"Not Your Everyday Disinfectant" Antiviral Efficacy of Natural Acids and Essential Oils

Melanie Gorritz[1-2], Charles P. Gerba, PhD[2-3], Stephanie A. Boone, PhD[2-3]

[1]Mel and Enid Zuckerman College of Public Health, University of Arizona; [2]Department of Environmental Science[3] Water & Energy Sustainable Technologies (WEST) Center

General Background

The WEST Center focuses on microbiology and their current study is the efficacy of a variety of organic acids and plant essential oils that possess antimicrobial properties that include antibacterial, antifungal, and antiviral components. These natural acids and essential oils are tested against the bacteriophages Phi-X 174, a single stranded DNA virus as well as MS-2, a single stranded RNA virus; MS 2 can be used as a surrogate for respiratory viruses and neuroviruses. The overall goal is to replace the current surface disinfectants used that are known to have harmful ingredients that can cause irritation, itching and even dermatitis. The current ingredients seen in these disinfectants and sanitizers include alcohol, chlorine, hydrogen peroxide among others. The West Center wants to replace these harmful ingredients with acids like Salicylic acid, Acetic acid, Tartaric acid and plant essential oils like Eugenol, Cinnamaldehyde, Thymol, and Carvacrol.

Essential Staff:

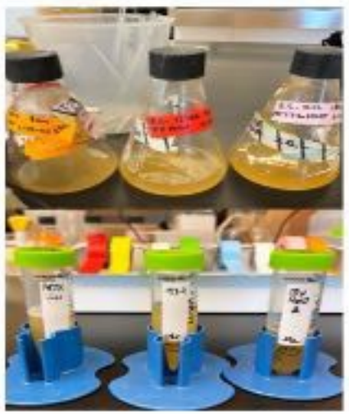
PI: Charles P. Gerba

Lab Tech: Jon Q. Lehman

PhD Research Scientist: Stephanie A. Boone

Grad Students: Ray Sanchez, Skylar Tilden

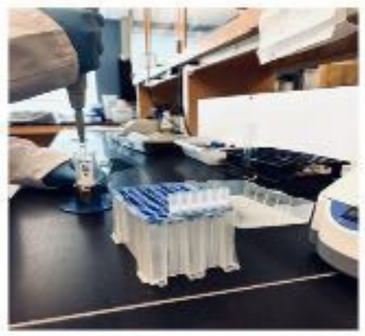
Methods and Processes



- Bacteriophages MS-2, Phi-X 174, and were propagated into their E. coli hosts to reach log phase of growth
- This was accomplished by adding the E. coli into TSB (tryptic soy broth) through sterile pipettes

- Plates with TSA (tryptic soy agar) was made and labeled with the virus that would be used to pour an agar overlay to perform the titer
- The titer is performed so we can know the concentration of the virus.

Methods and Processes



- Then came the actual titer, for this 100µ of diluted plaque forming units of the bacteriophages were vortex and then added into the top agar solution.
- After that the solution was vortexed again before pouring it over the surface of the TSA swirling it and allowing it to solidify.
- Once plates were semi-solidified, the plates were placed in the incubator at 37°C for 18-24 hours.
- The next day plates were counted at the dilutions -8,-9, -10, and -11 to get the concentration of each virus

- For my research the antimicrobial we specifically looked at the Salicylic acid
- With these we did screening assays to determine the correct concentration of the virus with Salicylic acid

- Taking the pH of the waters and other solutions we use in the lab were essential to make sure the filters for the water were leaving the solutions at the right pH especially since we used them for our experiment so often (Nano-pure, DI, and Tap Water)

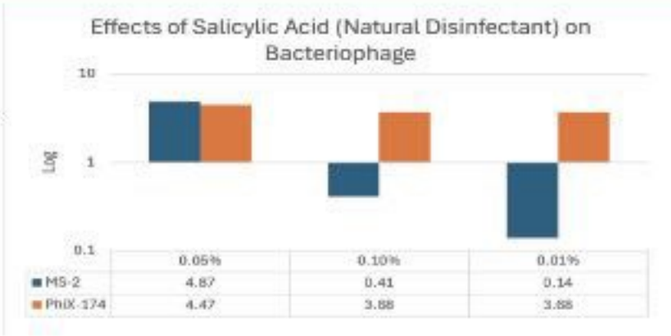
- Creating dilutions were almost a daily occurrence for our lab as well as creating Media because we always needed fresh dilution tubes and plates for our titers.

- Creating the concentrations for Cinnamaldehyde, Acetic acid by diluting the Acetic and Cinnamaldehyde with Saline water as well as creating concentrations of Salicylic acid with 30% Ethanol

Key Takeaways

My summer experience was very fun as well as enlightening. At first the whole idea of this experience was very nerve-wracking, mainly the thought of working in a microbiology lab with no prior experience in microbiology and a lab in general. Despite all my nerves I truly loved the overall experience here. My research experience was very hands on and working with real viruses and bacteria was very cool and something I would never have seen myself doing. Keeping all the steps and methods for these procedures in my memory was surely one my biggest struggles, but my lab mentors were very helpful and always offered refreshers so I could make sure I was doing correctly and preventing any contamination that could alter our results.

Conclusion



In conclusion, this project is still ongoing and still has more results to be made but we were able to get results for Salicylic Acid that showed the following:

- Phi-X 174 is very sensitive to Salicylic acid in lower amounts and can be deactivated by Salicylic acid completely
- Salicylic acid in lower amounts is less effective at deactivating MS-2
- We were able to read plaque counts of Phi-X more visibly by increasing the amounts of agar used in our overlays

Acknowledgements

I would like to take this opportunity to acknowledge everyone in my lab and how welcoming and open everyone was towards me. I would especially like to thank Dr. Gerba, Dr. Boone, and Jon Lehman for being so gracious and helpful throughout this whole process as well as the Steps 2 Stem program for allowing me to be apart of this great experience!

Arizona | Southwest Environmental Health Sciences Center, College of Pharmacy