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The Effectiveness of Air Ionization in Reducing Bioaerosols and Airborne PRRS Virus in a Ventilated Space

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Abstract.
The presence of bioaerosols in swine production facilities affects the respiratory health of swine workers and pigs. Air ionization (AI) is an affordable technology for removing bioaerosols in the air. The purpose of this study was to assess the effect of AI on aerosols in a ventilated space in terms of reduction in aerosol concentration, changes in particle size distribution, and reduction of airborne Porcine Reproductive and Respiratory Syndrome virus (PRRSV). Experiments were performed in a two-chamber system in which aerosols containing PRRSV were introduced. Tests were conducted for two ventilation rates of 34 and 136 m^3 h^{-1} and two aerosol generation rates of 14.8 and 33.0 mL h^{-1}. The aerosol concentration and size distribution were measured with an aerosol particle size spectrometer. The average reduction in geometric mean diameter of aerosols by AI treatment ranged from 8% to 53%, and reduction in aerosol concentration ranged from 68% to 96%. Ventilation rate was found to affect the efficiency of AI in reducing aerosol concentration; the removal efficiency decreased with increased ventilation rate. The removal efficiency of AI varied with particle size. Specifically, at the low airflow rate, the removal efficiency of AI increased sharply with particle size from 70% at 0.25 µm to 95% at 0.6 µm and reached 100% for particles larger than 6 µm. At the high airflow rate, the removal efficiency varied between 50% to 80% before reaching 100% removal for particles sizes of 7 to 9 µm. The average reduction in PRRSV concentration ranged from 68% to 96%, and the residual PRRSV remaining in the air after treatment ranged from 154 to 4593 viral genome copy number (VGCN) m^{-3}. Ozone generation by the AI

system was not measured in this study, and it may be a concern due to the health risk to pigs and workers when using AI systems for removing bioaerosols.