

Egg Flats and Pallets Disinfection with Heat Treatment

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Summary and Implications

Sanitation of egg flats and pallets may be done by heating them up above 130 °F and maintaining the high temperature for a period of time (e.g., 6-8 h). To assess the heating performance of a newly built heat treatment room at a commercial layer farm in wintertime (December) in Iowa, temperature of room air and inside the stacked pallets and flats were monitored during the heating process. Preliminary results show that directing heat more toward the floor improved the room heating effect greatly; the room air and pallet stacks temperature reached the target zone (130-140°F) 30 min and 4 h after starting the heater, respectively. The temperature of flat stacks did not reach the target temperature zone due to larger volume and heat resistance as compared to the pallet stacks. Findings of this study provide basis to improve the design of the heat treatment system for disinfecting the egg flats and pallets for commercial laying hen farms.

Introduction

Reusable plastic egg flats are used by some producers to transport eggs from off-line hen farms to processing plants. After the highly pathogenic avian influenza outbreaks in 2015, disinfecting egg flats before their reuse has become an integral biosecurity step. Sanitation of egg flat stacks may be done by heating them up above 130 °F (54°C) and maintaining the high temperatures for a period of time (e.g., 6-8 h).

However, it remains unclear how the temperature of flat and pallet stacks effectiveness of disinfecting to different heating strategies. In addition, the temperature distribution inside the stacks of egg flats, pallets (for transporting the flat stacks), and boards (separating flat stacks) need to be examined for improving the system design.

The objectives of this field study were 1) to assess the time required for the flat/pallet stacks in the heat treatment room to reach an effective disinfection temperature range (130 to 140°F), and 2) to provide recommendations to expedite the heating process.

Materials and Methods

A heat treatment room (the capacity of heater is 250,000 btu/hr) was built at a commercial egg farm in central Iowa in 2016 (Fig. 1). To monitor indoor air temperature and the temperature distribution in stacked pallet and flats at different height, 24 thermal couples were used together with a LabVIEW program (Fig. 2 to Fig. 4). The room temperature was set at 155 °F. The pallets and flats were heated gradually by indoor air. Seven locations were monitored for the room air temperature during the heat treatment (Fig. 5).

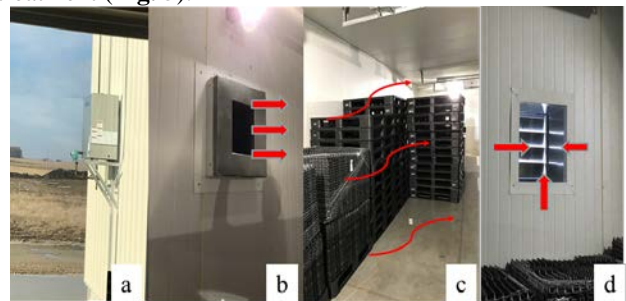


Figure 1. Heat treatment room (room dimension is 38' x 12'10" x 9'9" (L x W x H; a- heater, b- air outlet of heater, c- stacked pallets/flats, d- air outlet of the room).

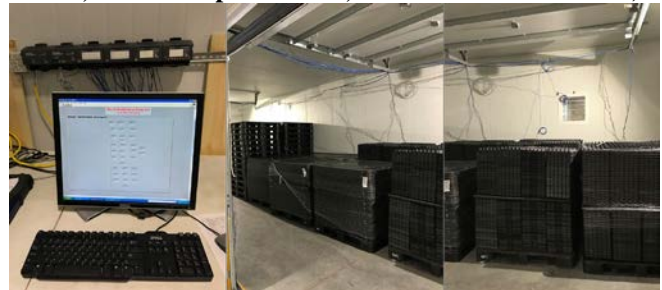


Figure 2. LabVIEW program and stacked egg flats, pallets, and boards.

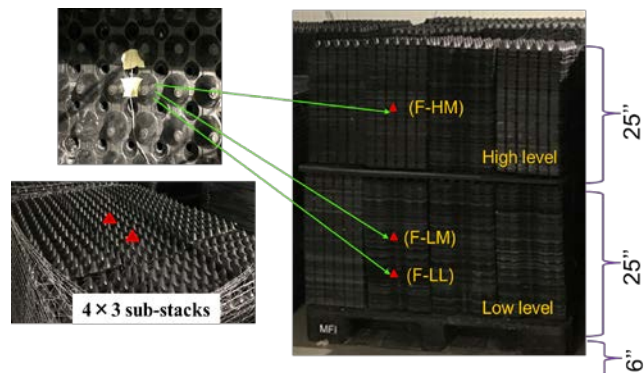


Figure 3. Temperature monitoring of egg flat stacks (F-HM: flat stack at mid-location of high level; F-LM: flat stack at mid-location of low level; F-LL: flat stack at low-location of low level).

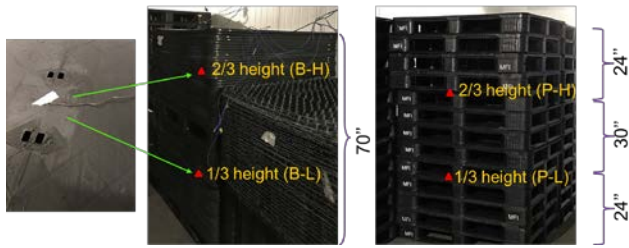


Figure 4. Temperature monitoring for stacks of board and pallets (B-H: board stack of high level; B-L: board stack of low level; P-H: pallet stack of high level; P-L: pallet stack of low level).

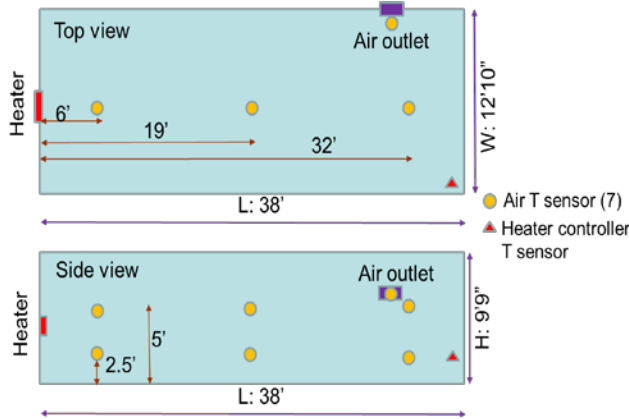


Figure 5. Layout of air temperature monitoring in the heat treatment room.

Air flow pattern from the heater outlet was found to affect the heating effect on the room air temperature and egg flats/pallets during the first test on Dec. 6, 2016. Therefore, four metal discharge deflectors were added to direct the air toward the floor to improve the heating efficiency (Fig. 6).

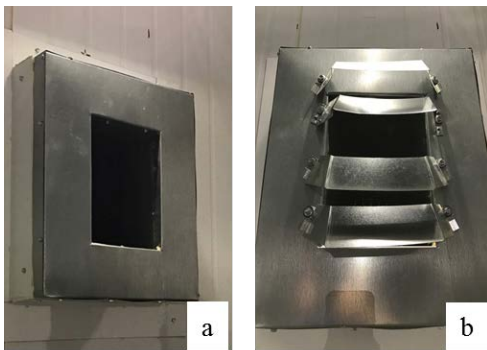


Figure 6. Heater air outlet (a- without deflector, b- with deflector).

Results and Discussion

Air temperature of the heat treatment room before and after adding the deflectors to the heater outlet are shown in Fig. 5 and Fig. 6, respectively. Before adding the deflectors, most of the hot air was thrown directly from the heater outlet to the farthest end of the treatment room; as a result, air temperature at 32' from the heater was warmer than at 6'

and 19'. Because air outlet of the heat treatment room was near the 32' location, the hot air was quickly lost to the outside. With installation of the deflectors, air temperature at 6' was higher than 19' and 32'. In addition, the room was heated to the target zone temperature faster.

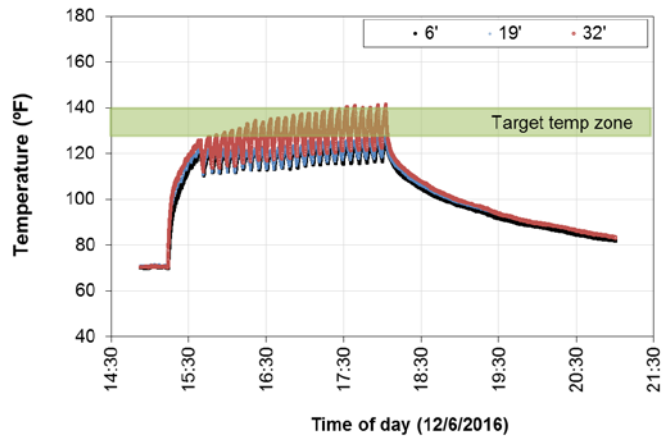


Figure 7. Room air temperature before installation of discharge deflectors to the heater.

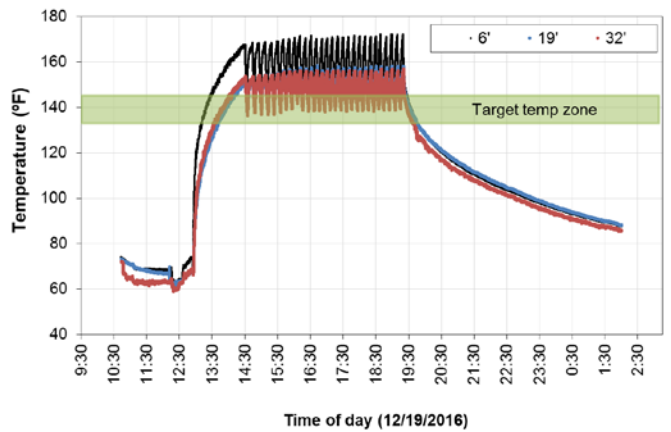


Figure 8. Room air temperature after installation of discharge deflectors to the heater.

On Dec. 19th, 2016, the heater was turned on around 12:30h. Temperature of the room at 6', 19', and 32' and stacks of boards, pallets and flats are shown in Fig. 9 and Fig. 10. The room air and pallets temperature reached the target zone of 130-140°F 30 min and 4 h after starting the heater, respectively. However, the temperature of flat and board stacks failed to reach the targeted zone before the heating was stopped at 19:00 h, because the stacks of flats and boards had larger volumes and heat resistance than the pallet stacks. Further studies such as extending heating period and installing mixing fans to accelerate heat exchange between the room air and the flat and board stacks are guaranteed.

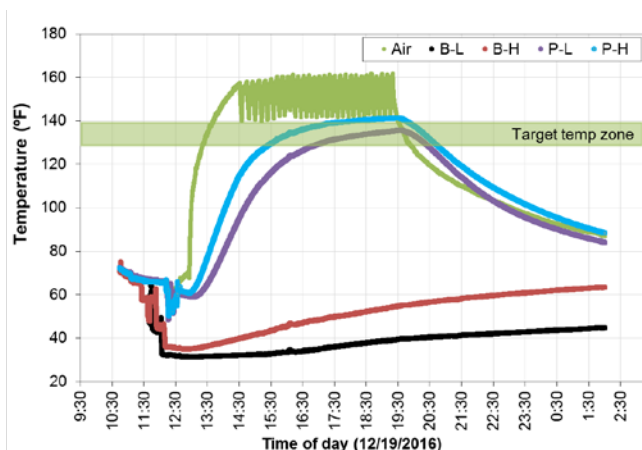


Figure 9. Temperature of room air and stacks of boards and pallets: B-H: board stack of high level; B-L: board stack of low level; P-H: pallet stack of high level; P-L: pallet stack of low level).

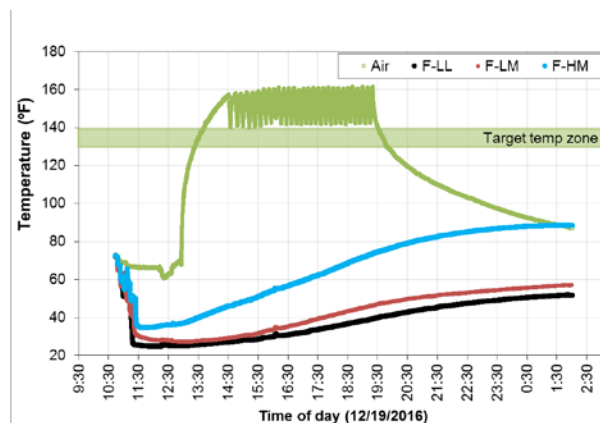


Figure 10. Temperature of room air and flat stacks (F-HM: flat stack at middle place of high level; F-LM: flat stack at middle place of low level; F-LL: flat stack at low place of low level).

Acknowledgments

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