Alexander Zuniga, Clin Microbiol 2018, Volume: 7
DOI: 10.4172/2327-5073-C3-039

Displacement ventilation to prevent pathogen spread during meat processing

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Statement of problem: Bacteria have posed a serious problem to the commercial and private food industries for centuries. Only recently have aerosolized bacteria been seen as a large threat to human health and shelf life of food. The beef industry has a particular hard problem in maintaining a clean environment in the slaughterhouses that process the cattle. The main bacteria that threaten human health with regards to beef are *Salmonella*, STEC *E. coli, Campylobacter jejuni, Listeria monocytogenes*, and *Staphylococcus aureus*. In particular importance to this study is *Salmonella* and STEC *E. coli,* due to their prevalence and severe pathogenic qualities.

Methodology & Theoretical Orientation: In this study one major beef facility established in Texas was sampled during the spring, summer seasons and soon to be fall. In order to identify the location and sources of contamination efficient samplers, such as the wetted wall cyclone (WWC), were used. These collectors were continuously sampling air at 100L/min for a whole working day period around the facility. The locations that were focused on were the dehiding area, Hot Box, tripe room, and fabrication room. The samples were analyzed by microbial plating, whole-cell qPCR and microbiome sequencing. The facility was then modeled in a computational fluid dynamics program using blueprints of the facility's structure as well as their heating, ventilation, and air conditioning (HVAC) system. Lastly marking where the detection zones were and analyzing the structure of the facility new implementations of the facility's HVAC system was designed to reduce pathogenic spreading.

Findings: The concentration of airborne *Salmonella* and STEC has elevated during the summer months. The computational air flow models that were created based on the facility's layout and ventilation design validated with the collected bioaerosol concentrations enabled the visualization of the pathogen movement in meat processing facilities. The optimization of the air flow for improved sanitation and our design will be implemented in the facility for validation and further analysis.

Conclusion & Significance: Based on the air flow pattern models and bioaerosol movement older facilities can update their HVAC system to reduce pathogenic spread.

Biography

Alexander Zuniga is a first year candidate for a Master's of Science under the Department of Biological & Agricultural Engineering at Texas A&M. His thesis is under the focus of Displacement Ventilation to Prevent Pathogen Spread during Meat Processing, in which he uses dynamic air sampling paired with computational fluid dynamic air modeling to monitor pathogens and create new heating, ventilation, and air conditioning (HVAC) configurations to minimize contamination. Throughout his undergraduate years he has worked at Texas A&M's Aerosol Laboratory with Dr. Maria King on various projects. His scope of work includes using the wetted wall cyclone bioaerosol collector system in meat processing facilities, creating different wind tunnel configurations to perform EPA regulated shrouded probe testing and optimize virtual impactor nozzle design to lower cut point and reduce wall losses for monodisperse particles between 0.5 to 10 micrometers.

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