A new organic way to keep food fresh

KEEP your FOOD *edible*

With

BFRESH

A NEW ORGANIC WAY TO KEEP FOOD FRESH

TABLE OF CONTENTS

DESCRIPTION

In the section below, we will discuss the problem that companies face in preparing, packaging and distributing their products to consumers. We highlight the losses that companies and consumers endure due to food loss and reasons behind such losses. We will also discuss the current techniques that are used to prevent food spoilage and decay and offer an innovative method that we have developed to increase the food shelf life and its advantages both for companies and consumers.

CROP AND POST-HARVEST FOOD LOSS

Both quantitative and qualitative food losses occur from harvesting, to handling, storage, processing and marketing, and the final delivery of the products to the consumer. The latest published values indicate that, each year, industrialized and developing countries dispose of roughly similar quantities of spoiled food. In developed countries the losses occur at the retailer and consumer levels. However in the developing countries, because of poor infrastructure, low levels of technology, and low investment in food production systems, the losses occur during the production, harvest, post-harvest and processing phases.

The post-harvest losses of fruits and vegetables account for almost 50% of the produce. The average rate of loss for individual fresh fruit, vegetable, meat, and poultry commodities at the supermarket level, as estimated by the Perishables Group, Inc., in the years 2005-2006 varied from 0.6 percent for sweet corn to 63.6 percent for mustard greens. The study showed the impact on per capita estimates varied broadly among various commodities. Annual supermarket losses in 2006 were 8.4 to 51 per cent for fresh fruit and averaged 11.4 percent for fresh fruit, 9.7 percent for fresh vegetables, and 4.5 percent for fresh meat, poultry, and seafood.

Food and Agricultural Organization (FAO) of the United Nations estimates that 25 to 35 percent of world food production is lost through natural causes such a pests, microbes, and insects. The post-harvest losses of cereals are estimated at 30 percent, fruits and vegetables at 20 to 40 percent, and up to 50 percent for fish. Some products in Africa suffer post-harvest losses as high as 50 percent. One of the best responses to the problem of the world hunger is preservation of what has already been grown. If post-harvest losses worldwide could be minimized, food supply gains could be made without allocation of additional resources.

The softening that accompanies ripening of fruits enhances fruit damage during shipping and handling processes. This softening plays a major role in determining the cost factor, because it has a direct impact on palatability, consumer acceptability, shelf life, and post-harvest disease/pathogen resistance. Generally, reduction in fruit firmness due to softening is accompanied by increased expression of cell wall–degrading enzymes.

Each year, a large amount of crops are lost due to attacks by pest and parasites such as *Synchytrium endobioticum, Ceratostomella ulmi, Phytophthora infestans, Puccinia graminis, Pseudotsuga taxifolia Pseudotsuga menziesii], Phaeocryptopus gaeumanni, Actinomyces scabies Streptomyces scabiei, Puccinia glumarum Puccinia striiformis, Ustilago spp., Fusarium spp., Ophiobolus graminis Gaeumannomyces graminis, Leptosphaeria herpotrichoides, Claviceps purpurea*. For this reason, farmers use a variety of pesticides, substances or mixture of substances that intend to prevent, destroy, repell or mitigate pests and growth of microorganisms on crops. Pesticides include herbicides that destroy weeds and other unwanted vegetations, insecticides that control a wide variety of insects, fungicides that prevent the growth of molds and mildew, disinfectants that prevent the spread of bacteria, and chemicals that control mice and rats. Due to such a widespread use of chemicals in food protection, people consume residues of pesticides which are left on or within food. There is as yet no clear understanding of the health effects of these pesticide residues. Results from ongoing studies on pesticide exposures show that farmers who use agricultural insecticides experience an increase frequency of headaches, fatigue, insomnia, dizziness, hand tremors, and other neurological symptoms. Pesticide exposure causes from simple irritation of the skin and eyes to more severe effects such as those that affect the nervous system, those that cause reproductive problems, and also cancer. There is a positive association between pesticide exposure and development of non-Hodgkin lymphoma and leukemia as well as neurological, birth defects, fetal death and neurodevelopmental disorder.

The problems of food production, processing and storage, therefore, require a continuing search for effective, technically and economically feasible alternative methods of food preservation.

FOOD SPOILAGE

Spoilage is a process of food deterioration that reduces the edibility of food. Ultimately, food that is partially or completely spoiled is often totally un-edible. Food that is capable of such spoilage is referred to as “perishable.” Degradation, loss of color and flavor dissipation of freshly cut plant parts are known to be caused by the occurrence of oxidation, enzymes, microbes, and metal ions. Autolysis, the process that is largely responsible for the change of color, texture, and flavor of food over time, occurs because of naturally occurring enzymes in all plants and animals. Atmospheric oxygen can also react with some food components which can increase the level of rancidity or change in color of food. Finally, infestations (invasions) by insects and rodents account for huge losses in food stocks.

Among causes that spoil food; **the growth of microorganisms – including bacteria and yeast (mold) – on food products is the primary cause of food spoilage**. Some of these bacteria such as *E. coli* or *Salmonella* directly threaten human health. Foods with a high sugar content are susceptible to growth of yeast. Microorganisms including bacteria and yeast break down food and produce by-products such as acids that make food less edible. As such, affected foods will acquire a change in taste, texture, aroma, and color. Spoiled, un-cooked, or under-cooked animal flesh is typically quite toxic, and its consumption can result in serious illness or death. The toxic effect that results from the consumption of spoiled food is known as "food poisoning" or "food borne illness."

FOOD DECAY

Food decay is a process that includes putrefaction, fermentation and rancidity. **Putrefaction** is one of seven stages in the decomposition of the body of a dead animal. **Fermentation** is a metabolic process whereby electrons released from nutrients are ultimately transferred to molecules obtained from the breakdown of the same nutrients. **Rancidification** results from chemical decomposition of fats, oils and other lipids. There are three types of rancidity: ester hydrolytic, oxidative and microbial. Hydrolytic rancidity occurs when water splits fatty acid chains away from the glycerol backbone in triglycerides (fats). Because most fatty acids are odorless and tasteless, this process will usually go unnoticed. However, when the triglyceride is derived from short chain fatty acids, the released carboxylic acid can confer strong flavors and odors; this can be observed in butter, which has a high content of butyric acid derivatives. Oxidative rancidity is associated primarily with the degradation of unsaturated fat by oxygen. During this process, the double bonds of an unsaturated fatty acid undergo cleavage, releasing volatile aldehydes and ketones. This process can be suppressed by the exclusion of oxygen or by the addition of antioxidants. Microbial rancidity refers to a process by which lipases in the microorganisms break down fat. This pathway is currently prevented by sterilization. Generally, food decay as a result of these processes leads to undesirable odors and flavors. In processed meats, these flavors are collectively known as warmed over flavor. Rancidification reduces the nutritional value of the food. Some vitamins are highly sensitive to such degradation processes.

PRESERVATION OF FOOD

The preservation of food has been a great concern of mankind since the dawn of civilization. During early civilization, food preservation processes were mainly limited to smoking or curing with salt. With the advent of the industrial revolution and the discovery that food spoilage was due to the activity of living microorganisms such as bacteria, yeast or molds, the art of preserving food developed rapidly. Due to the health hazards that spoiled food poses, there is a great interest in preserving food and preventing its spoilage. A number of methods have been devised that prevent or slow the process of food spoilage, including the use of techniques that expand the shelf life of food and prolong the duration that food can be consumed. Acidulants are known to prevent microbial degradation by maintaining a relatively low pH environment, but their effectiveness is limited to temporary conservation.

Present day methodologies for preserving food include sterilization by heat, refrigeration, pickling and the addition of chemical preservatives, Ohmic heating and dielectric heating, which includes radio frequency (RF) and microwave (MW) heating as well as non-thermal processing. Among other methods are freezing, vacuum sealing (removes oxygen required for growth of microorganisms), or drying which by removing water prevents the growth of microorganisms. All these techniques allow for a longer term food storage.

Sterilization by heat is useful since it provides complete destruction of all bacterial life forms. However, heat sterilization is not well-suited for treating heat sensitive food stuffs such as vegetables or fruits. Furthermore, heat sterilization does not prevent subsequent attacks by bacteria. Preservation of food by refrigeration requires the continued operation of refrigeration systems. Drying of food by processes such as freeze-drying is an effective food preservation process; however, such drying techniques require specialized equipment and are not well suited for many types of foods. The use of chemical preservatives is also a popular food preservation technique; they can be added to many different types of food stuffs and do not require special processing equipment or continuous attention (as opposed to freeze-drying or refrigeration, which require energy, equipment and attention). The use of chemical preservatives, however, is undesirable since the chemical adulterants incorporated into the food may be harmful to the human body.

One process which has been widely used involves preserving food by storage in an atmosphere of gaseous ethanol. Although the storage of food in an ethanol vapor atmosphere has been found effective in preserving a wide variety of foods, further improvements are necessary with regards to preserving high moisture foods, such as fresh meat and fresh fish. In order to completely prevent the growth of microrganisms in fresh meat and fish, a high concentration of ethanol vapors in the atmosphere surrounding the fish is necessary. As a result, the meat and fish become tainted with the odor of ethanol. Although the partial absorption of ethanol by the meat or fish is not a health hazard, it does produce a bad taste in the meat or fish.

Sulfiting agents including sulfur dioxide, sodium sulfite, sodium and potassium bisulfite and sodium and potassium metabisulfite when added to the food possess the ability to preserve vegetable food products. These products have been used particularly in the restaurant industry. Sulfites have also been employed as preservatives in prepared foods such as flavored beverages, syrup concentrates, wine and vinegar as well as in the processing of sugar, corn starch and shrimp. Sulfiting of fresh food such as whole peeled potatoes results only in a shelf life (at 8° C) for up to ten days. Moreover, allergic reactions to these compounds and sometimes death have been reported. As a result of such occurrences, the U.S. Government Food and Drug Administration (FDA) has removed the use of sulfites on raw foods and vegetables as "generally recognized as safe" (GRAS) and has imposed labeling requirements for direct or indirect additions of sulfites on packaged food. As such, the use of sulfiting agents has fallen into disfavor.

Ohmic heating and dielectric heating, which includes radio frequency (RF) and microwave (MW) heating, are promising alternatives to conventional methods of heat processing. However, such technologies do not lend themselves to preservation of foods that can not be heated prior to consumption. To avoid the deleterious effects of heat on flavor, color and nutritive value of foods, other methods are developed. Among these, the term 'non-thermal processing' is often used to designate technologies that are effective at ambient or sublethal temperatures. High hydrostatic pressure, pulsed electric fields, high-intensity ultrasound, ultraviolet light, pulsed light, ionizing radiation and oscillating magnetic fields have the ability to inactivate microorganisms only to varying degrees. These novel technologies are still struggling with full industrial application. For example, irradiation has a high potential and is probably one of the most versatile among the food preservation technologies. However, its development and commercialization has been hampered because it leads to the development of radiolytic compound within the food and unfavorable public attitude to their use. Pulsed Light is also considered an emerging, non-thermal technology capable of reducing the microbial population on the surface of foods and food contact materials by using short and intense pulses of light in the Ultraviolet Near Infrared (UV–NIR) range. Pulsed Light has a relatively low operation costs and does not significantly contribute negatively to the environmental impact of the processes where it is included because it has the potential to eliminate microorganisms without the need for chemicals. The most extensively researched and promising non-thermal processes for preservation of foods appear to be pulsed electric fields (PEF) and high hydrostatic pressure (HHP) which are being commercially applied mostly for the processing of juices and other fruit-derived products microorganisms by using pressure rather than heat to achieve pasteurization. PEF inactivates microorganisms with minimal effects on the nutritional, flavor and functional characteristics of food products due to the absence of heat. PEF technology is based on the application of pulses of high voltage (typically 20–80 kV/cm) to the product which is placed between a pair of electrodes that confine the treatment gap of the PEF chamber. The large field intensities are achieved through storing a large amount of energy in a capacitor bank (a series of capacitors) from a direct current power supply, which is then discharged in the form of high voltage pulses. The pulse caused by the discharge of electrical energy from the capacitor is allowed to flow through the food material for an extremely short period of time (1–100 ls) and can be conducted at moderate temperatures for less than 1 second. When food is subjected to the electrical high-intensity pulses several events, such as resistance heating, electrolysis and disruption of cell membranes, occurs which all contribute to the inactivation of microorganisms.

The photobiological effects of light, including visible light (380-780 nm), near ultraviolet light (300-380 nm) and far ultraviolet light (190-300 nm), have been studied for many years, for example, as reported in Jagger, J., "Introduction to Research in Ultraviolet Photobiology", Prentice Hall, Inc., 1967, and efforts have been made to employ light to sterilize food products or containers for food products. U.S. Patent No. 2,072,417 describes illuminating substances, e.g., milk, with active rays, such as UV rays. U.S. Patent No. 3,817,703 describes sterilization of light-transmissive material using pulsed laser light. U.S. Patent No. 3,941,670 describes a method of sterilizing materials, including foodstuffs, by exposing the material to laser illumination to inactivate microorganisms. However, such methods have various deficiencies, such as limited throughput capacity, limited effectiveness, adverse food effects, inefficient energy conversion (electrical to light) and economic disadvantages.

Among several food preservation methods, change of the gaseous composition in contact with the food to be preserved are the most common. Changing the gaseous composition in contact with the food to be preserved is necessary, since air and humidity cause yeast and other microorganisms to grow on food, leading to a loss of flavor and aroma and changes in their color. A number of documents including WO 2008/094083, WO 2006/121540, WO2009100509A1, US 4971821, US 6579549, US 2064678, US 3477192, EP2138785 A2, describe change in gaseous compositions inside food packages. Among the gases being used are inert gases such as nitrogen, carbon dioxide, and argon. Such processes are applied in foods as alternatives to the expansion of the validity period and/or maintenance of the food quality throughout its validity period. However, these processes all entail multiple steps including heating, and other food processing steps, and require machinery and skilled personnel.

Thermal or non-thermal approaches used in the food industry, such as cooking, pasteurization, sterilization, drying, use of pulsed electrical fields, UV, ultrasound or other techniques, they all involve the consumption of a significant amount of diverse energy types that has markedly increased the footprint of the food industry. The preservation of liquid media by PEF was shown to cause operation costs that is about 10-fold higher than those needed for conventional thermal processing. Reduction of the use of non-renewable energy resources, lower emission of air pollutants such as CO_2, and increase of the energy efficiency of devices and processes utilizing renewable energy, is now a major concern for all processors. In addition, all these technologies require skilled use by professionals, are not applicable to all food categories, can not be applied during food transport or to storage of food within refrigerator and are not available for the consumer use. Clearly, methods and techniques that utilize low energy, and can be used during food transport and after purchase of the food by the consumer, will decrease food spoilage, increase food availability, lowers the cost of the food and decreases human morbidity and mortality from spoiled food.

OUR INNOVATION AND NEW IDEA ON FOOD PRESERVATION

We have developed a new method (Bfresh) for food preservation that is organic in nature. This method prevents fruit and vegetable ripening, decontaminates food from microorganisms it harbors, prevents food spoilage or decay, and prolongs food shelf life. Bfresh can substitute current methods of food preservation including those that require addition of preservatives, or the use of pasteurization, sterilization, cooking, drying, radiation, high frequency freezing, ultrasounds, high pressure processing, pulsed electric fields, pulsed light treatment, or cooling. The method preserves the natural characteristics of the food or processed food, such as flavor, aroma and texture, requires low energy and can be used by commercial companies as well as by end consumers. The process does not require special packaging or removal of air from package or changing the composition of food, and no special machinery or technical skill. Our innovative method can be applied to fruits, produce, plants, meat, poultry, fish, water or any other food product and is of low cost both to companies and to consumers and can decrease the food wastage, and consequently the food shortage and lowers the price of the food. We expect and anticipate that Bfresh can substitute or augment, most if not all other technologies and methods of food preservation that require preservatives, or special machinery, or skills and is likely to become acceptable to public due to its low cost and health benefits that it offers since current chemical preservatives are no longer required to keep food fresh.

The process that we have developed is safe, and harmless to the food and to the user and can be used from the post-harvest time, during transport, processing to distribution and sale of the food. The method is also in-expensive and highly reduces the cost of loss of revenue by companies due to food spoilage and decay or utilization of energy for food preservation across the globe. We anticipate that BFresh will become the gold standard in food industry and is likely to eradicate food shortage. BFresh will reduce the cost of food for the consumer, and will reduce the loss of revenue by farmers, producers, distributors and all other food companies.

Our technology is geared towards the use by large institutions, farmers and companies that grow, store, transport and sell food to consumers to the end users who utilize our method to preserve food and to increase the shelf life of the food in their homes. We have simplified our technology. Our products is available in different formats (tablet, film, paste, dried powder, paper, liner) depending on the particular use. The activation of “BFRESH” can be as simple as adding it to a container where food is stored with or without addition of water. Consumers also keep the BFRESH with their food within a closed container. The shelf life of the food is increased at any temperature as compared to the same items stored without our preservation method at the same temperature.

Compounds included in BFRESH act as follows:

1. Compound A. This compound is a dried food, vegetable, and seasoning in a special format that is conducive to various types of protection against one or a host of bacteria and/or fungi. The complexity of the compound can vary to provide the broadest protection against antimicrobial growth.
2. Compound B. This compound is an activator that activates the compound A.
3. Compound C. This compound can be water or oil.

PATENTS AND PUBLICATIONS

Patent pending.

COMMERCIALIZATION

We have started to reach out to the major food companies to determine whether they would like to implement this technique in their food production since their product can be considered for the first time to be organic due to non-use of preservatives. This will lead to a greater amount of sales to all consumers who prefer their food to be preservative free and organic in nature. So, not only adoption of this technique will reduce the loss of revenue by major companies due to food spoilage and decay, it will increase their sales across the globe.

We truly hope that your institution will give us the opportunity to meet you and present our data to you so that we can gauge your level of interest in our invention and help you to reduce any loss of revenue due to food spoilage, increase your revenue and give you the ability to sell your product as a preservative-free and organic food to your customers.

COMMERCIAL READINESS

The idea is ready to be implemented. Proof of concept is in place and all experimentations have been done and the patent is filed. We can share the data with you to show you the effectiveness of our method.

PROCESS FOR FURTHER DISCUSSION

We need to meet with the responsible individuals in your organization to present our data to convince you that the method that we have developed works well on a variety of food, vegetables and fruits. We also need to visit your current food processing techniques that you use. Following our examination of your current practices, we will prepare several ideas as how you can use our technology and refine it as required for your food preservation. Then, we will need your company to sign a licensing agreement with our firm in order for your company to start benefiting from our innovative idea. We do not need your firm to fund any part of our endeavors nor we need any help in manufacturing the materials. In fact, our firm, as part of the licensing agreement, will provide you with all that you need to use and implement our idea during the processing and distribution of your food.

ADDITIONAL INFORMATION

Data on food preservation and a PowerPoint presentation are included below for your perusal.

OTHER USES

Besides food preservation, our technology has many other uses due to its inherent disinfective and decontamination properties. These include among others

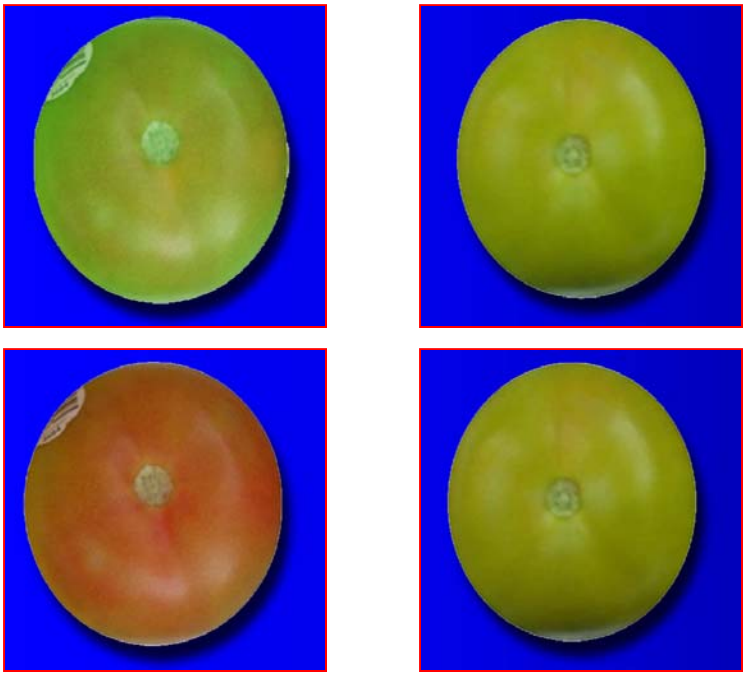
1. Providing fresh food in war theatre, in inter-planetary journeys or in remote sites
2. Creation of drinking water from contaminated water for cities across the globe and in remote areas
3. Changing the refrigerator of today to a new device capable of longer term storage as compared to mere 4C prevention that it currently offers
4. Providing sterilization of equipment, products and any item when autoclave is not available or not suitable such as sterilizing of medical instruments, devices that melt or disfigure at high temperature or in remote areas where sterilization is not available such as in war theatre
5. Providing sterilization at home, for example in shower area to rid the surfaces from microorganisms
6. Mouthwash
7. Hand sanitizer
8. Medical mask

Preservation of Tomato

Non-preserved | Preserved

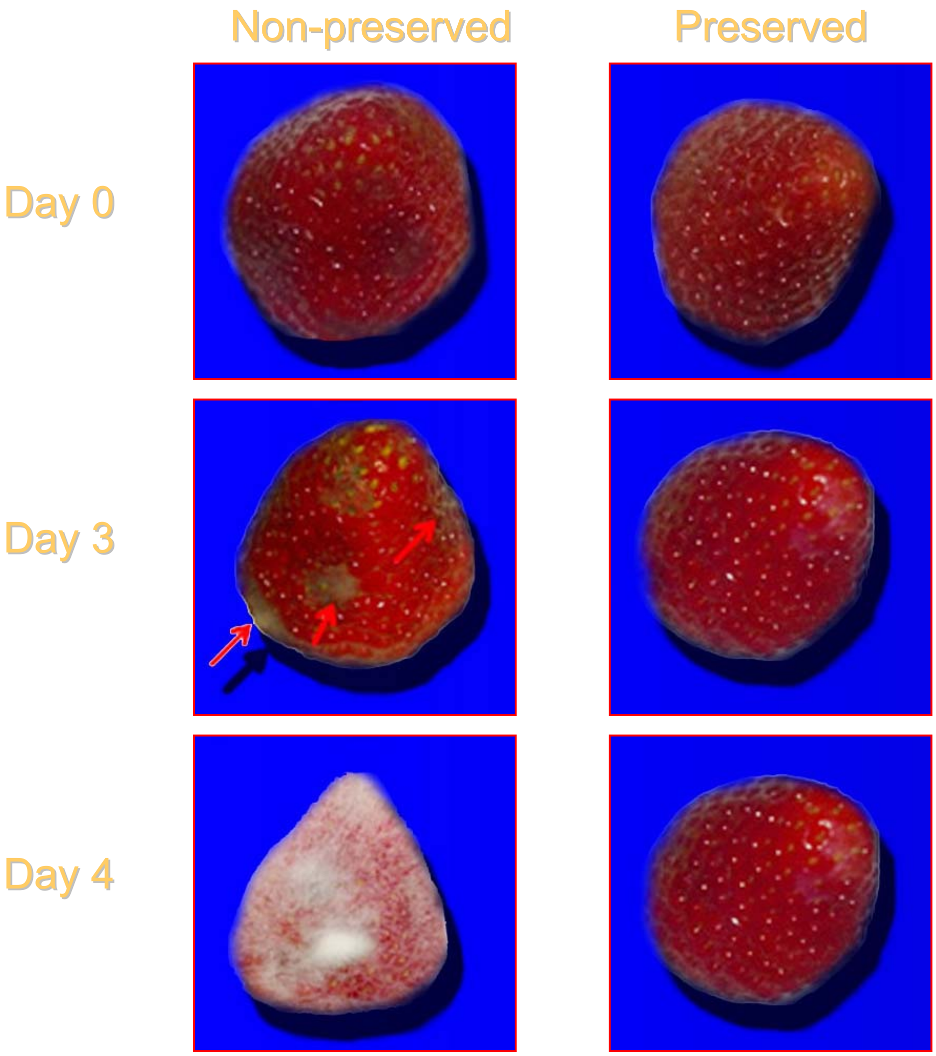
Day 0

Day 8



The non-preserved tomato shows evidence of ripening by day 8 while the preserved tomato shows little evidence of ripening.

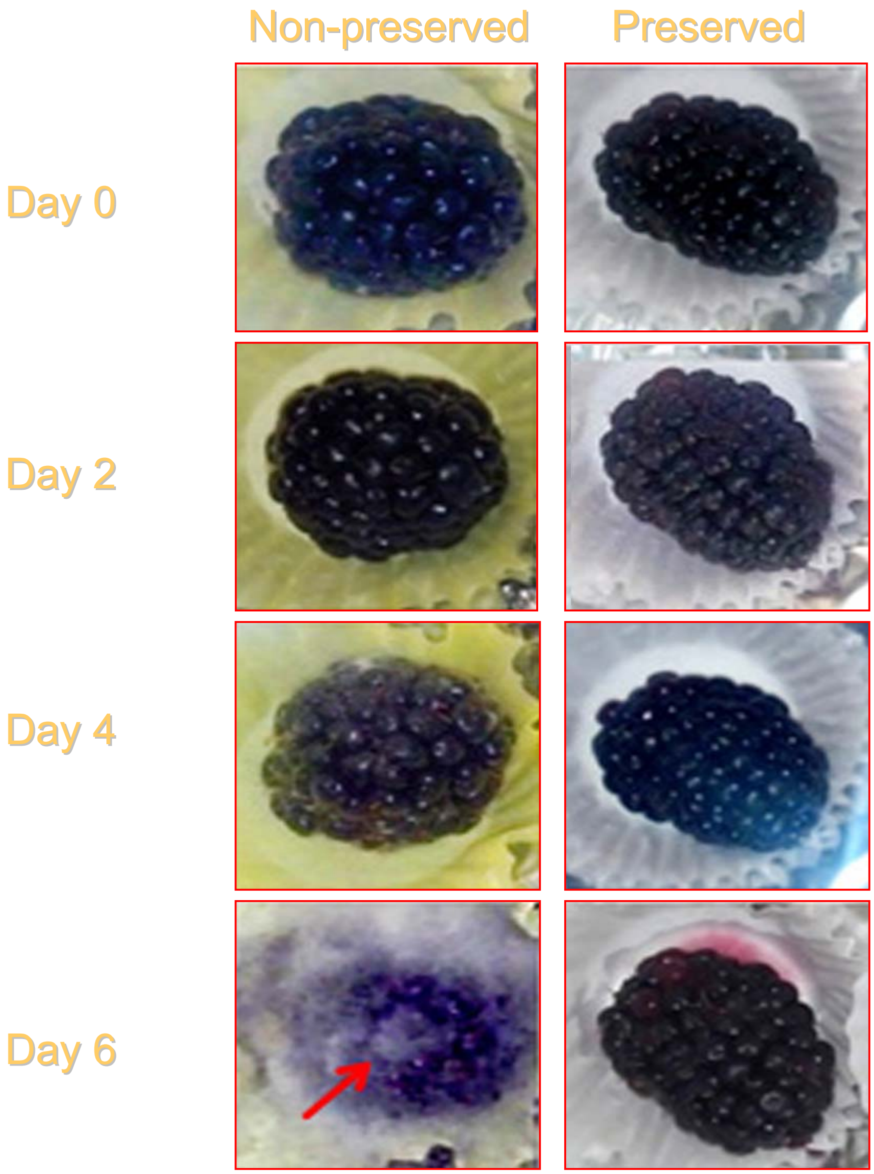
Preservation of Strawberry



Arrows point to the development of yeast on the surface of non-preserved strawberry on day 3.

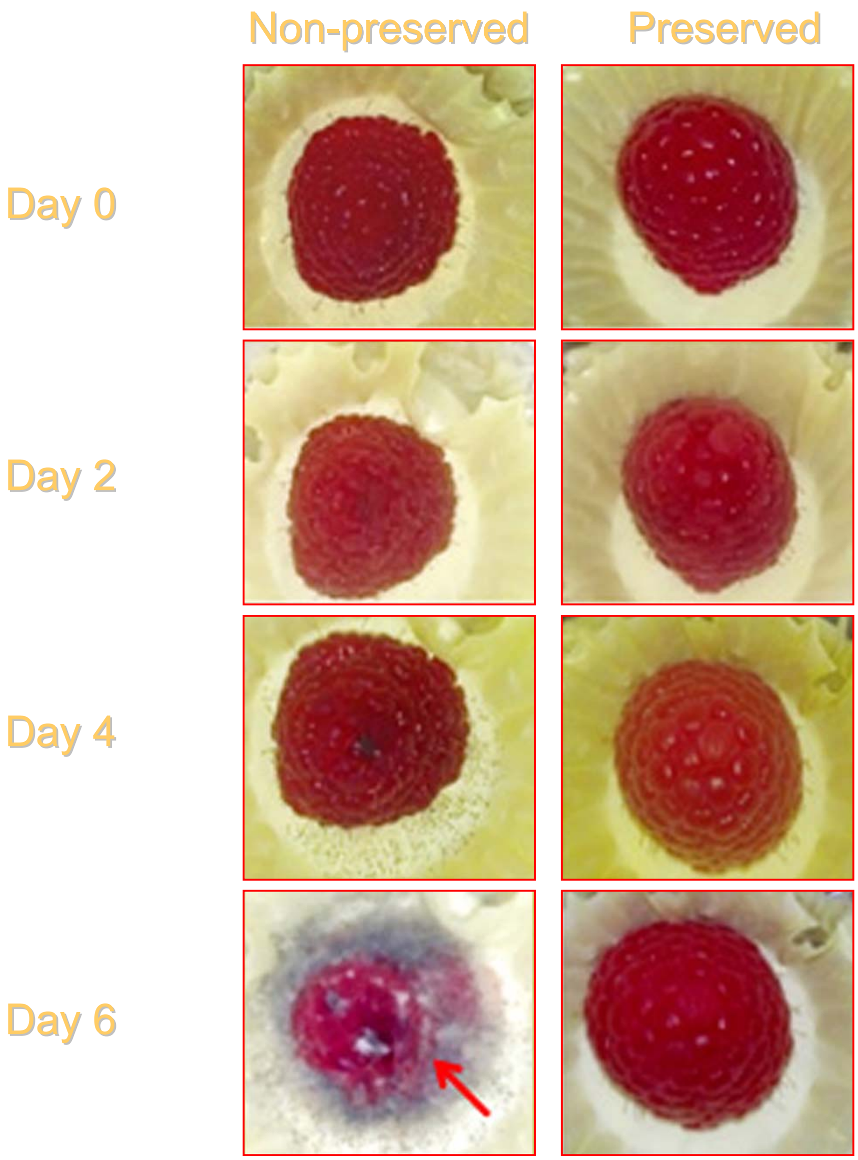
By day 4 the yeast has covered the non-preserved strawberry. There is preservation of freshness in the preserved fruit and no evidence of yeast growth on day 4.

Preservation of Blackberry



The non-preserved blackberry shows evidence of yeast growth by day 4 and is fully covered by yeast on day 6 (arrow). The preserved blackberry maintains its freshness on day 4 and shows no evidence of growth of yeast on day 6.

Preservation of Raspberry



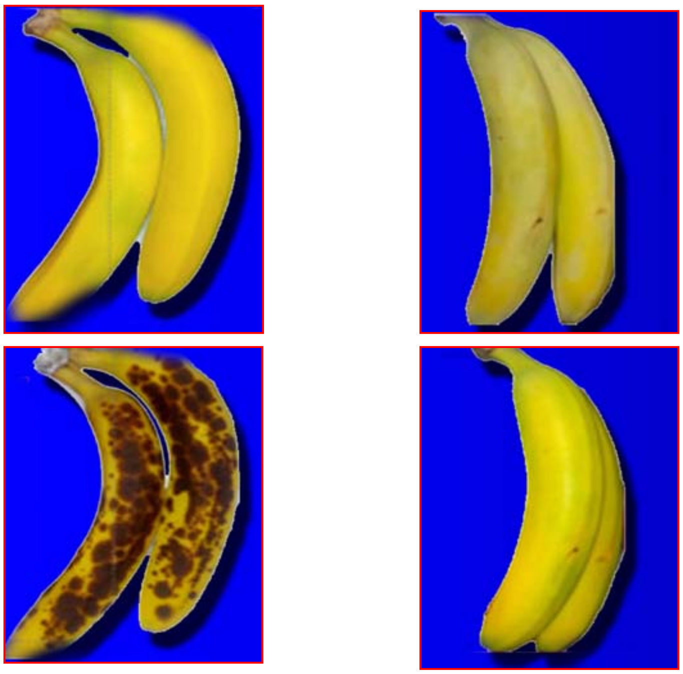
The non-preserved raspberry shows evidence of yeast growth by day 4 and is fully covered by yeast on day 6 (arrow). The preserved blackberry maintains its freshness on day 6 and shows no evidence of growth of yeast.

Preservation of Banana

Non-preserved | Preserved

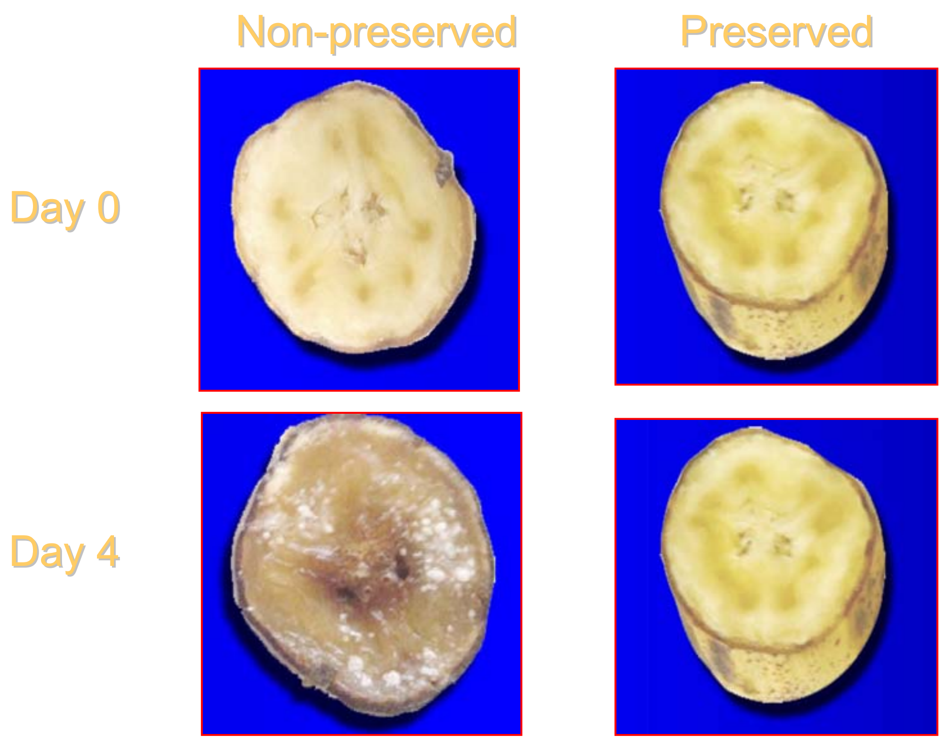
Day 0

Day 8



The non-preserved bananas show surface areas of brown discoloration while the preserved bananas have maintained their freshness and show no discoloration on day 8.

Preservation of Slice of Banana



The non-preserved slice of banana shows surface areas of brown discoloration and shows yeast on its surface on day 4. The preserved slice of banana does not show any change in color nor any evidence of yeast growth.

Preservation of Slice of Avocado

Non-preserved Preserved

Day 0

Day 4

By day 4 the yeast has covered the non-preserved slice of avocado. The preserved slice of avocado has slight discoloration but no evidence of yeast growth on day 4.

Preservation of Slice of Tomato

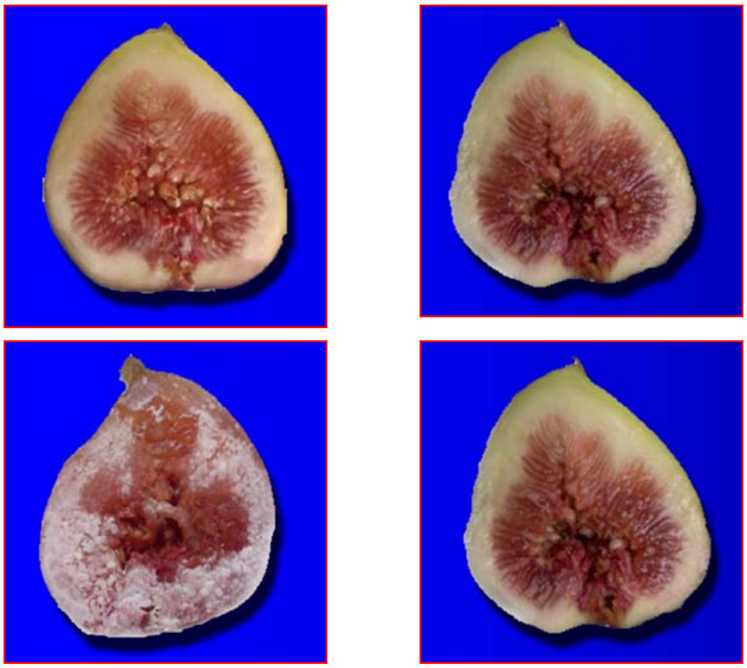
The non-preserved slice of tomato shows evidence of yeast growth by day 4 while the preserved slice maintains its freshness on day 4 and shows no evidence of growth of yeast.

Preservation of Slice of Fig

Non-preserved Preserved

Day 0

Day 4



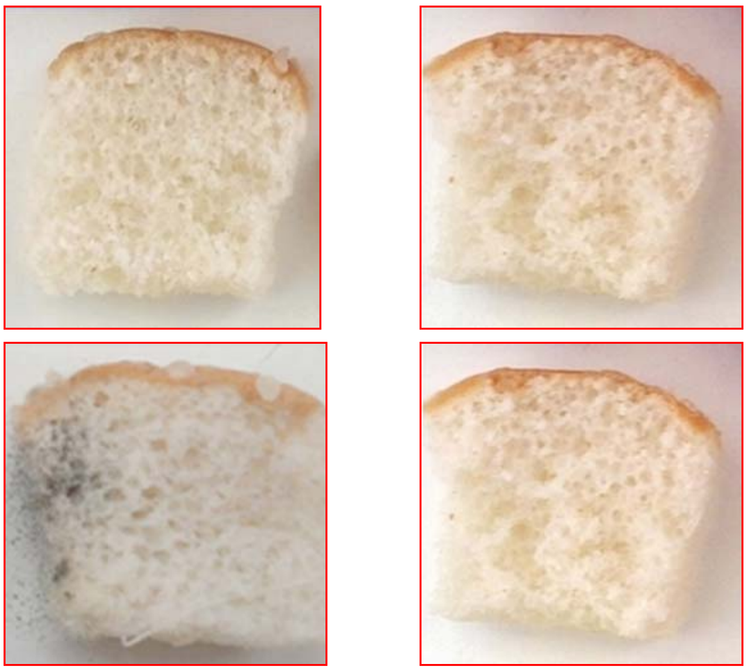
The non-preserved slice of fig shows evidence of yeast growth by day 4 while the preserved slice of fig maintains its freshness on day 4 and shows no evidence of growth of yeast.

Preservation of Slice of Bread

Non-preserved   Preserved

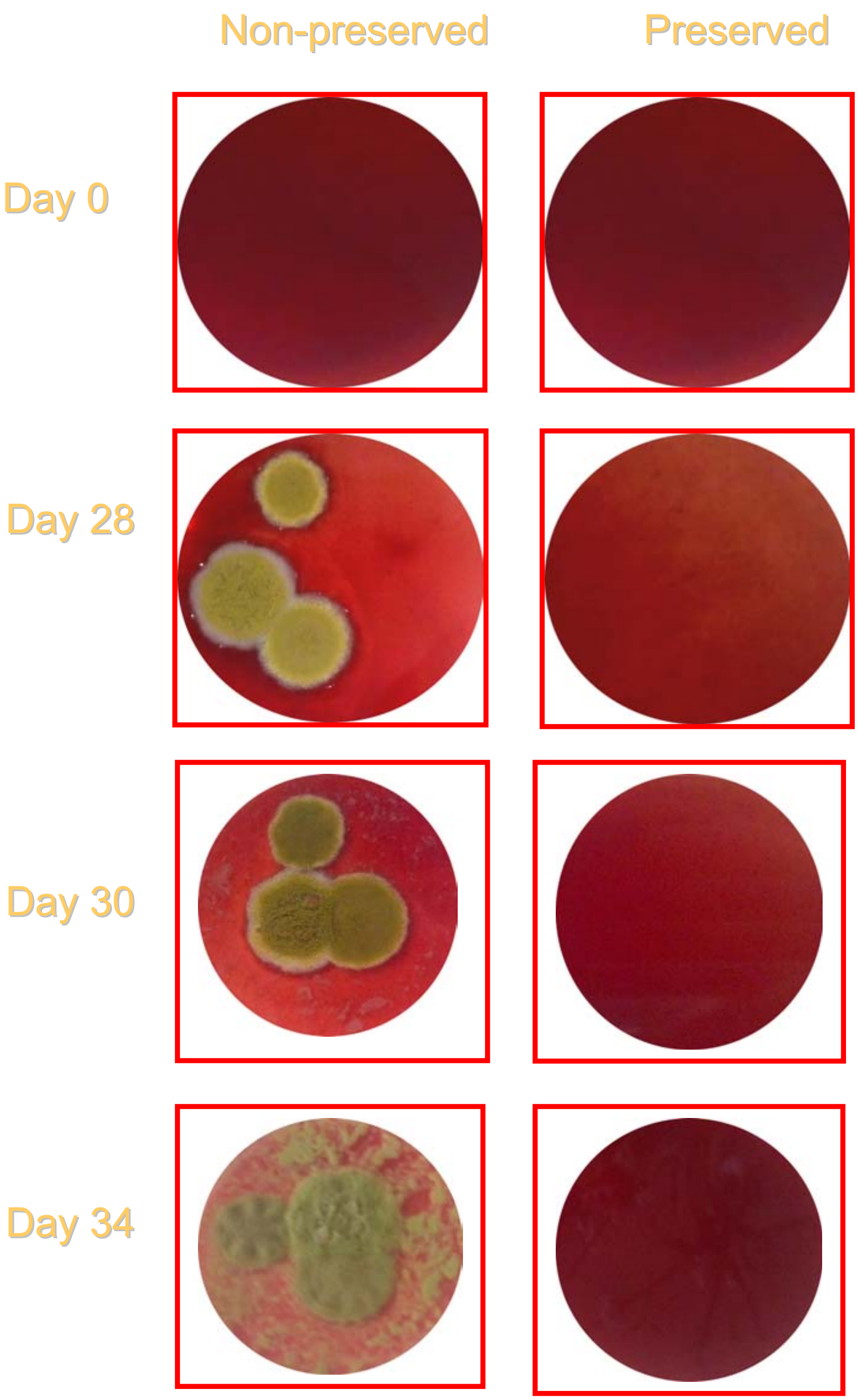
Day 0

Day 8



The non-preserved bread shows evidence of yeast growth by day 8 while the preserved bread shows no evidence of growth of yeast on day 8.

Preservation of Smoothie



The non-preserved smoothie shows evidence of yeast growth by day 28 while the preserved smoothie shows no evidence of growth of yeast on the same or subsequent days.

KEEP YOUR FOOD FRESH WITH BFRESH

- ✓ Decrease your loss of revenue from food spoilage.
- ✓ Decrease your electric bill. You can store your products at higher temperature and save on your bill.
- ✓ Substitute heat sterilization with our method and save on your electric bill.
- ✓ Substitute heat sterilization with our heatless sterilization technology and maintain the nutritional composition of your food intact. Heat kills microorganisms but at the same time, it kills water soluble vitamins such as vitamins B and C, it denatures proteins, and causes significant change in food properties. Our technology preserves food content including its vitamins, proteins and all other composition.
- ✓ Free your products from preservatives, chemicals and pesticide.
- ✓ Keep your products fresh organically. You will be able to put the label "Organically Preserved" on your products. You will be the first company to make such a claim.
- ✓ Less expensive than any other method of preservation for foods that require preservative.
- ✓ The only method of preservation for foods that can not currrently be preserved.
- ✓ Increase your sales by offering organic food to health conscious consumers.
- ✓ Decrease the price of your product by prolonging its shelf life.
- ✓ Increase shelf life of fresh-cut fruits, whole fruits, vegetables, fruit and vegetable juice or other food products.
- ✓ Increasing post-harvest life of produce. Produce are often lost during growth or post-harvest. Apply our technology to your fields to protect your crop from infestations, parasites, bacteria and fungi.

Start using BFRESH