Slurry tank with injection toolbar for land applying slurry.

Ozonation Implications

Ozonation systems, such as the MOC unit have been used in municipal waste water treatment. Using ozone to treat swine slurry is a successful way to reduce odor under production scale conditions. Depending upon an economic analysis, ozonation of slurry could be a practical way for producers to maintain air quality. The potential benefits that could follow treatment with ozone include reduced odor:

- During storage
- Within swine facilities
- During land application
- Following land application

Land application by center pivot irrigation

Smart Earth Technologies® MOC-50 unit

ISU Ozonation Research

Walker, P. M., A. R. Omer, M. S. Brewer, K. R. Cadwallader, T. R. Kelley. 2011. Evaluation of a Commercial Ozone Treatment System to Improve Swine Slurry. ASABE. (In Press)

Omer, A. R., Paul M. Walker. 2011. Treatment of Swine Slurry by an Ozone Treatment System to Reduce Odor. J. Environmental Protection 2:867-872.

ILLINOIS STATE UNIVERSITY

DEPARTMENT OF AGRICULTURE

Campus Box 5020
Normal, IL 61790-5020
Phone: 309-438-3881
Fax: 309-438-5653
E-mail: pwalker@ilstu.edu
www.sweeta.illinois.edu

ILLINOIS STATE UNIVERSITY

DEPARTMENT OF AGRICULTURE

Odor Mitigation of Slurry Odor Using Ozonation

Implementation of ozone technology has been previously used to control odors in the exhaust of industrial establishments. In addition, ozone has been used to bleach and deodorize agricultural products. Currently, ozonation facilities are being used in the United States to safely deodorize and disinfect municipal waste water. A production scale ozonation system can improve odor emitted from swine slurry can prove beneficial to animal feeding operations.

Increased urban sprawl meeting agricultural production facilities is creating increased concern about air quality. Reducing odor of swine slurry during storage and land application will help to meet future air quality concern and regulation. Illinois State University's LUW Team has investigated an ozonation system under production scale conditions. The system evaluated is manufactured and sold by Smart Earth Technologies® and is referred to as the Manure Odor Control (MOC) Unit. The link to Smart Earth Technologies® Sobrite website is: www.sobrite.com.

Current Odor Regulation

Defining odor limits including measurement and evaluation has been difficult due to few objective measurements of odor. The 1990 Clean Air Act Amendments to the 1963 Clean Air Act does not address odors. In Illinois, the Illinois Livestock Management Facilities Act requires a waste management plan and enforces set back distances but does not directly address odor regulation. Although regulation of odor created from agricultural practices isn't currently enforced, this does not depict the absence of common-law nuisance claims or future regulation. But, proposed EPA regulations may be on the horizon.

Ozonation

Ozone (O_3) molecules are composed of three oxygen atoms making it a potent oxidant that is capable of destroying molds, amoebae, viruses and bacteria. Ozone can destroy anaerobic odor causing bacteria by oxidizing the cellular membrane. Ozone is unstable and decomposes readily into oxygen gas. This creates the need for it to be generated at the time of application. Ozonators can create O_3 through several processes including: electrolysis, radiochemical, chemonuclear, chemical reactions, and photochemical.

Ozonation System

The ozone treatment system evaluated by the LUW team to treat swine slurry is patented by Smart Earth Technologies®. The Manure Odor Control (MOC) unit treats slurry with O_3 created photochemically by exposing air to UV light. Once the MOC unit creates the O_3 it injects it into a continuous flow slurry line at rates shown in Table 1. The pump consists of a 5 hp single phase motor with a power consumption of no more than 28 amps. The intake and discharge lines are normally placed on opposite ends of the pit being treated and slurry is sustained at flow rates shown in Table 1.

Smart Earth Technologies® MOC-225 unit

Table 1. Treatment Descriptors

	# Hogs	Pit Depth (ft)	Pit Total Volume (gal)	Actual Volume Treated (gal)	Rate of Treatment	Number of Times Pit Volume Turned Over in 48 hours	% Decrease in Odor Offensiveness after 48 hours of treatment	% Decrease in Odor Intensity after 48 hours of treatment
Study 1	300	6	107,730	44,888	100 gal/min (6,000 gal/hr)	3.2	27%	24%
Study 2	500	8	203,450	152,588	225 gal/min (13,500 gal/min)	4.3	26%	17%

Test Facilities

The facilities utilized to test the MOC unit under production scale settings were environmentally controlled grow-finish buildings. The buildings were constructed over manure pits and utilized a slatted floor system. Additional descriptions of the pits are provided in Table 1.

An environmentally controlled curtain sided facility used to test the MOC unit. The intake and discharge hoses are running into the pump out of ports for the manure pit.

MOC unit Performance

In study 1 the MOC system significantly reduced odor. The system performed best over a 48 hour treatment period. Volatile organic acids that caused odor where significantly decreased. Microbial concentrations where not decreased, therefore we attributed odor reduction to the oxidizing of volatile organic acids.

In study 2 the MOC unit significantly reduced odor. The unit made the greatest reduction in odor after 48 hours of treatment. Both intensity and offensiveness were reduced. A significant reduction in ammonia also, was observed.