Bio-exclusion and bio-containment strategies to control epidemics resulting from airborne viral and bacterial transmission

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A testing platform was developed that can be used as a tool to design affordable filtration systems. This platform will:

- Allow the capture efficiency of commercial filters regarding airborne viruses and bacteria to be evaluated.

- Help pig producers in the future to choose economically suitable air filtration systems and to determine if used filters (e.g. 6-month old filters) are still as efficient as new ones to capture airborne viruses (e.g. porcine reproductive respiratory syndrome (PRRS)).

Why was this study done?

The airborne transmission of pathogens among pig herds can be an economic burden for producers and it is not always completely stopped by biosecurity measures. HEPA filter systems have proven to be an efficient tool against pathogen transmission, but are expensive. Therefore, researchers wanted to study the effectiveness of less expensive filter systems to prevent the transmission of airborne viruses and bacteria in a controlled and standardized environment.

What was done and what was the outcome?

In 2015, researchers completed a literature review titled 'Air filtration as bio-exclusion and bio-containment strategies for Canadian pig buildings,' which served as a base for the project's next steps.

A new testing platform was designed and built in 2016 to evaluate the capture efficiency of different pre-filter and filter combinations for PhiX174 and Phi6 phages and *Streptococcus thermophilus* which are non-pathogenic models of Influenza and PRRS virus and *Streptococcus suis* serotype 2, respectively. Specifically, this new platform consists of a test duct, a mixing chamber, sampling probes, and a data acquisition system. As viruses and bacteria that affect pigs often travel on dust, the platform's mixing chamber was designed to reproduce real-life conditions in pig barns.

Air filtration systems composed of different combinations of MERV (Minimum Efficiency Reporting Value) rated pre-filters and filters were studied, such as the following combinations:

- MERV 8 pre-filter + MERV 14 filter
- MERV 8 pre-filter + MERV 16 filter

Testing platform. Source: CDPQ
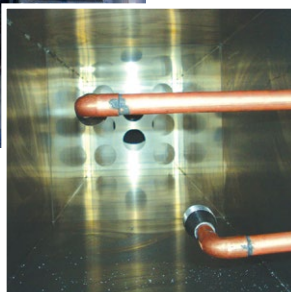
Sampling probes inside the testing platform. Source: CDPQ

Set-up used to collect data from testing platform. Source: CDPQ

Verifying ASHRAE standards. Source: CDPQ

When testing filters and pre-filters, researchers used viral models that mimicked pathogens affecting pigs. These viral and bacterial models are not harmful for animals or humans and, therefore, do not require any biosecurity nor bio-containment measures to be taken. This is an innovative strategy and has the advantage of reducing cost and simplifying the testing procedure.

Tests were conducted at an average temperature of 24°C and average relative humidity of 65%. The following was found:

- The combination of the MERV 8 pre-filter and MERV 16 filter demonstrated the highest capture efficiency against Influenza and PRRS virus models.

- The combination of the MERV 8 pre-filter and MERV 14 filter was as efficient in capturing the *Streptococcus suis* serotype 2 model as the MERV 8 and 16 combination.

Collaborators

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