Best Practices For Cleaning In A Vivarium

P209

Carmen Bryant Volpe BA, RVT, LATG[1]; Alma Silva[1]; Lindsey Lueptow[2]; Irina Zhuravka[2]; Cris Torres DVM, MPH[1];

[1]Division of Laboratory Animal Medicine, David Geffen School of Medicine At UCLA;

[2]Behavioral Testing Core, UCLA, Los Angeles, CA

David Geffen School of Medicine

Division of Laboratory Animal Medicine

University of California, Los Angeles

Abstract

Our department oversees the sanitation of the animal rooms in 10 buildings, with 21 species, including 38,000 rodent cages. To validate our sanitation processes throughout the department, a comprehensive environmental monitoring program (EMP) was implemented. The EMP exposed many challenges, particularly the effectiveness of our facility's hygiene practices. ATP bioluminescence (Adenosine triphosphate) demonstrated the amount of organic material that remained after cleaning the floors was unacceptable - 48% of the floors failed with swab results > 500 relative light units (RLUs). To address this failure, we wanted to consolidate one cleaner/disinfectant for all the surfaces in the animal rooms. The chemistry needed to show no behavioral aversion by the animals and have its cleaning and biocidal efficacy validated. We evaluated the cleaning effectiveness of two chemistries, & two types of mops. An alkaline pH quaternary ammonium (Quat) was compared to the chemistry of hydrogen peroxide (H2O2). Cotton and microfiber mop heads were used. Four technicians received one chemistry, one mophead, and a 2-in-1 mop bucket. To create consistency, a specific protocol was followed for mopping. The behavior core tested potential odor aversion for each chemistry vs. tap water using a 3-chamber assay. ATP samples were collected before & after to validate performance.

Objective

1. **Select one detergent/disinfectant product to be used in animal rooms**: The data from the 2020 EMP pointed out failures in our chemicals and cleaning tools. We had three different chemistries, used with cotton mops producing RLUs >10,000. We preferred H2O2, but a residue was left behind. Quat was chosen to compare to H2O2. The optimal product would have no odor and not leave a residue on surfaces. Microfiber mops needed to be included in our decision.
2. **Evaluate the animals' aversion to both cleaning products:** Our final choice needed to be approved by the psychology department. The labs had used the same cleaner since ~1985, and the new product must not be aversive to the animals so as not to interfere with their behavioral testing.
3. **Establish a consistent mopping technique**: A new process needed to be established that was effective yet reproducible and easily followed by all techs.
4. **Validation of cleaning:** Establish a process to evaluate the biocidal efficacy of the chemistry with microfiber. A standard was established using ATP testing.

Parameter Evaluated	H202	Quaternary Ammonium
Animals displayed a decreased aversion to the product		X
Clean appearance		X
Cost savings		X
Decreased ATP results with Microfiber	X	X
Technician preference (No fragrance, decreased tackiness, and foaminess)		X

Figure 1. *Parameters evaluated & the product that performed the best in each field.*

Methods

1. **Four groups were set up and assessed, each consisting of one mop type and one disinfectant: Microfiber-Quat, Microfiber-H2O2, Cotton-Quat, & Cotton-H2O2**. ATP samples were collected before and after mopping to determine the amount of organic material. Data were collected in four animal rooms weekly for three weeks. A T-test was used to evaluate significance.
2. **Aversion to the products:** Mice and rats were exposed to the two products compared to water in a three-chamber preference test. Each side was sprayed fifteen (15) times with water or the cleaner and allowed to air dry. The animals received ten (10) minutes of habituation time in the center chamber (water); then ten (10) minutes for free exploration in the two additional chambers (one sprayed with quat, the other with H2O2). Thirty-two (32) mice and eighteen (18) rats were each exposed twice to the chambers. The box was rotated between subjects to avoid room-side preference. Due to aversion, quat was chosen for hood use as well.
3. **The new mop system:** 2-in-1 mop buckets and microfiber tube mopheads. New chemical dispensing stations delivered properly diluted the chemical. A training video was created and distributed to standardize the mopping technique. Training the room technicians was the first step to creating a consistent pattern that could be reproduced, thus minimizing soil load.
4. **Validation:** ATP validated the process and chemical's ability to clean. Floors passed if ≤ 2500 RLUs. Caging passed if ≤ 150. All areas and supplies were tested quarterly. For the use of quat in spray bottles, we verified how long quat was active once diluted. Quat binding (quaternary ammonia cations are neutralized in a cleaning solution, reducing its germ-killing efficacy) concerns were deflated by checking the parts per million(ppm) daily using Hydrion® pH and sanitizer test kit (Quat Check 1000). Quat ppms were above 1000 for at least three weeks.

Figure 2. *Quat was left in a spray bottle to mimic use in the hood. Test strip dipped daily for 3 weeks.*

Conclusions

Both H2O2 and quat with microfiber decreased the soil load - H2O2 was significant (p=0.0039), and quat trended towards significance (p=0.088). Mice displayed a significant aversion to H2O2 ($p < 0.0001$), and rats had an aversion to H2O2. Both mice and rats displayed no preference or aversion to quat. Quat left no residue & didn't foam up. 1.25 ounces of quat was needed compared to 2-8 ounces of H2O2. Based on all parameters, quaternary ammonium was chosen.

Results

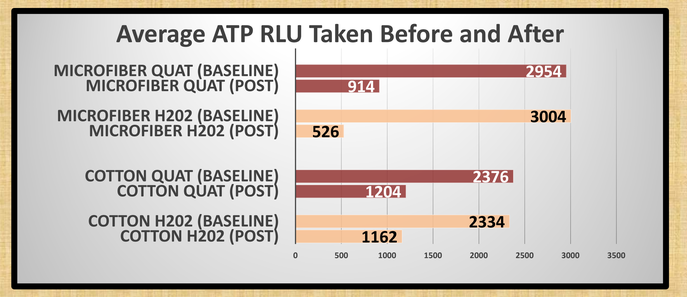

Figure 1*. Using a microfiber mop with a quat solution decreased the ATP by 68%, compared to 48% with a cotton mop. Findings trended towards significance (P=0.08828). Using a microfiber mop with H202 solution decreased the ATP by 79% compared to 48% with a cotton mop. The results were significant (P= 0.003915).*

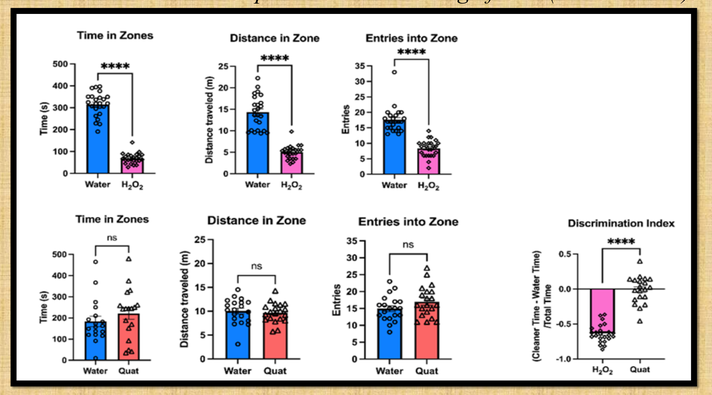

Figure 2. *Mice showed a significant aversion to H202 (p<0.0001). They showed no preference or aversion to quat.*

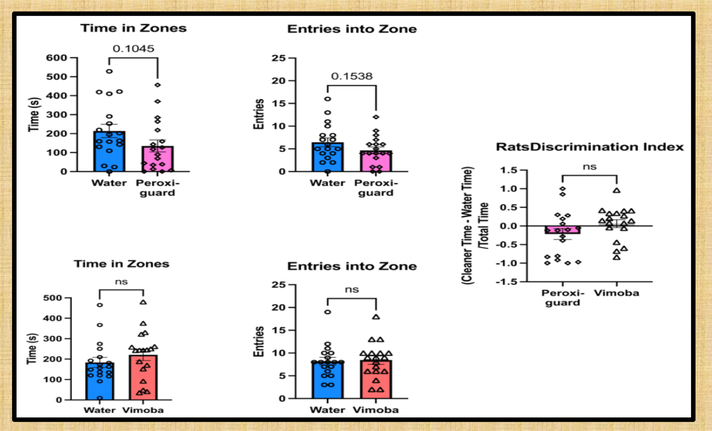

Figure 3. *Rats were trended towards having an aversion of H2O2. They did not have a preference or aversion to quat.*

Acknowledgments

Special thanks to DLAM's technicians who helped us: Mariela Del Real, David Pelayo, Lorena Cervantes, Yaned Alvarez, Dora Welch, and Maria Cruz. Thanks for taking pride in your work!

We'd also like to thank Donna, Stephanie, Tim, and Nick from Quip Labs for their assistance with rolling out the environmental monitoring program and their dedication.

For the aversion study, we owe thanks to Dr. Zahorsky Reeves and the Fanselow lab for coordinating studies with the behavior core.

Contacts: Carmen Bryant Volpe: cvolpe@mednet.ucla.edu

Alma Silva: aisilva@mednet.ucla.edu