Washing Away the Worries About Germs

Originating Technology/ NASA Contribution

Fresh fruits and vegetables have been in demand by orbiting astronauts since the early days of the Space Shuttle. As one can imagine, however, oranges, onions, tomatoes, garlic, and other fresh items can provide a cornucopia of smells in a closed environment such as the Space Shuttle or the International Space Station (ISS), especially when they begin to perish. It does not help that they are loaded onto the Space Shuttle up to 24 hours in advance of a launch, and that the on-orbit shelf life is just 2 to 3 days for most, due to a lack of refrigeration.

While such produce adds significant variety to astronauts' diets and increases their morale, the odor that emanates from it as it ages can cause nausea. One of the last things astronauts need is associating this healthy fare with feelings of nausea.

NASA is currently investigating the use of a commercial sanitation product it helped develop with private industry to thoroughly cleanse and, thus, increase the shelf life of fruits and vegetables being sent into space. Meanwhile, this product is ripe for the picking for consumers looking to do the same, and more, on Earth.

Partnership

Microcide, Inc., was incorporated in 1990, with the primary objective to develop unique, non-toxic, and environmentally safe microbicidal products for personal care, public health, food, and agriculture, through research and development. The Troy, Michigan-based company was introduced to NASA through the Glenn Research Center-sponsored Garrett Morgan Commercialization Initiative (GMCI), a program for small, minority- and woman-owned businesses that can benefit from NASA resources.

As a result of this meeting, Microcide was welcomed to join the NASA Food Technology for Commercial Space Center (FTCSC) as an affiliate partner, with sponsorship from GMCI. The mission of the NASA FTCSC is to lead a national effort in developing foods and food-processing technologies that enhance the safety of space missions and advance commercial food products through cooperative efforts with NASA scientists and technologists, commercial companies, and academic researchers.

As an affiliate partner, the company interacted with personnel from Johnson Space Center and learned that there was a need for a nontoxic, biodegradable, microbicidal product to disinfect fresh fruit and vegetables for Space Shuttle crews. Hydrogen peroxide and hypochlorite are the oxidizing agents that have been used as sanitizing agents in past space missions, but the efficacy of hydrogen peroxide remains questionable and both hydrogen peroxide and hypochlorite are known to produce carcinogenic free radicals, according to published research.

Microcide developed PRO-SAN, a technology comprised of safe sanitizing agents that could possibly be used as an alternative to the two controversial oxidizing agents.

Astronaut James Voss, Expedition Two flight engineer, is deciding between two colors of apples as he takes a break for a snack in the Zvezda Service Module on the International Space Station.

Dr. Anthony Pometto, director of the NASA FTCSC, and Vicki Kloeris, manager of Space Shuttle and ISS food systems at Johnson, wondered whether PRO-SAN could improve current food-sanitizing measures in space, so they commissioned Dr. Aubrey Mendonca, an FTCSC outreach mission specialist, and Dr. Cheryll Reitmeier, an FTCSC education mission specialist, to carry out a comparative investigation of the sanitizer against various other disinfecting products.

The study proved the potential of PRO-SAN as a safe, stable, and biodegradable product for use in space; however, at the time, it was only available as a concentrated powder and a ready-to-use liquid. The powder is difficult to handle in zero gravity and the use of liquid presents increased payloads for flights. NASA and Microcide decided that the alternative would be to have the PRO-SAN powder concentrate available as a water-soluble package. Once this package is dropped in water, it can be stirred until it dissolves, creating a ready-to-use sanitizer.

Based on this research, Microcide has perfected a food-grade soluble packaging design for use on Earth.

Produce Outcome

The water-soluble powder concentrate formula of PRO-SAN is now available, in addition to the ready-made spray bottle formula. The difference between the two is that the water-soluble version is 100 times more concentrated than the spray version.

Microcide asserts that all PRO-SAN products offer safety from harmful foodborne bacteria, such as *E. coli*, *salmonella*, *listeria*, *cholera*, *shigella*, *staphylococcus*, *streptococcus*, and many others. PRO-SAN even instantly kills antibiotic-resistant bacteria, the company adds.

The sanitizer is free of volatile organic compounds, chemicals that have been found to be a major contributing factor to ozone pollution. Simply stated, PRO-SAN does not pollute indoor air in enclosed spaces of homes and kitchens. Also important is that the food-grade ingredients and emulsifying agent of PRO-SAN do not produce carcinogenic by-products or free radicals.

PRO-SAN sanitizing products offer safety from harmful foodborne bacteria, such as *E. coli*, *salmonella*, *listeria*, *cholera*, *shigella*, *staphylococcus*, and *streptococcus*.

The technology has three different functional properties of cleaning, sanitizing, and chelating (a process that uses chemical substances to bind molecules and, thus, remove toxins), with the power to kill 100 million bacteria in 30 seconds, with 99.999-percent efficiency, according to tests. PRO-SAN-treated fruits and vegetables maintain their original taste and flavor, not to mention that even their natural colors are enhanced—all without leaving behind an unwanted film or residue. In addition to fruits and vegetables, PRO-SAN can be used on counter tops, cutting boards, dishes, utensils, forks, knives, and sinks.

Ideal environments for the use of PRO-SAN include hospitals, nursing homes, day care centers, dormitories, restaurants, and offices.

In 2004, Microcide was awarded a Phase I **Small Business Innovation Research (SBIR)** contract with Johnson to further explore how nontoxic sanitizing methods can prevent food contamination and improve hygienic conditions during prolonged space missions and here on Earth. ❖

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