

Effect of Different Disinfectants on Rodent Cage Integrity Following Repeated Autoclaving



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Abstract

Effective sterilization of animal caging is required prior to their removal from high containment facilities to ensure biosafety. However, repeated sterilization events can lead to cage cloudiness and loss of integrity. Maintaining good visibility of plastic cages is critical for performing health checks and ensuring the welfare of laboratory rodents. Previous application of disinfectants can exacerbate the negative effects of sterilization on cage integrity, and removal of disinfectants from cages prior to autoclaving is preferred to slow or prevent these effects. However, washing rodent caging prior to autoclaving in high containment facilities is not often feasible, and so selecting disinfectants that effectively inactivate experimental pathogens but have minimal effects on cage transparency and integrity is needed. The effect of three different disinfectants commonly used in animal biosafety level 3 (ABSL3) facilities on polysulfone cage integrity following autoclaving was evaluated, with the hypothesis that corrosive disinfectants, specifically phenolic solutions, would lead to impaired transparency at a faster rate than other non-corrosive disinfectants. Cages were sprayed with one of three disinfectants: 1) a phenolic disinfectant, 2) a hydrogen peroxide-based disinfectant, and 3) an alcohol-based disinfectant, or were left untouched. The disinfectants were allowed to fully dry, and the cages were autoclaved using standard sterilization settings of 121°C at 30 minutes. The cages were allowed to cool completely, at which time the disinfectants were reapplied, and the autoclave cycle repeated. No change in transparency was observed after repeated disinfectant application-autoclave cycles in any of the disinfectant groups. However, etching was observed on cages sprayed with the hydrogen peroxide-based disinfectant after just one cycle, and full thickness breaks in the plastic were observed in this group after three cycles. This study highlights the importance of balancing experimental pathogen inactivation effectiveness with reduction of adverse effects on caging integrity when choosing disinfectants for high containment animal facilities.

Purpose

Texas Biomed has experienced many cages becoming opaque so that observations can no longer be done cage side (see Figure 1) at an accelerated rate. The purpose of this experiment is to confirm the cause of loss in transparency. Our original hypothesis is that corrosive disinfectants, specifically phenolic solutions, will lead to impaired transparency at a faster rate than other non-corrosive disinfectants.



Figure 1. Example of a cage that has become opaque so that animals can no longer be visualized from outside.

Methods

New cages were ordered and separated into four groups (Figure 2). Each group was then sprayed with disinfectant, given time to allow disinfectant to dry, and then autoclaved at 121°C for 30 minutes. The autoclaving and disinfectant reapplication process was repeated ten times for each group to simulate the cumulative effects of repeated sterilization cycles on the cage material, mimicking real-world conditions in high containment facilities over time.

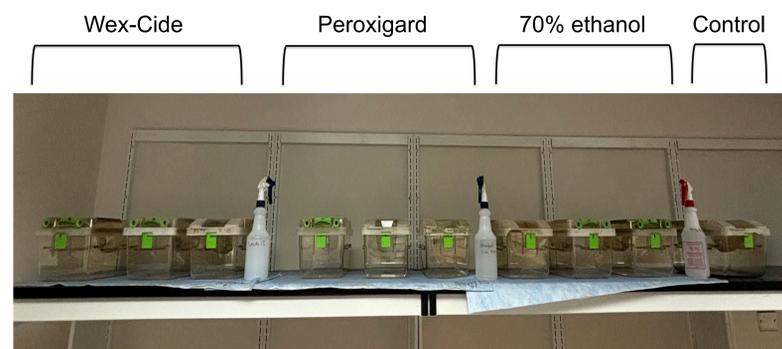


Figure 2. Ten cages were coded (A-J) and split into four groups.

Results

No significant change in transparency was observed in any group after repeated cycles. The Wex-Cide group had very little changes of any kind. However, The three cages sprayed with Peroxigard before autoclaving experienced significant cracking after just three cycles and were determined to not be useable after six cycles. Discovering how detrimental Peroxigard is to the integrity of the polysulfone plastic is a significant discovery (Figure 3).

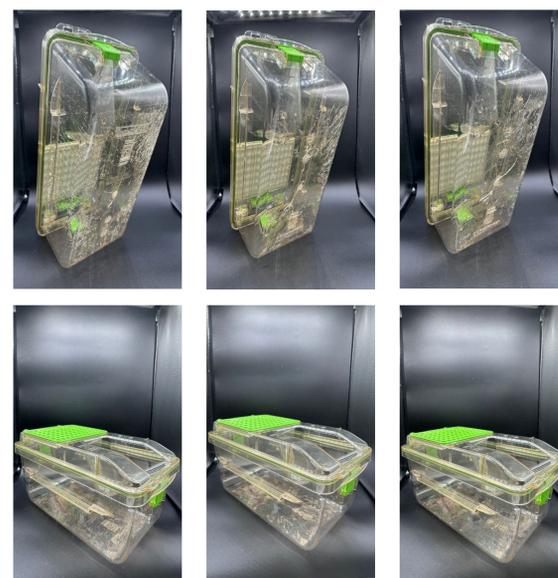


Figure 3. Pictured is the Peroxigard group and the results after 10 autoclave cycles.

All other cages that were sprayed with Wex-Cide and 70% ethanol and the control had no significant change in visibility after 10 cycles.

Conclusions

- The study clearly demonstrates that while the transparency of polysulfone cages remains largely unaffected by repeated sterilization cycles while using any disinfectant we tested.
- The observation of etching after just one autoclave cycle with the hydrogen peroxide-based disinfectant raises critical concerns about its long-term use in environments where repeated sterilization is necessary.
- We should prioritize the selection of disinfectants that have been demonstrated to maintain cage quality over repeated use.

Considerations

We believe that our inability to replicate the conditions of the cages in high containment may stem from not fully accounting for the repeated exposure to disinfectants that occurs when staff and researchers open the cages. In future studies, we aim to extend the experiment by applying the disinfectants multiple times over an extended period before autoclaving the cages. This approach will more accurately reflect staff interactions with the cages. Additionally, it would be valuable to investigate how Peroxigard impacts the cages under these new conditions. We also plan to explore alternative disinfectants to identify a more suitable option. Furthermore, we intend to assess whether adjustments to our lab practices could help prevent cloudiness and cracking in the polysulfone cages.

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