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SDEC Partners Research Update

Project Update: Assessment of biocontainment technologies for the treatment of airborne viruses

Investigators: Montse Torremorell, Carmen Alonso, Peter Davies, Peter Raynor, Bernard Olson

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Background

- Preventing the introduction of airborne diseases and containing their spread remains a challenge for the swine industry.
- Although air filtration is considered effective at reducing the incidence of PRRSV outbreaks, few options are available to contain airborne infections to mitigate their spread to neighboring sites.
- Current in lab methods to assess the effectiveness of technologies against PRRSV are for the most part PCR-based and do not measure reduction in virus viability.

Objective

To develop methods to measure the inactivation of airborne pathogens and assess whether a UV-based technology has potential to inactivate airborne pathogens under high speed air flow

Material and methods

- We adapted the ASHRAE wind tunnel available in the Department of Mechanical Engineering at the University of Minnesota to generate a large volume of a high titer PRRSV aerosol (Fig 1). Aerosols were generated continuously and air samples collected downstream (point B in the diagram) using two distinct air samplers to measure total virus viability. Samples were then submitted for virus isolation and titration at the Veterinary Diagnostic Laboratory.
- A commercially available UV-based technology primarily used in health care was adapted to fit the wind tunnel.
- Inactivation of PRRSV by the technology was measured downstream in the tunnel at 3 distinct air flows (200, 400 and 650 cfm) and 4 UV intensity levels , with the system on and off.
- The difference in virus concentration with the technology “on” and “off” was calculated for each of the air flows.

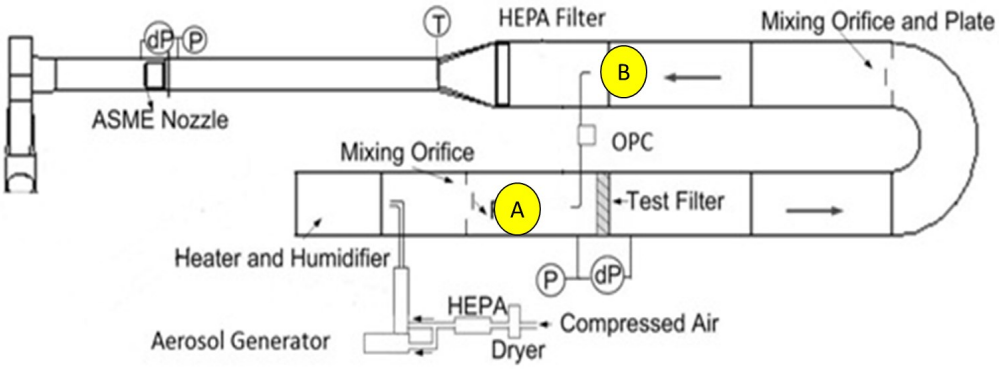

Figure 1. Schematic diagram of ASHRAE wind tunnel available in the Department of Mechanical Engineering.

Results:

UV Intensity level	log10_TCID50/m3														
	200 cfm					400 cfm					650 cfm				
		OFF		ON			OFF		ON			OFF		ON	
		Mean	SD	Mean	SD	N	Mean	SD	Mean	SD	N	Mean	SD	Mean	SD
Level 1 (lowest)	3	4.94	0.34	0	0		NT	NT	NT	NT	3	4.32	0.19	3.12	0.50
Level 2	3	4.74	0.41	0	0	3	4.92	1.35	0.00	0.00	3	4.96	0.78	0.00	0.00
Level 3	3	4.78	0.24	0	0		NT	NT	NT	NT		NT	NT	NT	NT
Level 4 (highest)	3	4.43	0.43	0	0	3	4.44	0.33	0.00	0.00	3	2.73	2.49	0.00	0.00

Table 1. Viability of PRRSV with the UV system ON and OFF under 4 UV levels and 3 air flows.

- Viable PRRSV could be quantified downstream (B) of the wind tunnel to measure the effectiveness of the technology. Values of $1x10^4$ TCID50/m^3 were obtained when no treatment was applied.

- PRRSV could not be isolated from air samples collected at 200 and 400 cfm from any of the UV intensity levels. However, PRRSV was recovered, although in a reduced quantity, when air was treated with level 1 UV intensity at 650 cfm.

Conclusions and Implications:

- The methods developed in this study appear appropriate to evaluate the effectiveness of technologies directed at reducing viable airborne PRRS virus.
- The UV system used in this study was effective at reducing viable airborne PRRSV although its effectiveness was dependent on air flow and UV intensity level.
- Further research is needed to evaluate the effectiveness and applicability of this system in swine production systems.