical products produced to assist in the processing of fruit, feed, and fibre.

Food processing induced chemicals

Undesirable chemicals can be formed in certain foods during processing as a result of reactions between compounds that are natural components of the food. In some cases an undesirable chemical may be formed as a result of a food additive being intentionally added to food and reacting with another compound in the food. When foods are heat-processed (baked, deep-fried, etc.), there are reactions that occur between components of the food, resulting in the desired flavour, appearance and texture of the food. However, some of these reactions can lead to the production of undesirable compounds. Similarly, certain storage or processing conditions may allow reactions to occur that otherwise would not. These reactions could generate potentially harmful compounds. Such chemicals can be collectively referred to as food-processing-induced chemicals. Some of these chemical

reactions involve naturally-occurring components in the food, while other reactions may involve food additives, ingredients, or food packaging materials that were intentionally used.

In many cases, the presence of processing-induced chemicals in food cannot be avoided; however, understanding the processes by which these products are formed can allow us to optimize or adjust food preparation methods, formulae or processes, thereby reducing or eliminating the formation of such chemicals.

Examples of food-processing induced chemicals include:

- Acrylamide
- Benzene
- Chloropropanols
- Ethanol
- Ethyl carbamate
- Furan
- Heterocyclic aromatic hydrocarbons
- Nitrosamines
- Polycyclic aromatic hydrocarbons (PAH's)
- Semicarbazide

The Chef and Basic Chemical Reactions

Any cooking you do involves chemistry. The use of heat, cold, and cutting changes the composition of foods. Even simply slicing an apple sets off chemical reactions that change the color of the apple's flesh. If you heat up sugar to turn it into syrup, you're using a chemical reaction.

How Chefs Use Chemistry, Sometimes Without Even Realizing It

Once you start learning how these specific processes work, you can use them to your advantage, creating effects in food that make plain dishes look fantastic. If you know that sugar browns in heat, you know that adding a sprinkle of sugar to the top of a product will give the final cooked product a nice caramelized look. cookies baked in an oven turn golden or brown as the sugar in the dough caramelizes, but if you bake the cookies in a car (seriously), the caramelizing doesn't happen, and the cookies look unbaked. But if you're expecting that, you'll know that the looks are not a problem as long as the cookies show other signs of being done. You won't keep trying to brown the cookies because you're aware that the chemical reactions will be different.Knowing chemistry in food is also helpful when creating copycat dishes for people with special dietary requirements. If you're cooking for someone who can't have eggs, you'll know that you need to find a substitute binder for the recipe.

Molecular Gastronomy

Learning more about chemical processes in food and how one substance might affect another helps you if you're interested in cooking in the field of molecular gastronomy. This is a field that is dedicated to playing around with the chemical properties of food. The more aware you are of

what can be done chemically, the more dishes you can create.Chemistry and food also comes into play when you're trying to verify old cooking legends and advice.

Conclusion

Food chemistry is the study of chemical processes and interactions of the biological and non biological components of foods.It deals with the components of food such as carbohydrates, lipids, proteins, water, vitamins, and dietary minerals.The history of food chemistry dates back to the late 1700s, when many famous chemists were involved in discovering.The study of chemical reactions and interactions between all biological and non-biological components of food is known as food chemistry. As examples of biological substances, consider foods like beef, poultry, lettuce, beer and milk. In terms of its primary constituents, such as carbs, lipids and protein, it is comparable to biochemistry; however, it also encompasses elements like water, vitamins, minerals, enzymes, food additives, tastes and colours. This field of study also includes measures to improve or prevent the way products change when subjected to specific food processing methods. Allowing dairy products to ferment with bacteria that turn lactose into lactic acid is an example of improving a process; inhibiting a process would be to halt the browning of newly cut fruit and vegetables.

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