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Time-Temperature Relationships for Sanitizing Meat Processing Equipment

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Objectives

The current method for in-line sanitation of most meat processing equipment is a brief submersion in hot (> 82°C) water. However, there is no industry or government standard for the time the equipment must remain submerged to be properly sanitized. Previous research has shown this method to be ineffective in killing bacteria on knife surfaces, due to the duration of time the knife was allowed to remain submersed in water. Personal, in-facility observations by the authors, of workers submersing equipment for variable lengths of time led to the hypothesis that differences in equipment mass may warrant differences in dwell time during submersion. Thus, the objective of this research was to develop time-temperature curves for typical red meat slaughter equipment.

Materials and Methods

Equipment tested is common to commercial animal harvest facilities and included a shroud pin (16.0g), boning hook (66.9g), lymph node hook (94.1g), lamb skinning knife (99.2g), boning knife (106.2g), beef skinning knife (112.0g), honing steel (249.6g), cleaver (377.0g), weasand rod (490 g), beef trolley hook (525 g), pork gambrel (1,100 g), and pneumatic de-hider (1,345 g) ranged widely in mass. One thermocouple was attached to the surface of each piece of equipment and another was submerged in the water bath. A thermocouple data acquisition module recorded temperature change of the equipment and the water bath each 15 ms during submersion. Time-temperature change data was collected for each piece of equipment submerged in 81, 87, and 95°C water. Logarithmic curves were fitted to each piece of equipment at each sanitation temperature.

Results

Geometric mean (± SEM) dwell times for all equipment to reach 71°C were 9.668 (± 4.603), 5.841 (± 2.545), and 1.614 (± 1.078) seconds in 81, 87, and 95°C water. These results suggest that while the current method of sanitation may be feasible for smaller equipment such as knives, larger equipment with greater mass is unlikely to reach a temperature adequate for sanitation in the time (< 10 s) allowed between carcasses at many commercial processors, thus increasing the potential for cross-contamination between carcasses.

Conclusion

In conclusion, these results suggest that equipment sanitation at some points of process may be improved by equipment operators having access to multiple pieces of equipment which can individually be submerged in hot water to achieve dwell times sufficient for surface sanitation.