

# Research Briefs: Simultaneous treatment of odor, VOCs, H<sub>2</sub>S, NH<sub>3</sub>, and pathogens with UV light

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## Research Purpose

The simultaneous treatment of odors, gases, airborne pathogens using novel UV treatment project addresses a critical need of the control of odor and pathogens generated in commercial swine production. The same technology could potentially be used for other species (e.g., poultry) that are housed in mechanically-ventilated barns. This study will test the potential for using currently available technology for the simultaneous degradation of most offensive odorants, NH<sub>3</sub>, and model pathogens (SIV, BVDV). Such UV light-based technology is suitable for application for ventilation air and could be applied to exhaust air (to treat emissions) and inlet air (to prevent the spread of infectious diseases) for new and existing operations. The long-term goal is to develop a cost-effective technology for the simultaneous treatment of odor and pathogens in swine and possibly poultry housing in order to limit their impact on air quality and health (both human and animal).

## Activities

A standard gas/odor system for generating and measuring gases is being used for lab-scale experiments. The system generates 13 odorous gases including H<sub>2</sub>S, mercaptans, VFAs, and phenolic compounds responsible for swine odor. NH<sub>3</sub> gas and its removal is included. Odor measurement with a standard ASTM method are conducted by the Olfactometry Lab.

## What We Have Learned

We measured the effectiveness of odor treatment and pathogen inactivation in laboratory scale. Almost 100% removal was achieved for all the compounds tested except H<sub>2</sub>S and dimethylsulfide using only 1 sec irradiation. Removals of H<sub>2</sub>S and dimethylsulfide are

also significant. Longer UV irradiation times resulted in complete percent reduction of target compounds and odor. Of specific interest is very efficient removal of *p*-cresol which has been recognized as priority odorant responsible for the characteristic livestock odor. Treatment cost of \$0.25 per pig and continuous operation during growing cycle was estimated when the lab-scale results were extrapolated to typical ventilation rates and electricity cost at a swine finish operation in rural Iowa.

## Why is This Important?

Comprehensive solutions to swine aerial emissions are expected to be even more urgent in the future. Thus, the proposed study addresses several critically important issues confronting pork and poultry producers, but also has a broader applicability to homeland security, human/animal health, indoor air quality and hazardous waste treatment.

## For More Information

Read the following articles or visit our website <http://www.abe.iastate.edu/odor>

Yang, X., Koziel, J.A., Cai L., Hoff, S. et al. Novel treatment of VOCs and odor using photolysis. ASABE Annual International Meeting, 2007, Minneapolis, MN, paper No. 074139.

Koziel, J.A., X. Yang, T. Cutler, S. Zhang, J.

Zimmerman, S. J. Hoff, W. Jenks, Y. Laor, U. Ravid, R. Armon, J.H. van Leeuwen. 2008. Mitigation of odor and pathogens from CAFAs with UV/TiO<sub>2</sub>: exploring cost effectiveness. In the proceedings of the *Mitigating Air Emissions From Animal Feeding Operations Conference*. Des Moines, May, 2008.

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