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MITIGATION OF ODOR AND PATHOGENS FROM CAFOs WITH UV/TiO₂: EXPLORING COST EFFECTIVENESS

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Species: Swine, Poultry

Use Area: Confined Animal Housing

Technology Category: UV photocatalysis

Air Pollutants Mitigated: Volatile organic carbon, Odor, Pathogens

Point of Contact:

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System Summary:

Odor and target VOCs responsible for livestock odor are mitigated by UV-185 nm ('deep' UV) in presence of TiO₂ as a catalyst into less odorous or odorless products such as CO₂ and H₂O. Percent removals from 80 to 99% were measured in lab-scale experiments involving simulated livestock VOCs/odorants and 1 sec irradiation with a low wattage 5.5 W lamp. Selected VOCs simulating livestock odor included p-cresol, sulfur-containing VOCs, and volatile fatty acids. 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. The long-term goal is to develop cost-effective technology for the simultaneous treatment of odor and pathogens in livestock housing through logical progression of testing from lab-scale, through pilot-scale and finally at commercial scale. Such treatment would be applicable to both the inflow (for airborne pathogen control) and outflow air (for odor and pathogen control) at typical existing and new mechanically-ventilated barns.

Applicability and Mitigating Mechanism:

- Removal of VOCs and responsible for livestock odor in simulated barn air exhaust with UV light and advanced oxidation.
- Research continues to move this technology from lab to commercial applications.
- Potentially applicable to both the inflow (for airborne pathogen control) and outflow air (for odor and pathogen control) at typical existing and new mechanically-ventilated barns
- On-demand, intermittent operation.

Limitations:

- This technology is still under development
- Cost estimates are extrapolated from lab-scale experiments
- Effects of particulate matter on UV treatment needs to be investigated
- Effectiveness and costs associated long-term full-scale operation are not known at this time.

Cost:

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. This cost could be further reduced for intermittent, on-demand operation. The capital costs would be mainly cost of 'on-the-shelf' deep' UV lamps (currently at \$90 for 10W lamp) and the cost of retrofitting of barn exhaust.