



Agricultural Research Service

U.S. DEPARTMENT OF AGRICULTURE

Use of Microbial Reactors to Transform Ammonia

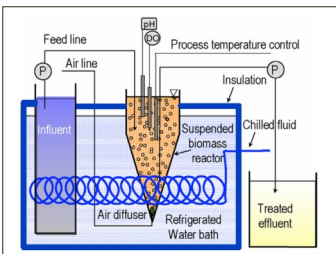


Diagram of bioreactor with HPNS for wastewater treatment under cold temperatures.

Features and Benefits:

- **Novel microbial community (HPNS).**
- **Rapid reactor start-up and steady performance at high ammonia levels (> 95% ammonia control).**
- **The highest rate of nitrification treatment found in the world at low temperatures.**
- **An oxidized environment that substantially eliminates odor causing compounds in manure.**

The discovery is a novel composition of bacteria, designated “high-performance nitrifying sludge” or HPNS, having Accession Deposit Number NRRL B-50298 in the ARS Culture Collection in Peoria, Ill, which is effective for economical removal of ammonia from wastewater contaminated with ammonia. The process is effective at high ammonia levels and low temperatures. In addition to oxidizing the ammonia, the process substantially reduces the presence of odor-causing compounds in the wastewater.

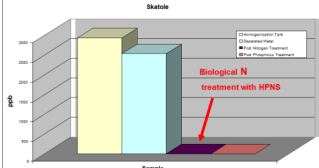
The novel bacterial composition of this invention (US Patent No. 8,445,253, “High Performance Nitrifying Sludge for High Ammonium Concentration and Low Temperature Wastewater Treatment”, by Vanotti, Szogi and Ducey) has provided: 1) rapid reactor start-up, 2) the highest rate of nitrification treatment found in the world at low temperatures, and 3) substantial elimination of odors in manure.

USDA awarded two co-exclusive licenses. One licensee, Terra Blue Inc., tested HPNS in 2nd and 3rd generation manure treatment systems in swine farms in NC. Animal health and productivity were enhanced with the cleaner environment. Another licensee, Pancopia Inc., used HPNS for ammonia/odor capping of swine lagoons and for removing ammonia contamination from biogas feedstock.

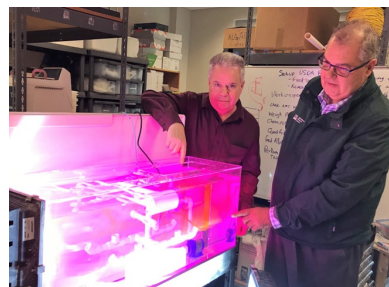


In 2020, USDA/ARS received the FLC National Award in Excellence in Technology Transfer for “Odor/Ammonia Capping of Swine Lagoons using High Performance Nitrifiers”.

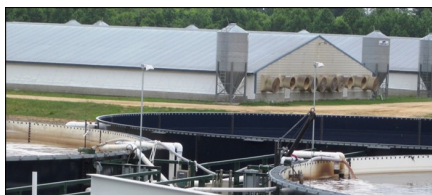
Odor reduction in the liquid manure



One quart of HPNS is needed for start-up of a 60,000 gal tank.



Bill Cumbie (left) of Pancopia Inc. and Dr. Matias Vanotti of USDA-ARS with alpha reactor for odor/ammonia capping.



Terra Blue Inc. used HPNS in 3rd generation system treating 75,000 gal of manure per day.



After 10 months, swine lagoons were converted in clean water reservoirs.

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About the Research Organization

USDA/ARS delivers scientific solutions to national and global agricultural challenges. The technology was developed at the ARS Coastal Plains Soil, Water and Plant Research Center in Florence, SC. An important part of the Center’s mission is development of treatment technologies to better manage manure from swine, poultry, and dairy operations to reduce releases to the environment of odors, pathogens, ammonia, and greenhouse gases as well as to maximize nutrient recovery.

Center inventions include: a high-performance nitrifying sludge, novel anammox bacterium isolate, recovery of ammonia from manure using gas permeable membranes, recovery of phosphorus from liquid and solid manures, recovery of proteins from wastes, and integrated systems of treatment technologies.