

PUBLIC HEALTHWORKER SAFETY

Title: Evaluation of the electrostatic particle ionization technology to decrease the risk of zoonotic infections. Identification **NPB# 13-025**

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Scientific Abstract:

Influenza A virus (IAV) and *Staphylococcus aureus* (S. aureus) are important swine pathogens able to transmit via aerosols. Both of them are considered important zoonotic agents of important public health concern. The electrostatic particle ionization system (EPI) is a technology able to reduce airborne particles because of its ability to clump and settle the particles. As a result it improves the air quality and has the potential to decrease the risk of disseminating pathogens. The objectives of this study were to determine under controlled conditions the effect of the EPI system on the quantity and viability of IAV and S. aureus in experimentally generated aerosols. We also assessed whether the distance to the source of ions and the relative air humidity had an effect on EPI's pathogen removal efficiency. The EPI system, consisting of a line of stainless steel corona points attached to a stainless steel cable (30KV), was installed at 3 different levels (1, 2 and 3 meters) along the length of a 35.1 m³ isolation unit at the University of Minnesota. Aerosols were generated using a Collison nebulizer and sampled using both a cyclonic air sampler and two Andersen cascade impactors able to separate particles as a function of size. Air samples were collected with the EPI system "off" and "on" for 30 minutes. Three replicates were performed with the EPI line connected at 1, 2 and 3 meters from the ground. Samples were analyzed quantitatively by quantitative RRT-PCRs in the case of IAV, and bacterial culture (colonies forming units (CFUs)) in the case of S. aureus. Difference in the quantity of pathogens with the system "off" and "on" and the removal efficiency by particle size were calculated for both agents during the study. The effect of RH was tested at 30% and 70% in an environmentally controlled chamber. Both IAV and S. aureus could be found associated to all particle size ranges measured in the study, which included ranges of 0.3 to 10 microns for IAV, and 0.7 to and 9 microns for S. aureus. Overall, reduction levels were greater for both pathogens when the EPI line was located at 3 m from the ground, which also corresponded to closer proximity to the aerosol source. Reduction levels between the system "off" and "on" ranged, between 0.56 and 2.58 logs per m³ of air for IAV, and 0.62 and 1.35 logs CFUs/m³ of air for S. aureus. There were no differences in the EPI removal efficiency of IAV at 30% and 70% relative humidity. In summary, our results indicated that the EPI system was effective at reducing IAV and S. aureus in aerosols generated experimentally and that the level of reduction was influenced by the location of the EPI line, the type of pathogen but not the conditions of relative humidity. In summary, the EPI system has potential to reduce exposure of zoonotic agents to producers and swine workers and improve the overall health and well being of pigs and people.

These research results were submitted in fulfillment of checkoff-funded research projects. This report is published directly as submitted by the project's principal investigator. This report has not been peer-reviewed.

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