RESEARCH ABSTRACT

SWINE HEALTH

Title: Demonstration of Airborne PRRSv Inactivation by a Non-Thermal Plasma
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Scientific Abstract:

Porcine reproductive and respiratory syndrome virus (PRRSv) has been detected in air more than 9 km downwind of infected swine. Applying air filtration to ventilation air supplied to hog barns involves structural retrofits to buildings that can be costly, in addition to the periodic replacement of used filters. Non-thermal plasmas (NTPs) are electrical discharges comprised of reactive radicals and excited species that inactivate viruses and bacteria. Our previous experiments using a packed bed non-thermal plasma reactor demonstrated effective inactivation of bacteriophage MS2 as a function of applied voltage and power, ranging from less than one-log inactivation at < 20 kV and a few watts to greater than two-log inactivation at 30 kV. The present study examined the effectiveness of the same reactor in inactivating aerosolized PRRSv. A PRRSv solution containing ~10^5 TCID50/ml was aerosolized at a rate of 3 ml/min by an air-jet nebulizer and introduced into air flows of 5 or 12 cfm followed by NTP exposure in the reactor. Twin impingers upstream and downstream of the reactor collected samples of the virus-laden air flow. Subsequent TCID50 assay and quantitative polymerase chain reaction (qPCR) analyses of the collected samples determined the pre- and post-treatment abundance of infective PRRSv (in TCID50/ml) as compared with the abundance of the viral genome (qPCR), whether infective or rendered inactive by NTP exposure. An optical particle sizer measured upstream and downstream aerosol size distributions, giving estimates of aerosol filtration by the reactor. The results showed that PRRSv was inactivated to a similar degree as MS2 at the same conditions, with the 1.3-log inactivation of PRRSv achieved at 20 kV and 12 cfm air flow rate. Differential pressure across the reactor was minimal compared to HEPA filters and a consumer-grade ozone filter reduced residual ozone concentrations down to levels commensurate with the ambient laboratory environment. The results demonstrate the potential of properly optimized NTPs for preventing infiltration of PRRSv into hog barns with ventilation air.