ADAPTING FOOD PROCESSING TO DECONTAMINATE N95 RESPIRATORS DURING THE 2019 NOVEL CORONAVIRUS PANDEMIC

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I. OBJECTIVES

The coronavirus disease 2019 pandemic caused an abrupt shift in university practices and a great need for personal protective equipment (PPE) by medical providers, first responders, and food plant personnel. The objective was to utilize food manufacturing equipment and food safety principles to decontaminate PPE for required personnel.

II. MATERIALS AND METHODS

The Michigan State University Extension dry heat decontamination system for N95 respirators (masks) was developed. Logistics for labeling, collecting, and transporting used masks were established with a partnering health system provider. Personnel decontaminating masks wore appropriate PPE. A spiral oven (Unitherm/Marlen XSSO-12-1.1-6AG-T, Riverside, MO) was set to 82.2°C with a 45-min residence time and fan speed of 95% and masks placed on a coffee filter on the oven belt. A calibrated datalogger (HOBO, Bourne, ME) was included in each batch to verify that the critical control point of 75°C for 30 min was met. Validation was conducted for biological indicators, mask integrity, and fit testing. Vegetative bacteria (*S. aureus* ATCC 29213, *K. pneumoniae* ATCC 700603, *E. coli* ATCC 25922, *P. aeruginosa* ATCC 27853, *K. pneumoniae* ATCC 27736, *K. pneumoniae* ATCC 35657, *K. oxytoca* ATCC 49131, *E. aerogenes* ATCC 13048, *E. cloacae* ATCC 23355) were used to determine 8 log reduction biological effectiveness of the dry heat decontamination system in killing bacteria and viruses such as the novel coronavirus. Mask integrity including filtration efficiency and pressure drop was conducted on masks ($n = 3$) at new and after 5, 10, 15, and 20 heat cycles. Fit testing was completed on 6 masks after 10, 15, and 20 heat cycles. Cross-contamination was minimized by developing a no-touch system for the masks, and the facility utilized was divided between used and decontaminated masks with separate foot traffic. Decontaminated masks were packaged in clear plastic bags, sealed, labeled, and boxed to return to the originating facility and original mask user.

III. RESULTS

One hundred percent of masks passed fit testing after 10 cycles of dry heat decontamination. It remained at 100% passing after the masks were decontaminated for 15 and 20 cycles ($P = 1.00$). The fit test has a confidence interval of 54%–100% at 95% probability. Biological growth validation results indicated that there was no growth of the vegetative bacteria tested after going through the dry heat decontamination system ($P = 0.1$).

The dry heat decontamination system was effective for no biological growth at 48 h, mask integrity and fit testing passed through 20 cycles. An emergency use authorization application was submitted to the U.S. Food and Drug Administration with accompanying risk assessments and is currently being reviewed.

IV. CONCLUSION

The Michigan State University Extension dry heat decontamination system for N95 respirators is effective at extending the use of the critical PPE through 20 uses during times of shortages and the coronavirus disease 2019 pandemic. Dry heat treatment utilizing food safety principles and processing equipment has potential for global implementation during periods of extreme PPE shortages, including pandemics.

Keywords: decontaminate, food processing, pandemic, personal protective equipment