DOWNLOAD PDF FOOD PRESERVATIVES

Chapter 1 : C&EN: SCIENCE & TECHNOLOGY - WHAT'S THAT STUFF? FOOD PRESERVATIVES

Food is so important for the survival, so food preservation is one of the oldest technologies used by human beings to avoid its spoilage. Different ways and means have been found and improved for the purpose.

Just this year, I discovered golden raisins. I like their light flavor in my morning oatmeal--not too sweet, and milder than their darker cousins. California seedless raisins, sulfur dioxide added as a preservative. Chemical preservatives like sulfur dioxide help keep food fresh. Of the 32 ingredients in my favorite type of granola bar oatmeal raisin , one is labeled as a preservative, although a few other ingredients also inhibit decay. Some grocery items have no preservatives at all--in particular those that are sufficiently preserved by freezing, drying, smoking, pickling, canning, or some other means. But chemicals can be used effectively to slow spoiling and keep microorganisms at bay. Preservatives can be categorized into three general types: Sulfur dioxide serves all three functions, which is one reason why it and related compounds called sulfites are found in so many household products. A small percentage of the population is allergic to sulfites, though FDA states that, for the majority of the population, they are safe. In my cupboards, I found sulfites in a package of sun-dried tomatoes, Turkish dried apricots, dried sweet potatoes, balsamic vinegar, red wine vinegar, lemon juice, and Hawaiian coconut syrup. Sulfites are also commonly used in wine preparation and to lengthen the life of fruit juices. Sulfites inhibit microbial growth through a number of actions, says Hassan Gourama , associate professor of food science at Pennsylvania State University. They react with the energy currency of the cell, adenosine triphosphate; inhibit some metabolic pathways; and block cellular transport systems. Other antimicrobials alter microbial membrane or cell wall permeability or destroy the genetic material. In addition to its antimicrobial action, sulfur dioxide inhibits degradation reactions in fruits, Gourama says. It keeps raisins and other dried fruits from losing their light color by blocking both enzymatic browning and a nonenzymatic browning reaction between reducing sugars and amino acids called the Maillard reaction. The reaction darkens raisins, alters their flavor, and reduces essential amino acid levels. Antimicrobials are found throughout the grocery store. Propionates hold sway in the bakery aisle. Propionic acid occurs naturally in strawberries, apples, violet leaves, grains, and cheese. The acid is effective against bread molds and the spores of the bacterium Bacillus mesentericus, which cause an inedible condition in baked goods called rope. Other weak organic acid antimicrobials include benzoates, found naturally in cranberries, and sorbates. Because these compounds work best at a low pH--in the range that excludes much bacterial growth--they are used primarily as antifungals. Esters of p-hydroxybenzoic acid, also known as parabens, are similar to benzoic acid but effective at a higher pH. Many beverages, jams, pickled products, salads, cheeses, meats, and margarines contain benzoates or sorbates. Nitrites and nitrates roost mainly among the packaged meats. They also impart a pink, fresh hue to cured meat. Nitrates readily convert to nitrites, which then react with the protein myoglobin to form nitric oxide myoglobin. During cooking, this is converted to nitrosohemochrome, a stable, pink pigment. In the absence of nitrates or nitrites, meat turns brown. However, "the only problem with nitrites is that they react with amino acids to form nitrosamines"--cancer-causing agents, Gourama says, adding that "the levels that are used in cured meat are not of concern right now. Unsaturated fatty acids in oils and lipids are particularly susceptible to autooxidation. In this process, a free radical initiates peroxide formation at fatty acid double bonds. The chain reaction propagates to other double bonds, and aldehyde, ketone, and acid-termination products eventually build up to create the rancid off-flavors characteristic of oils and fats gone bad. Antioxidant preservatives sop up the free radicals that help initiate and propagate these reactions. A third group of preservatives targets enzymes in the food itself that continue to metabolize after harvest. The enzyme phenolase, for example, goes to work as soon as an apple or potato is cut. It browns the exposed surface. Acids such as citric acid and ascorbic acid vitamin C inhibit phenolase by making the pH uncomfortably low for the enzyme. And metal-chelating agents such as EDTA ethylenediamine tetraacetic acid can remove the metal cofactors that many enzymes need. Chelators also make it difficult for bacterial and fungal enzymes to carry on. Currently, Gourama says, many food scientists are searching for preservatives in natural products. Some of the newest antimicrobials have been found in microorganisms themselves as they

form their own chemical defenses when competing with each other for space and nutrients. For example, nisin and natamycin--cheese preservatives called bacteriocins--are harvested from microorganisms. Other potential natural preservative sources include honey, milk, and even dried plums as scientists seek new sources and combinations of safe, effective preservatives.

Chapter 2 : List of Permitted Preservatives (Lists of Permitted Food Additives) - calendrierdelascience.com

Sodium benzoate is a food additive used as a preservative. Foods that have it. Sodium benzoate is used in a variety of processed food products and drinks. Why it's controversial.

Since Can YOU prevent health problems, cancer, disease, and illness through healthy foods, fitness, and a more relaxed lifestyle? Soft Drinks, Sport Drinks and Sugar Sweetened Beverages Soft drinks have artificial sweeteners Saccharin, NutraSweet, Aspartame that are small quantities of poison because these alter brain neurochemistry. These drinks also have high fructose corn syrup that has mercury and over time damages body cells. Refined Sugar High consumption of sugar, and the corresponding elevated insulin levels , can cause weight gain , bloating, fatigue , arthritis, migraines, lowered immune function, gallstones, obesity , breast cancer, gum disease and cavities, and cardiovascular disease. This stuff is harmful because, it inhabits natural growth hormone and dramatically promotes irreversible obesity. In order to cut out MSG from your diet, you will need to remove foods with the following ingredients in their label: Hello, now you can eat again! In the US, the majority of the corn , soybean , cotton, and canola crops are now genetically modified, and one or more of these can be found in nearly every processed food. What does this do? Not a whole lot except: Although there is no actually evidence, but I believe personally that it would even lead to mental retardation. Sodium Nitrate and Nitrite These are preservatives that are added to canned foods and processed foods in particular processed meat products such as bacon, corned beef, ham, hot dogs, lunch meats, and sausage, yeah the lovely sausage. Do I really need to say more about this? Caffeine as an additive which is added to soft drinks , gum, diet pills, and pain relievers is an addictive stimulant that causes calcium to be excreted from the bones, which can lead to osteoporosis, and can increase infertility. At higher doses, caffeine can cause birth defects, miscarriage, heart disease , depression , behavioral changes, and insomnia. Withdrawal symptoms include headaches, irritability, sleepiness and lethargy. Brominated vegetable oil BVO Brominated vegetable oil is used to keep flavor oils in soft drinks in suspension. Bromate, the main ingredient of BVO, is a poison. In adults, this additive reduces immune defenses and depletes histamine, which can lead to allergic reactions. When this occurs, the level of polyunsaturated oils good fat is reduced and trans fats are created. Trans fats can be found in foods such as vegetable shortening, some margarines, crackers, candies, baked goods, cookies, snack foods, fried foods , salad dressings, and many processed foods. They are associated with heart disease , breast and colon cancer , atherosclerosis and elevated cholesterol. All of us also have measurable levels of polychlorinated biphenyls PCBs , dioxin, heptachlor, chlordane, aldrin, dieldrin, and other pesticides in our bloodstream. And since our bodies cannot remove these chemicals, over time, they weaken our endocrine, reproductive, circulatory, immune, and central nervous systems. As a result, our likelihood of having heart disease, cancer, and allergies is greatly increased. Pesticide accumulation also undermines our ability to resist infectious organisms, may impair fertility, and contributes to miscarriages and birth defects. What to do Drink lots of pure water or spring water to flush out toxins from your body and have some fresh raw vegetable juices to replace the minerals that you lose by drinking lots of water. Exercise to relax your body and mind. Also important, the less TV you watch, the less you will be exposed to food advertising , and the less processed food you will eat. And finally, be mindful of what you eat. All of this will not start from day one for everybody but you can do all of these step by step and before long you are doing all to keep your body healthy and yourself out of hospital.

Chapter 3 : food preservation | Definition, Importance, & Methods | calendrierdelascience.com

A preservative is a substance or a chemical that is added to products such as food, beverages, pharmaceutical drugs, paints, biological samples, cosmetics, wood, and many other products to prevent decomposition by microbial growth or by undesirable chemical changes.

Common sequestering agents are disodium EDTA , citric acid and citrates , tartaric acid , and lecithin. Ascorbic acid and tocopherol , which are vitamins, are common preservatives. Smoking entails exposing food to a variety of phenols, which are antioxidants. Natural preservatives include rosemary and oregano extract, [8] hops , salt , sugar , vinegar , alcohol , diatomaceous earth and castor oil. Traditional preservatives, such as sodium benzoate have raised health concerns in the past. Benzoate was shown in a study to cause hypersensitivity in some asthma sufferers. This has caused reexamination of natural preservatives which occur in vegetables. Smoked meat for example has phenols and other chemicals that delay spoilage. The preservation of foods has evolved greatly over the centuries and has been instrumental in increasing food security. The use of preservatives other than traditional oils, salts, paints, etc. Many developing countries that do not have strong governments to regulate food additives face either harmful levels of preservatives in foods or a complete avoidance of foods that are considered unnatural or foreign. These countries have also proven useful in case studies surrounding chemical preservatives, as they have been only recently introduced. Food drying In ancient times the sun and wind naturally dried out foods. Middle Eastern and Oriental cultures started drying foods in 1, B. The Romans used a lot of dry fruit. Sometimes fires were made to create heat to dry foods. Drying prevents yeasts and bread molds Rhizopus from growing by removing moisture so bacteria cannot grow. Frozen food Cellars, caves, and cool streams were used for freezing. American estates had ice houses built to store ice and food on the ice. Icebox was converted in the s to mechanical refrigeration. Clarence Birdseye found in the s that freezing meats and vegetables at a low temperature made them taste better. Fermentation in food processing Fermenting was discovered when a few grains of barley were left in the rain and turned into beer. Microorganisms ferment the starch-derived sugars into alcohols. This is also how fruits are fermented into wine and cabbage into Kimchi or sauerkraut. Anthropologists believe that as early as 10, B. C people began to settle and grow barley. They began to make beer and believed that it was a gift from gods. It was used to preserve foods and to create more nutritious foods from less desirable ingredients. Vitamins are produced through fermentation by microorganisms making the end product more nutritious. Pickling Pickling occurs when foods are placed in a container with vinegar or another acid. It is thought that pickling came about when people used to place food in wine or beer to preserve it due to them having a low pH. Containers had to be stoneware or glass vinegar will dissolve metal from pots. After the food was eaten, the pickling brine had other uses. It was very concentrated and the dish that it would be used in would only need a few drops to get the fish taste. Due to new foods arriving from Europe in the 16th century, food preservation increased. Ketchup originated from Europe as an oriental fish brine and when it made it to America, sugar was added. Pickling sauces were soon part of many recipes such as chutneys, relish, piccalilli, mustard, and ketchup when different spices were added to them. Curing food preservation and Salting food The beginning of curing was done through dehydration. Salting was used by early cultures to help desiccate foods. Many different salts were used from different places such as rock salt, sea salt, spiced salt, etc.. People began to experiment and found in the s that some salts gave meat an appealing red color instead of the grey that they were used to. During their experimenting in the s they realized this mixture of salts were nitrates saltpeter that prevented Clostridium botulinum growth. Fruit preserves The early cultures also used honey or sugar as a preservative. Greece used a quince and honey mixture with a slight amount of drying and then tightly packed into jars. The Romans used the same technique but instead cooked the honey and quince mixture to make a solid texture. The Indian and Oriental traders brought sugarcane to the northern climates where housewives were then able to learn to make preservatives by heating fruit with the sugarcane. Canning Canning started in from a French confectioner, Nicolas Appert , when he found that by applying heat to food in sealed glass bottles, the food is free from spoilage. Even though Appert found a method that worked, he did

not understand why it worked because many believed that the lack of air caused the preservation. Different foods are placed into jars or cans and heated to a microorganism and enzyme inactivating temperature. They are then cooled forming a vacuum seal which prevents microorganisms from contaminating the foods. This may be true, but the occurrence of illnesses, hospitalizations, and deaths are still high. It is estimated by the Center for Disease Control CDC that each year there are 76 million illnesses, , hospitalizations, and 5, deaths linked to food-borne illness. Artificial preservatives meet some of these challenges by preserving freshness for longer periods of time, but these preservatives can cause negative side-effects as well. Sodium nitrite is a preservative used in lunch meats, hams , sausages , hot dogs , and bacon to prevent botulism. It serves the important function of controlling the bacteria that cause botulism , but sodium nitrite can react with proteins , or during cooking at high heats, to form carcinogenic N-nitrosamines. For over 30 years, there has been a debate about whether or not preservatives and other food additives can cause hyperactivity. Studies have found that there may be increases in hyperactivity amongst children who consume artificial colorings and benzoate preservatives and who are already genetically predisposed to hyperactivity, but these studies were not entirely conclusive. Hyperactivity only increased moderately, and it was not determined if the preservatives, colorings, or a combination of the two were responsible for the increase. The Chemistry of Food Additives and Preservatives. Chemical and Engineering News. Retrieved 9 February The Science of Keeping Food Safe. The Chemistry of Household Ingredients. Progress in Food Preservation. Journal of Food Science. National Journal of Community Medicine, 4 3 ,

Chapter 4 : Preservative | food processing | calendrierdelascience.com

Food preservation prevents the growth of microorganisms (such as yeasts), or other microorganisms (although some methods work by introducing benign bacteria or fungi to the food), as well as slowing the oxidation of fats that cause rancidity.

Every manufacturer adds food preservative to the food during processing. The purpose is generally to avoid spoilage during the transportation time. Food is so important for the survival, so food preservation is one of the oldest technologies used by human beings to avoid its spoilage. Different ways and means have been found and improved for the purpose. Sugar, mineral salt and salt are also often used as preservatives food. Nuclear radiation is also being used now as food preservatives. Modified packaging techniques like vacuum packing and hypobaric packing also work as food preservatives. Food Preservation is basically done for three reasons To preserve the natural characteristics of food To preserve the appearance of food To increase the shelf value of food for storage. Natural Food Preservatives In the category of natural food preservatives comes the salt, sugar, alcohol, vinegar etc. These are the traditional preservatives in food that are also used at home while making pickles, jams and juices etc. Also the freezing, boiling, smoking, salting are considered to be the natural ways of preserving food. Coffee powder and soup are dehydrated and freeze-dried for preservation. In this section the citrus food preservatives like citrus acid and ascorbic acid work on enzymes and disrupt their metabolism leading to the preservation. Sugar and salt are the earliest natural food preservatives that very efficiently drops the growth of bacteria in food. To preserve meat and fish, salt is still used as a natural food preservative. Chemical Food Preservative Chemical food preservatives are also being used for quite some time now. They seem to be the best and the most effective for a longer shelf life and are generally fool proof for the preservation purpose. Examples of chemical food preservatives are: Benzoates such as sodium benzoate, benzoic acid Nitrites such as sodium nitrite Sulphites such as sulphur dioxide Sorbates such as sodium sorbate, potassium sorbate Antioxidants are also the chemical food preservatives that act as free radical scavengers. In this category of preservatives in food comes the vitamin C, BHA butylated hydroxyanisole , bacterial growth inhibitors like sodium nitrite, sulfur dioxide and benzoic acid. Then there is ethanol that is a one of the chemical preservatives in food, wine and food stored in brandy. Unlike natural food preservatives some of the chemical food preservatives are harmful. Sulfur dioxide and nitrites are the examples. Sulfur dioxide causes irritation in bronchial tubes and nitrites are carcinogenic. Artificial Preservatives Artificial preservatives are the chemical substances that stops of delayed the growth of bacteria, spoilage and its discoloration. These artificial preservatives can be added to the food or sprayed on the food. Types of Artificial Preservatives Food Antimicrobial agents.

Chapter 5 : Food Preservatives - How Safe Are They?

Sulfites: These preservatives are used to stop the browning and discoloration of food, but have been linked to an asthma-related sensitivity and allergy in some cases Clinical effects of sulfite.

Preservative food additives can be antimicrobialâ€”which inhibit the growth of bacteria or fungi , including mold â€”or antioxidant , such as oxygen absorbers , which inhibit the oxidation of food constituents. Common antimicrobial preservatives include calcium propionate , sodium nitrate , sodium nitrite , sulfites sulfur dioxide , sodium bisulfite , potassium hydrogen sulfite , etc. Other preservatives include formaldehyde usually in solution , glutaraldehyde insecticide , ethanol , and methylchloroisothiazolinone. Food irradiation Irradiation of food [9] is the exposure of food to ionizing radiation. Multiple types of ionizing radiation can be used, including beta particles high-energy electrons and gamma rays emitted from radioactive sources such as cobalt or cesium Irradiation can kill bacteria, molds, and insect pests, reduce the ripening and spoiling of fruits, and at higher doses induce sterility. The technology may be compared to pasteurization ; it is sometimes called "cold pasteurization", as the product is not heated. Irradiation may allow lower-quality or contaminated foods to be rendered marketable. National and international expert bodies have declared food irradiation as "wholesome"; organizations of the United Nations , such as the World Health Organization and Food and Agriculture Organization , endorse food irradiation. Activists have also opposed food irradiation for other reasons, for example, arguing that irradiation can be used to sterilize contaminated food without resolving the underlying cause of the contamination. These are mainly spices and condiments , with an increasing segment of fresh fruit irradiated for fruit fly quarantine. Electroporation Pulsed electric field PEF electroporation is a method for processing cells by means of brief pulses of a strong electric field. PEF holds potential as a type of low-temperature alternative pasteurization process for sterilizing food products. In PEF processing, a substance is placed between two electrodes, then the pulsed electric field is applied. The electric field enlarges the pores of the cell membranes, which kills the cells and releases their contents. PEF for food processing is a developing technology still being researched. There have been limited industrial applications of PEF processing for the pasteurization of fruit juices. To date, several PEF treated juices are available on the market in Europe. For cell disintegration purposes especially potato processors show great interest in PEF technology as an efficient alternative for their preheaters. Potato applications are already operational in the US and Canada. Modified atmosphere Modifying atmosphere is a way to preserve food by operating on the atmosphere around it. Salad crops that are notoriously difficult to preserve are now being packaged in sealed bags with an atmosphere modified to reduce the oxygen O2 concentration and increase the carbon dioxide CO2 concentration. There is concern that, although salad vegetables retain their appearance and texture in such conditions, this method of preservation may not retain nutrients, especially vitamins. There are two methods for preserving grains with carbon dioxide. One method is placing a block of dry ice in the bottom and filling the can with the grain. Another method is purging the container from the bottom by gaseous carbon dioxide from a cylinder or bulk supply vessel. Carbon dioxide prevents insects and, depending on concentration, mold and oxidation from damaging the grain. Grain stored in this way can remain edible for approximately five years. This makes carbon dioxide preferable for fumigation in situations where a hermetic seal cannot be maintained. Controlled Atmospheric Storage CA: Oxygen levels in the sealed rooms are reduced, usually by the infusion of nitrogen gas, from the approximate 21 percent in the air we breathe to 1 percent or 2 percent. Humidity is maintained at 95 percent and carbon dioxide levels are also controlled. Exact conditions in the rooms are set according to the apple variety. Researchers develop specific regimens for each variety to achieve the best quality. Computers help keep conditions constant. The storage capacity study shows that 67 percent of that spaceâ€”enough for ,, boxes of applesâ€”is CA storage. This is a method of great antiquity, [22] as well as having modern equivalents. The success of the method relies on having the correct mix of sealing, grain moisture, and temperature. Nonthermal plasma This process subjects the surface of food to a "flame" of ionized gas molecules, such as helium or nitrogen. This causes micro-organisms to die off on the surface. Pascalization High-pressure food preservation or pascalization refers to the use of a food

preservation technique that makes use of high pressure. Some lactic acid bacteria manufacture nisin. It is a particularly effective preservative. Biopreservation Biopreservation is the use of natural or controlled microbiota or antimicrobials as a way of preserving food and extending its shelf life. Lactic acid bacteria have antagonistic properties that make them particularly useful as biopreservatives. When LABs compete for nutrients, their metabolites often include active antimicrobials such as lactic acid, acetic acid, hydrogen peroxide, and peptide bacteriocins. Some LABs produce the antimicrobial nisin , which is a particularly effective preservative. Using them in combination with other preservative techniques can effectively control spoilage bacteria and other pathogens, and can inhibit the activities of a wide spectrum of organisms, including inherently resistant Gram-negative bacteria. Hurdle technology Hurdle technology is a method of ensuring that pathogens in food products can be eliminated or controlled by combining more than one approach. These approaches can be thought of as "hurdles" the pathogen has to overcome if it is to remain active in the food. The right combination of hurdles can ensure all pathogens are eliminated or rendered harmless in the final product. Examples of hurdles in a food system are high temperature during processing, low temperature during storage, increasing the acidity , lowering the water activity or redox potential , and the presence of preservatives or biopreservatives. According to the type of pathogens and how risky they are, the intensity of the hurdles can be adjusted individually to meet consumer preferences in an economical way, without sacrificing the safety of the product.

Chapter 6 : Preservative | Definition of Preservative by Merriam-Webster

The preservative is commonly used in carbonated beverages, fruit juices, pickles, salsa and dip. According to Don Schaffner, a professor of food science at Rutgers University in New Jersey, sodium benzoate poses no health dangers when consumed in minimal amounts, and the concentrations used in food are low enough that they pose no risk.

Spoilage mechanisms Food spoilage may be defined as any change that renders food unfit for human consumption. These changes may be caused by various factors, including contamination by microorganisms, infestation by insects, or degradation by endogenous enzymes those present naturally in the food. In addition, physical and chemical changes, such as the tearing of plant or animal tissues or the oxidation of certain constituents of food, may promote food spoilage. Foods obtained from plant or animal sources begin to spoil soon after harvest or slaughter. The enzymes contained in the cells of plant and animal tissues may be released as a result of any mechanical damage inflicted during postharvest handling. These enzymes begin to break down the cellular material. The chemical reactions catalyzed by the enzymes result in the degradation of food quality, such as the development of off-flavours, the deterioration of texture, and the loss of nutrients. The typical microorganisms that cause food spoilage are bacteria e. Foods may be contaminated by microorganisms at any time during harvest, storage, processing, distribution, handling, or preparation. The primary sources of microbial contamination are soil, air, animal feed , animal hides and intestines, plant surfaces, sewage, and food processing machinery or utensils. Bacteria Bacteria are unicellular organisms that have a simple internal structure compared with the cells of other organisms. The increase in the number of bacteria in a population is commonly referred to as bacterial growth by microbiologists. This growth is the result of the division of one bacterial cell into two identical bacterial cells, a process called binary fission. Under optimal growth conditions, a bacterial cell may divide approximately every 20 minutes. Thus, a single cell can produce almost 70 billion cells in 12 hours. The factors that influence the growth of bacteria include nutrient availability, moisture, pH, oxygen levels, and the presence or absence of inhibiting substances e. The nutritional requirements of most bacteria are chemical elements such as carbon, hydrogen, oxygen, nitrogen , phosphorus, sulfur, magnesium, potassium, sodium, calcium, and iron. The bacteria obtain these elements by utilizing gases in the atmosphere and by metabolizing certain food constituents such as carbohydrates and proteins. Temperature and pH play a significant role in controlling the growth rates of bacteria. Bacteria may be classified into three groups based on their temperature requirement for optimal growth: In addition, most bacteria grow best in a neutral environment pH equal to 7. Bacteria also require a certain amount of available water for their growth. The availability of water is expressed as water activity and is defined by the ratio of the vapour pressure of water in the food to the vapour pressure of pure water at a specific temperature. Therefore, the water activity of any food product is always a value between 0 and 1, with 0 representing an absence of water and 1 representing pure water. Most bacteria do not grow in foods with a water activity below 0. Growth may be controlled by lowering the water activityâ€”either by adding solutes such as sugar , glycerol, and salt or by removing water through dehydration. The oxygen requirements for optimal growth vary considerably for different bacteria. Some bacteria require the presence of free oxygen for growth and are called obligate aerobes , whereas other bacteria are poisoned by the presence of oxygen and are called obligate anaerobes. Facultative anaerobes are bacteria that can grow in both the presence or absence of oxygen. In addition to oxygen concentration, the oxygen reduction potential of the growth medium influences bacterial growth. The oxygen reduction potential is a relative measure of the oxidizing or reducing capacity of the growth medium. When bacteria contaminate a food substrate, it takes some time before they start growing. This lag phase is the period when the bacteria are adjusting to the environment. Following the lag phase is the log phase , in which population grows in a logarithmic fashion. As the population grows, the bacteria consume available nutrients and produce waste products. When the nutrient supply is depleted, the growth rate enters a stationary phase in which the number of viable bacteria cells remains the same. During the stationary phase, the rate of bacterial cell growth is equal to the rate of bacterial cell death. When the rate of cell death becomes greater than the rate of cell growth, the population enters the decline phase. A bacterial population is expressed either per gram or

per square centimetre of surface area. Rarely does the total bacterial population exceed cells per gram. A population of less than cells per gram does not cause any noticeable spoilage except in raw milk. Populations of between and cells per gram cause spoilage in some foods; for example, they can generate off-odours in vacuum-packaged meats. Populations of between and cells per gram produce off-odours in meats and some vegetables. When the conditions for bacterial cell growth are unfavourable e. Endospores are highly resistant to heat, chemicals, desiccation drying out , and ultraviolet light. The endospores may remain dormant for long periods of time. When conditions become favourable for growth e. Page 1 of 9.

Chapter 7 : Preservatives to keep foods longer â€“ and safer: (EUFIC)

Preservatives are a recurring topic in public discussions, and whenever it crops up, many consumers associate them with harmful, modern chemicals in foodstuffs. But, as a brief look back into the past will show, preservation of food was practised several hundred years ago when man first used salt.

Previous - Next Many chemicals will kill micro-organisms or stop their growth but most of these are not permitted in foods; chemicals that are permitted as food preservatives are listed in Table 5. Chemical food preservatives are those substances which are added in very low quantities up to 0. Preservation of food products containing chemical food preservatives is usually based on the combined or synergistic activity of several additives, intrinsic product parameters e. This approach minimises undesirable changes in product properties and reduces concentration of additives and extent of processing treatments. The concept of combinations of preservatives and treatments to preserve foods is frequently called the hurdle or barrier concept. Combinations of additives and preservatives systems provide unlimited preservation alternatives for applications in food products to meet consumer demands for healthy and safe foods. Chemical food preservatives are applied to foods as direct additives during processing, or develop by themselves during processes such as fermentation. Certain preservatives have been used either accidentally or intentionally for centuries, and include sodium chloride common salt , sugar, acids, alcohols and components of smoke. In addition to preservation, these compounds contribute to the quality and identity of the products, and are applied through processing procedures such as salting, curing, fermentation and smoking. This acid is the main product of many food fermentations; it is formed by microbial degradation of sugars in products such as sauerkraut and pickles. The acid produced in such fermentations decreases the pH to levels unfavourable for growth of spoilage organisms such as putrefactive anaerobes and butyric-acid-producing bacteria. Yeasts and moulds that can grow at such pH levels can be controlled by the inclusion of other preservatives such as sorbate and benzoate. Acetic acid is a general preservative inhibiting many species of bacteria, yeasts and to a lesser extent moulds. It is also a product of the lactic-acid fermentation, and its preservative action even at identical pH levels is greater than that of lactic acid. The main applications of vinegar acetic acid includes products such as pickles, sauces and ketchup. Citric acid is the main acid found naturally in citrus fruits; it is widely used in carbonated beverages and as an acidifying agent of foods because of its unique flavour properties. It has an unlimited acceptable daily intake and is highly soluble in water. It is a less effective antimicrobial agent than other acids. Ascorbic acid or vitamin C, its isomer isoascorbic or erythorbic acid and their salts are highly soluble in water and safe to use in foods. Sodium benzoate is a common preservative in acid or acidified foods such as fruit juices, syrups, jams and jellies, sauerkraut, pickles, preserves, fruit cocktails, etc. Yeasts are inhibited by benzoate to a greater extent than are moulds and bacteria. Sorbates are used for mould and yeast inhibition in a variety of foods including fruits and vegetables, fruit juices, pickles, sauerkraut, syrups, jellies, jams, preserves, high moisture dehydrated fruits, etc. Sodium and calcium sorbates also have preservative activities but their application is limited compared to that for the potassium salt, which is employed because of its stability, general ease of preparation and water solubility. Sulphur dioxide SO2 has been used for many centuries as a fumigant and especially as a wine preservative. Sulphur dioxide and its various sulphites dissolve in water, and at low pH levels yield sulphurous acid, bisulphite and sulphite ions. A pH dependent equilibrium is formed in water and the proportion of SO2 ions increases with decreasing pH values. At pH values less than 4. Sulphur dioxide is used as a gas or in the form of its sulphite, bisulphite and metabisulphite salts which are powders. The gaseous form is produced either by burning Sulphur or by its release from the compressed liquefied form. Metabisulphite are more stable to oxidation than bisulphites, which in turn show greater stability than sulphites. The antimicrobial action of sulphur dioxide against yeasts, moulds and bacteria is selective, with some species being more resistant than others. Sulphur dioxide and sulphites are used in the preservation of a variety of food products. In addition to its antimicrobial effects, sulphur dioxide is added to foods for its antioxidant and reducing properties, and to prevent enzymatic and non-enzymatic browning reactions. Carbon dioxide is used as a solid dry ice in many countries as a means of

low-temperature storage and transportation of food products. Beside keeping the temperature low, as it sublimes, the gaseous CO2 inhibits growth of psychrotrophic micro-organisms and prevents spoilage of the food fruits and vegetables, etc. Carbon dioxide is used as a direct additive in the storage of fruits and vegetables. The final result is an extended storage of the products for transportation and for consumption during the off-season. The various forms of chlorine constitute the most widely used chemical sanitiser in the food industry. These compounds are used as water adjuncts in processes such as product washing, transport, and cooling of heat-sterilised cans; in sanitising solutions for equipment surfaces, etc. Important applications of chlorine and its compounds include disinfection of drinking water and sanitation of food processing equipment. The efficiency is less if the product has been contaminated because of preliminary careless hygienic treatment or an incipient alteration. Therefore, with a low initial number of micro-organisms in the product, the preservative dosage level could be reduced. Therefore, the smaller the slicing of the product, the higher the preservative action. Preservative dispersion is slowed down by viscous foods concentrated fruit juices, etc. Usual accepted chemical food preservatives are detailed in Table 5.

Chapter 8 : Food Preservation | calendrierdelascience.com

Top 10 Toxic Foods, Preservatives & Additives. In this section of Seattle Organic Restaurants I'm going to talk about the top 10 toxic foods, preservatives & additives.. 1. Soft Drinks, Sport Drinks and Sugar Sweetened Beve.

Preservatives to keep foods longer â€" and safer Preservatives to keep foods longer â€" and safer Ingredients Additives 03 July Preservatives are a recurring topic in public discussions, and whenever it crops up, many consumers associate them with harmful, modern chemicals in foodstuffs. But, as a brief look back into the past will show, preservation of food was practised several hundred years ago when man first used salt salting and smoke curing to stop meat and fish from going bad. Despite a number of misgivings, preservatives have nowadays become an indispensable part of the food we eat. One reason for this is the increasing demand from consumers for greater choice, ease and convenience of foods, and our high standards of food safety. Why are foods preserved? Preservation is usually defined as a method used to maintain an existing condition or to prevent damage likely to be brought about by chemical oxidation , physical temperature, light or biological microorganisms factors. Preserving food, made it possible to have food available from harvest to the next year. The main function of preservation is thus to delay the spoiling of foodstuffs and to prevent any alterations in their taste or, in some cases, their appearance. This can be done in different ways, through processing methods including canning, dehydration drying , smoking and freezing; the use of packaging; and the use of food additives such as antioxidants or other preservatives. In this article we will focus on preservatives The primary reason for using preservatives is to make foods safer by eliminating the influence of biological factors. The greatest threat to consumers is that of food being spoiled, or from becoming toxic by the effect of micro-organisms e. How are foods conserved, and what substances are used? To delay the spoiling of foodstuffs by micro-organisms, anti-microbial substances are used which inhibit, delay or prevent the growth and proliferation of bacteria, yeasts and moulds. Sulphur compounds such as the sulphites E are used to inhibit the growth of bacteria e. Sorbic acid E can be used for many different purposes, including the preservation of potato products, cheese and jam. Another important group of substances consists of the nitrate and nitrite compounds E These are used as additives in meat products such as sausages and hams to protect against the bacterium that causes botulism Clostridium botulinum , and in this way they make a significant contribution to food safety. Benzoic acid and its calcium, sodium or potassium salts E are used as antibacterials and antifungals in foods such as pickled cucumbers, low sugar jams and jellies, dressings, condiments. Examples of widely used preservatives in the EU: E-Number Some foodstuffs in which they are used E Sorbic acid and sorbate compounds Cheese, wines, dried fruit, fruit sauces, toppings E Pickled vegetables, low sugar jams and jellies, candied fruits, semipreservedfish products, sauces E Sulphur dioxide and sulphite compounds Dried fruits, fruit preserves, potato products, wine E Surface treatment of cheese and sausage E Sausage, bacon, ham, foie gras, cheese, pickled herring The need for controls and labelling To ensure that preservatives really do help make foodstuffs safer, their use is subject to pre-market safety assessment and authorisation procedure. At the European level, the bodies responsible for the safety assessment, authorisation, control and labelling of preservatives and other additives are the European Food Safety Authority EFSA and the European Commission, Parliament and Council. Safety assessment of preservatives, as for the rest of food additives, is based on reviews of all available toxicological data, including observations in humans and in animal models. From the available data, a maximum level of an additive that has no demonstrable toxic effect is determined. The ADI provides a large margin of safety and refers to the amount of a food additive that can be taken daily in the diet, over a lifetime span, without any negative effect on health. There has been much public concern that some food additives cause adverse reactions, although careful investigations show that it is mostly based on misconception rather than on identifiable adverse reactions. Preservatives have rarely been shown to cause true allergic immunological reactions. Among the food additives reported to cause adverse reactions are some preservatives from the group of sulphiting agents, which include several inorganic sulphite additives E , and benzoic acid and its derivatives E , may trigger asthma characterised by breathing difficulties, shortness of breath, wheezing and coughing in sensitive e. The European Parliament together with the European Council

has laid down a detailed labelling system for food additives to enable consumers to make informed choices with regard to foods containing preservatives. Legislation also stipulates that additives are labelled on the packaging of food products by their category preservative, colour, antioxidant, etc with either their name or E-number. Summary Preservatives are still necessary to ensure the safety and variety of different foodstuffs available. They function through delaying the spoiling of foodstuffs and preventing any alterations in their taste or appearance. Their assessment and use in foodstuffs is tightly controlled at both the European and the international level. More information General information on food additives rules on labelling of additives, intake, etc:

Chapter 9 : Food preservation - Wikipedia

Chemical preservatives like sulfur dioxide help keep food fresh. Of the 32 ingredients in my favorite type of granola bar (oatmeal raisin), one is labeled as a preservative, although a few other ingredients also inhibit decay.

Food preservation The term food preservation refers to any one of a number of techniques used to prevent food from spoiling. It includes methods such as canning, pickling, drying and freeze-drying, irradiation, pasteurization , smoking, and the addition of chemical additives. Food preservation has become an increasingly important component of the food industry as fewer people eat foods produced on their own lands, and as consumers expect to be able to purchase and consume foods that are out of season. The vast majority of instances of food spoilage can be attributed to one of two major causes: The various methods that have been devised for preserving foods are all designed to reduce or eliminate one or the other or both of these causative agents. For example, a simple and common method of preserving food is by heating it to some minimum temperature. This process prevents or retards spoilage because high temperatures kill or inactivate most kinds of pathogens. These compounds are known to act as antioxidants, preventing chemical reactions that cause the oxidation of food that results in its spoilage. Almost all techniques of preservation are designed to extend the life of food by acting in one of these two ways. The search for methods of food preservation probably can be traced to the dawn of human civilization. People who lived through harsh winters found it necessary to find some means of insuring a food supply during seasons when no fresh fruits and vegetables were available. Evidence for the use of dehydration drying as a method of food preservation, for example, goes back at least 5, years. Among the most primitive forms of food preservation that are still in use today are such methods as smoking, drying, salting, freezing, and fermenting. Early humans probably discovered by accident that certain foods exposed to smoke seem to last longer than those that are not. Meats, fish, fowl, and cheese were among such foods. It appears that compounds present in wood smoke have antimicrobial actions that prevent the growth of organisms that cause spoilage. Today, the process of smoking has become a sophisticated method of food preservation with both hot and cold forms in use. Hot smoking is used primarily with fresh or frozen foods, while cold smoking is used most often with salted products. The most advantageous conditions for each kind of smokingâ€”air velocity, relative humidity , length of exposure, and salt content, for exampleâ€”are now generally understood and applied during the smoking process. For example, electrostatic precipitators can be employed to attract smoke particles and improve the penetration of the particles into meat or fish. So many alternative forms of preservation are now available that smoking no longer holds the position of importance it once did with ancient peoples. More frequently, the process is used to add interesting and distinctive flavors to foods. Because most disease-causing organisms require a moist environment in which to survive and multiply, drying is a natural technique for preventing spoilage. Indeed, the act of simply leaving foods out in the sun and wind to dry out is probably one of the earliest forms of food preservation. Evidence for the drying of meats, fish, fruits, and vegetables go back to the earliest recorded human history. At some point, humans also learned that the drying process could be hastened and improved by various mechanical techniques. For example, the Arabs learned early on that apricots could be preserved almost indefinitely by macerating them, boiling them, and then leaving them to dry on broad sheets. The product of this technique, quamaradeen, is still made by the same process in modern Muslim countries. Today, a host of dehydrating techniques are known and used. The specific technique adopted depends on the properties of the food being preserved. For example, a traditional method for preserving rice is to allow it to dry naturally in the fields or on drying racks in barns for about two weeks. After this period of time, the native rice is threshed and then dried again by allowing it to sit on straw mats in the sun for about three days. Modern drying techniques make use of fans and heaters in controlled environments. Such methods avoid the uncertainties that arise from leaving crops in the field to dry under natural conditions. Controlled temperature air drying is especially popular for the preservation of grains such as maize, barley, and bulgur. Vacuum drying is a form of preservation in which a food is placed in a large container from which air is removed. Water vapor pressure within the food is greater than that outside of it, and water evaporates more quickly from the food than in a normal atmosphere. Vacuum drying is biologically

desirable since some enzymes that cause oxidation of foods become active during normal air drying. These enzymes do not appear to be as active under vacuum drying conditions, however. Two of the special advantages of vacuum drying are that the process is more efficient at removing water from a food product, and it takes place more quickly than air drying. In one study, for example, the drying time of a fish fillet was reduced from about 16 hours by air drying to six hours as a result of vacuum drying. Coffee drinkers are familiar with the process of dehydration known as spray drying. In this process, a concentrated solution of coffee in water is sprayed though a disk with many small holes in it. The surface area of the original coffee grounds is increased many times, making dehydration of the dry product much more efficient. Freeze-drying is a method of preservation that makes use of the physical principle known as sublimation. Sublimation is the process by which a solid passes directly to the gaseous phase without first melting. The food to be preserved by this method is first frozen and then placed into a vacuum chamber. Water in the food first freezes and then sublimes, leaving a moisture content in the final product of as low as 0. The precise mechanism by which salting preserves food is not entirely understood. It is known that salt binds with water molecules and thus acts as a dehydrating agent in foods. A high level of salinity may also impair the conditions under which pathogens can survive. In any case, the value of adding salt to foods for preservation has been well known for centuries. Sugar appears to have effects similar to those of salt in preventing spoilage of food. The use of either compound and of certain other natural materials is known as curing. A desirable side effect of using salt or sugar as a food preservative is, of course, the pleasant flavor each compound adds to the final product. Curing can be accomplished in a variety of ways. Meats can be submerged in a salt solution known as brine, for example, or the salt can be rubbed on the meat by hand. The injection of salt solutions into meats has also become popular. Food scientists have now learned that a number of factors relating to the food product and to the preservative conditions affect the efficiency of curing. Some of the food factors include the type of food being preserved, the fat content, and the size of treated pieces. Preservative factors include brine temperature and concentration, and the presence of impurities. Curing is used with certain fruits and vegetables, such as cabbage in the making of sauerkraut , cucumbers in the making of pickles , and olives. It is probably most popular, however, in the preservation of meats and fish. Honey-cured hams, bacon, and corned beef "corn" is a term for a form of salt crystals are common examples. Freezing is an effective form of food preservation because the pathogens that cause food spoilage are killed or do not grow very rapidly at reduced temperatures. The process is less effective in food preservation than are thermal techniques such as boiling because pathogens are more likely to be able to survive cold temperatures than hot temperatures. In fact, one of the problems surrounding the use of freezing as a method of food preservation is the danger that pathogens deactivated but not killed by the process will once again become active when the frozen food thaws. A number of factors are involved in the selection of the best approach to the freezing of foods, including the temperature to be used, the rate at which freezing is to take place, and the actual method used to freeze the food. The rate at which food is frozen is also a factor, primarily because of aesthetic reasons. The more slowly food is frozen, the larger the ice crystals that are formed. Large ice crystals have the tendency to cause rupture of cells and the destruction of texture in meats, fish, vegetables, and fruits. In order to deal with this problem, the technique of quick-freezing has been developed. In quick-freezing, a food is cooled to or below its freezing point as quickly as possible. The product thus obtained, when thawed, tends to have a firm, more natural texture than is the case with most slow-frozen foods. About a half dozen methods for the freezing of foods have been developed. One, described as the plate, or contact, freezing technique, was invented by the American inventor Charles Birdseye in In this method, food to be frozen is placed on a refrigerated plate and cooled to a temperature less than its freezing point. Alternatively, the food may be placed between two parallel refrigerated plates and frozen. Another technique for freezing foods is by immersion in very cold liquids. At one time, sodium chloride brine solutions were widely used for this purpose. More recently, liquid nitrogen has been used for immersion freezing. As with most methods of food preservation, freezing works better with some foods than with others. Fish, meat, poultry, and citrus fruit juices such as frozen orange juice concentrate are among the foods most commonly preserved by this method. Fermentation is a naturally occurring chemical reaction by which a natural food is converted into another form by pathogens. It is a process in which food spoils, but

results in the formation of an edible product. Perhaps the best example of such a food is cheese. Fresh milk does not remain in edible condition for a very long period of time. Its pH is such that harmful pathogens begin to grow in it very rapidly. Early humans discovered, however, that the spoilage of milk can be controlled in such a way as to produce a new product, cheese. Bread is another food product made by the process of fermentation. Flour, water, sugar, milk, and other raw materials are mixed together with yeasts and then baked. The addition of yeasts brings about the fermentation of sugars present in the mixture, resulting in the formation of a product that will remain edible much longer than will the original raw materials used in the bread-making process. Heating food is an effective way of preserving it because the great majority of harmful pathogens are killed at temperatures close to the boiling point of water. In this respect, heating foods is a form of food preservation comparable to that of freezing but much superior to it in its effectiveness. A preliminary step in many other forms of food preservation, especially forms that make use of packaging, is to heat the foods to temperatures sufficiently high to destroy pathogens. In many cases, foods are actually cooked prior to their being packaged and stored. In other cases, cooking is neither appropriate nor necessary. The most familiar example of the latter situation is pasteurization. During the s, the French bacteriologist Louis Pasteur discovered that pathogens in foods could be destroyed by heating those foods to a certain minimum temperature.