EFFICACY OF MR CLEAN, CLOROX, AND LYSOL DISINFECTING SPRAY IN KILLING MICROCOCCUS LUTEUS, BACILLUS MEGATERIUM, AND ESCHERICHIA COLI BY COMPARING ZONE OF INHIBITION.

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ABSTRACT

Lysol, Clorox, and Mr. Clean are popular household disinfecting brands. Each one has a different ingredient as its active ingredient, the ingredient that does the germ-killing. For Lysol, this ingredient is Alkyl dimethyl benzyl ammonium chloride; Clorox uses sodium hypochlorite; Mr. Clean uses sodium hydroxide. Each active ingredient works differently in the presence of bacteria. Alkyl dimethyl benzyl ammonium chloride can be said to be the most effective against *E. Coli*, and *M. Luteus*, with no effect on *B. Megaterium* because it is a sporing bacteria. Sodium hypochlorite is likely to be effective against all three species of bacteria. Finally, sodium hydroxide will be effective on *E. Coli* and *M. Luteus*, with a small effect on *B. Megaterium*, if any effect shows.

INTRODUCTION

The ongoing spread of COVID-19 has drastically impacted the world. More people are becoming concerned with how "clean" their homes are in order to minimize the spread of germs in their environment. With various brands of disinfectant sprays, it is natural to want to use the most effective brand when sanitizing. In the United States, the top brands of disinfectant sprays are Lysol, Clorox, and Mr. Clean. The purpose of this experiment is to determine which of those brands works best and is the most effective at killing common household bacteria. The bacteria species chosen were *Micrococcus Luteus*, *Bacillus Megaterium*, and *Escherichia Coli*. To figure out the effectiveness of each brand, the disk-diffusion assay method will be used to see the zone of inhibition of microbial growth. The larger the zone of inhibition, the better the brand. *M. Luteus* is a gram-positive bacteria that can be found in dust, water and/or human skin. It is

typically non-pathogenic but is capable of causing infections. *B. Megaterium* is a common bacteria that can be found on different surfaces. It is a gram-positive bacteria that is capable of forming an endospore. *E. Coli* is a gram-negative bacteria and is one of the most common bacterial causes of food poisoning. It can be found on surfaces that have been contaminated. Our hypothesis is that Lysol will be the most effective against *E. Coli* and *B. Megaterium*, Clorox will be most effective against *M. Luteus*, and Mr. Clean will be somewhat effective against *M. Luteus* and *E. Coli*, but not *B. Megaterium*.

METHODS

Our experimental design would have involved obtaining three bacterial living tube samples (*M. Luteus*, *B. Megaterium*, and *E. Coli*), along with 3 standard round, polystyrene Petri dishes (100 x 15 mm) complete with plain tops and bottoms divided into four 11-mL compartments ("X" plates). Each dish will contain 20 mL of Mueller Hinton agar. *M. Luteus* will be streaked uniformly onto each agar compartment for one dish using sterile inoculating loops with 10.0 µL tips and will be allowed to dry for 5 minutes. The same goes for *B. Megaterium*, and *E. Coli*. A blank, sterile antibiotic disk will be placed on one compartment of each disk using flame-sterilized forceps. After adding 20 µL of Lysol on an antibiotic disk and letting dry for 3 minutes, it will be placed onto a compartment of one disk using flame-sterilized forceps. This step will be repeated for Mr. Clean and Clorox until each compartment of the *M. Luteus*, *B. Megaterium*, and *E. Coli* culture contains a different antimicrobial disk. The plates will be incubated for 24 hours at a temperature of 37 °C. The resulting diameter (measured in mm) of the zone of inhibition for each compartment would have been recorded and organized in a table.

The table will consist of the first column listing the bacteria species, the column listing the zone of inhibition diameter for the control (which should be 0 mm), the third column listing the zone of inhibition diameter for Lysol, the fourth column listing the zone of inhibition diameter for Clorox, and the final column listing the zone of inhibition diameter for Mr. Clean. However, due to the cancellation of school, we were unable to carry out our experiment.

RESEARCH AND DISCUSSION

Lysol's All-purpose cleaner has two major ingredients that do the germ-killing: Alkyl (67% C12, 25% C14, 7% C16, 1% C8-C10-C18) dimethyl benzyl ammonium chloride and Alkyl (50% C14, 40% C12, 10% C16) dimethyl benzyl ammonium chloride (RB Brands, n.d.). These chemicals work by interrupting intermolecular interactions, which cause the breakdown of lipid bilayers, which ultimately results in cellular lysis (Maris, 1995). The chemicals can also affect enzymes in the cell by deactivating them. Due to the mechanism of the chemicals, it is expected that they will be more effective against gram-positive bacteria. This is because unlike gram-negative bacteria which has two layers above its plasma membrane (The first layer is an outer membrane which decreases its permeability. The second layer is a thin peptidoglycan structure to provide support), gram-positive only has one thick layer of peptidoglycan above its outer membrane. Bacteria with endospores are generally resistant to benzyl ammonium chlorides (Leggett, Setlow, & Maillard, 2016).

The main antimicrobial chemical in Clorox Clean-Up Cleaner plus Bleach is sodium hypochlorite (SmartLabel, n.d.). This chemical oxidizes different molecules and compounds in the cell, denaturing and destroying lipids, proteins and other metabolic chemicals (Maris, 1995).

Because this chemical targets protein and metabolic pathways, it is highly likely to be effective against gram-positive, gram-negative and spore-forming bacteria.

For Mr. Clean Antibacterial Multi-Surface Cleaner, the active ingredient is sodium hydroxide (EWG, n.d.). Sodium hydroxide is an alkaline compound that works on bacteria by removing nucleic acid and proteins and inactivating endotoxins (which are produced by gram-negative bacteria) (Maris, 1995). This means that sodium hydroxide will be effective against both gram-positive and gram-negative bacteria. As for bacterial spores, the effectiveness can be said to be limited.

CONCLUSION

Based on the information that was found on each brand's main antibacterial ingredient, Lysol might be the most effective against gram-positive, non-sporing *M. Luteus* and gram-negative, non-sporing *E. Coli*, with no effect on gram-positive, sporing *B. Megaterium*. It is highly plausible that Clorox will affect all three species of bacteria, and will have the largest zone of inhibition diameter on *B. Megaterium*. Mr. Clean will be effective against *M. Luteus* and *E. Coli*, with little to no effect on *B. Megaterium*.

REFERENCES

1. RB Brands. (n.d.). LYSOL® All Purpose Cleaner - Lemon Breeze. Retrieved March 12, 2020, from http://www.rbnainfo.com/product.php?productLineId=343
2. Maris, P. (1995). Modes of action of disinfectants. Retrieved March 13, 2020, from https://pdfs.semanticscholar.org/4bbf/90d8c567d17
3. Leggett, M. J., Setlow, P., & Maillard, J. Y. (2016, March 11). Assessing the activity of microbicides against bacterial spores: knowledge and pitfalls. Retrieved March 14, 2020, from https://sfamjournals.onlinelibrary.wiley.com/doi/full/10.1111/jam.13061
4. SmartLabel. (n.d.). Clorox® Clean-Up All Purpose Cleaner with Bleach – Lemon Scent. Retrieved March 13, 2020, from https://smartlabel.labelinsight.com/product/6095406/ingredients
5. EWG. (n.d.). Mr. Clean Antibacterial Cleaner, Summer Citrus Cleaner Rating. Retrieved March 14, 2020, from https://www.ewg.org/guides/cleaners/6230-MrCleanAntibacterialCleanerSummerCitrus/