

CASE STUDY 4

BIOERVE SPACE TECHNOLOGIES



PURAFIL REMOVES ETHYLENE GAS 4 BIOERVE SPACE TECHNOLOGIES



ABOUT BIOERVE SPACE TECHNOLOGIES

The shuttle missions conducted by the National Aeronautics and Space Administration (NASA) are critical in determining if plant and human life can be sustained in space.

BioServe Space Technologies in Boulder, Colorado is the leading research center for outer space plant experiments. Fully funded by NASA, BioServe has conducted experiments aboard more than 100 shuttle missions. Their purpose during these missions is to study those factors which affect plant growth in space.

THE PROBLEM

Ethylene is a ripening hormone emitted by growing vegetation. Though ethylene gas is colorless, it can be identified by its sweet, pungent odor. A high concentration of ethylene gas, especially in an enclosed space, can cause plants and flowers to wilt and die prematurely.

Ethylene off-gassing during space shuttle missions proved to be an impediment in BioServe's research. BioServe approached Purafil, Inc. in hopes of a solution.

PURAFIL PROVIDES THE SOLUTION

Purafil® Select media is popular in the supermarket and florist industries for preservation of fruits and cut flowers. When BioServe researchers approached Purafil, they recommended Purafil Select media to remove ethylene gas.

To date, Purafil Select media has flown shuttle missions aboard Columbia, Endeavor and Discovery. While aboard the Columbia, Purafil Select media was part of an experiment documenting plant growth in orbit. The Purafil media was used to remove some part of the ethylene that is secreted out by plant seedlings.



PLANT SEEDLINGS



PURAFIL® SELECT MEDIA

It was determined that ethylene gas was scrubbed out effectively by the Purafil Select media and was non-detectable in the canisters of seedlings. However, ethylene was present at 50ppb in the canisters not containing Purafil Select media.

Purafil Select media was also included in the Plant Module for Autonomous Space Support (P-MASS) on a 30-day, returnable satellite. In fact, BioServe plans to include Purafil Media as an important component of their dedicated shuttle-based payload for plant growth. Now, BioServe is able to grow plants under very confined circumstances aboard the space shuttles and move forward with their research.

BioServe continues to be pleased with Purafil's reliability and believes the media is a critical part of their ability to progress in their studies.

PURAFIL SELECT MEDIA

Purafil Select media is an activated alumina-based substrate impregnated with potassium permanganate (KMnO₄) and sodium bicarbonate. Activated alumina offers a greater surface area than other common substrates, such as zeolite or silica gel, for reaction with gaseous contaminants. With more surface area available within the media, more contaminants are removed by the active ingredient.

Purafil Select media removes gaseous contaminants through a chemical reaction process known as oxidation. The adsorbed gases are converted to non-toxic solids which remain on the media pellet without the possibility of desorption.

Among the gases removed by Purafil Select media is ethylene. Purafil media demonstrates a 2.0% removal capacity for ethylene; for every 100 lbs of Purafil media, 2 lbs of ethylene is removed.

Purafil Select media is UL Classified Class 1. Class 1 Units are defined as those that, when clean, do not contribute fuel when attacked by flame and emit only negligible amounts of smoke.

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CASE STUDY 4

THE SISTINE CHAPEL



PURAFIL PRESERVES ARTWORK 4 THE SISTINE CHAPEL



ABOUT THE SISTINE CHAPEL

Completed by Michelangelo in 1512, the frescoes have been exposed to centuries of damaging environmental conditions, including airborne pollutants resulting from more than two million visitors a year. During the past ten years, Vatican engineers have worked to restore the frescoes and prevent further deterioration.

THE PROBLEM

For nearly five centuries, Michelangelo's frescoes have been exposed to airborne pollutants from a multitude of indoor and outdoor sources, including:

- Burning candles
- Flaming coals for heat and light
- Nearby automobile traffic
- Industrial fumes
- Two million visitors annually

These pollutants, in addition to fluctuations in temperature and relative humidity, have resulted in layer upon layer of grime, dirt and glue. Vatican engineers realized that restoring this work was futile without a system to prevent further exposure to hazardous environmental conditions.

PURAFIL PROVIDES THE SOLUTION

A project team of environmental experts from Purafil and Carrier, incorporating personnel from the United States, England, France and Italy, worked closely with Vatican engineers and consultants over a two-year period to design, manufacture and install a new environmental control system.



VISITORS AT THE SISTINE CHAPEL



PURAFIL® SELECT MEDIA

The system treats the air within strict temperature and humidification parameters. The contaminated air stream passes through Purafil's dry scrubbing media, where gaseous contaminants are permanently removed. The air is then channeled up the chapel's outside wall and distributed to individual diffusers concealed in the base of each of the chapel's six south windows. The diffusers create two distinct airflows: (1) a very low velocity flow directed over the surface of the frescoes, and (2) a slightly higher velocity flow that "showers" visitors. The air is exhausted through the chapel's floor and recirculated through the HVAC unit and Purafil's gas-phase air filtration system. Because a separate building was constructed to house the complete system, admirers are never aware of the precise, environmental controls in place to protect Michelangelo's delicate work.

Purafil® Select Media is an activated alumina-based substrate impregnated with potassium permanganate. Alumina is a highly porous substrate and offers a greater surface area than other common substrates, such as zeolite or silica gel. Because the media offers a higher surface area, more of the active ingredient, potassium permanganate, is available for reaction with contaminants.

Purafil media removes gaseous contaminants through chemisorption, an irreversible chemical reaction process. The gases are absorbed by the media and oxidized to form noncorrosive solids which remain on the media pellet.

ABOUT PURAFIL

Purafil, Inc. specializes in the removal of odorous, toxic, and corrosive gases through gas-phase air purification. Call Purafil at (770) 662-8545 or (800) 222-6367 for assistance with your air quality concerns.