

Investigating the Potential Resistance of *E. coli* Against Argon Cold Atmospheric Plasma (CAP) Sterilization Exposure

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Introduction

- Cold atmospheric pressure plasma (CAP) has become an important tool to aid in the sterilization of pathogenic bacteria.
- CAP is generated when an electric current runs through a gas, causing it to be ionized. Due to the ionization of the gas, reactive oxygen species (ROS) are produced, which disrupt cell membranes and other components.¹
- The aim of this experiment was to investigate if bacteria develop resistance to CAP after being exposed and survive the treatment.

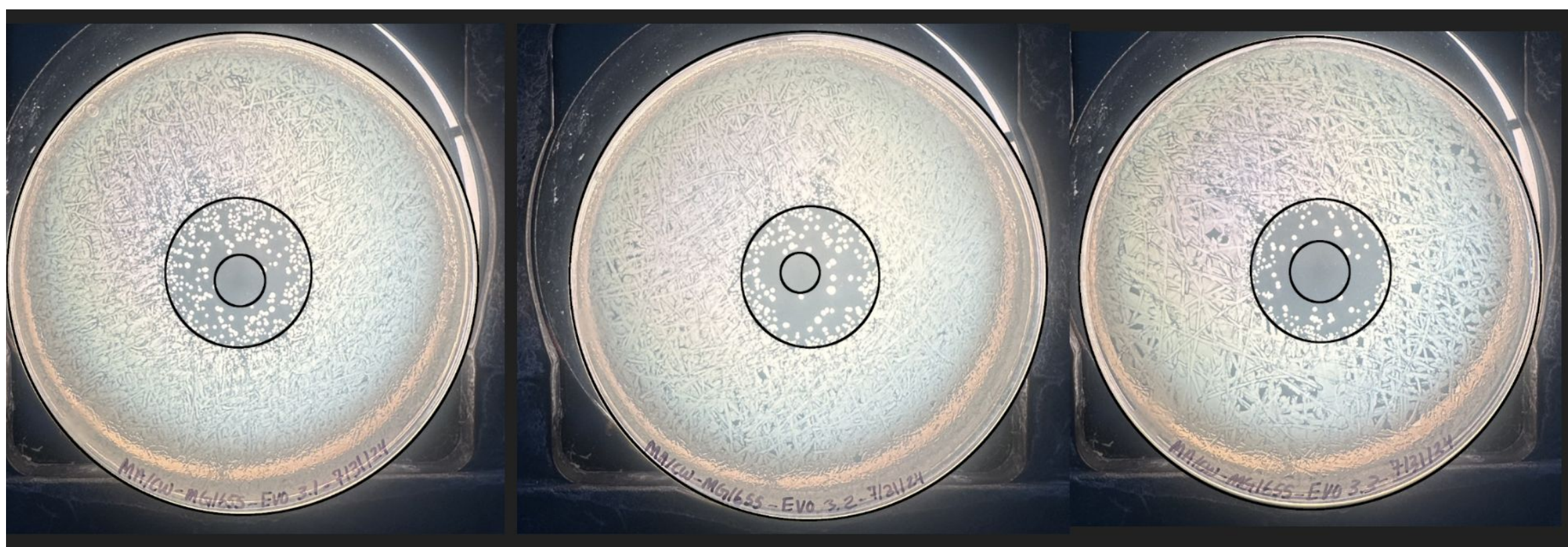


Image 1: Partial and complete kill areas were analyzed using GIMP image software as indicated in the image above

Methods

- The first generation of MG1655 *E. coli* were cultured on LB agar plates.
- The plates were then exposed to 180 seconds of argon CAP by using a gas flow of 1.5 SLPM and a voltage of 6.0 kV.
- After incubating the plates overnight at 37°C, the area where no colony was present was streaked onto fresh LB agar plates and incubated for 12-18 hours.
- From the exposed first generation plates, one colony closest to the area of no colony formation was selected to grow a second generation. The second generation plates were then exposed to 180 seconds of argon CAP under the same conditions as the first generation.
- GIMP image software was used to analyze the area of the partial and complete kill zones where no colonies were present.
- Statistical analysis was performed using a Student's t-test.

References

1. Zhang, Hao, Chengxi Zhang, and Qi Han. 2023. "Mechanisms of Bacterial Inhibition and Tolerance around Cold Atmospheric Plasma." *Applied Microbiology and Biotechnology* 107 (17): 5301–16. <https://doi.org/10.1007/s00253-023-12618-w>.

Acknowledgements

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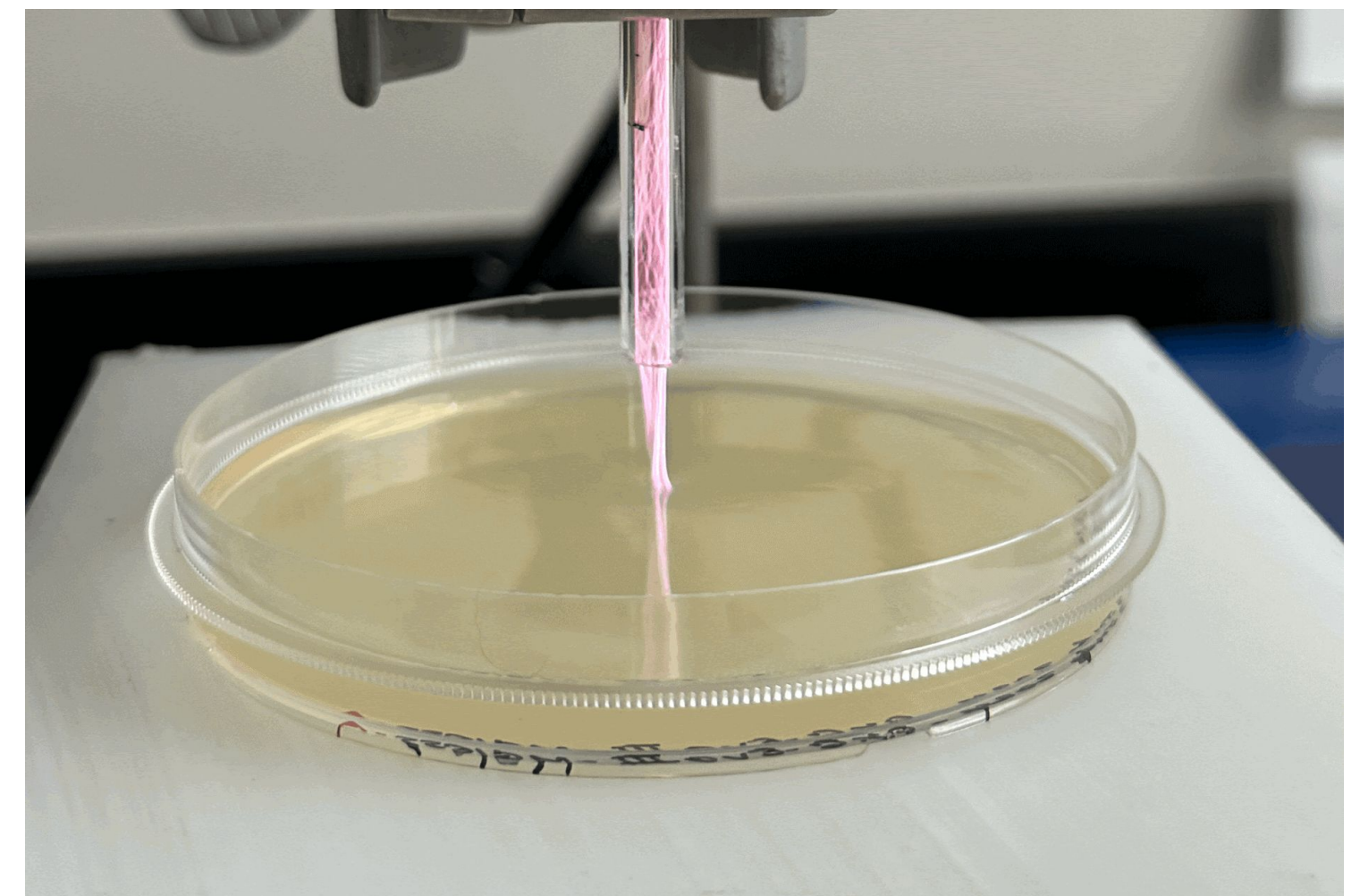


Image 2: Argon CAP apparatus treating a plate of *E. coli*

Findings

- No colonies were present on the plates streaked from the complete kill zone indicating bactericidal action of CAP.
- The p-value calculated for first and second generation in the partial kill zones was 0.185 (Image 3 left).
- The p-value for the complete kill zones was 0.009, which indicates a statistical significant decrease of the complete kill zones for the generation 2.

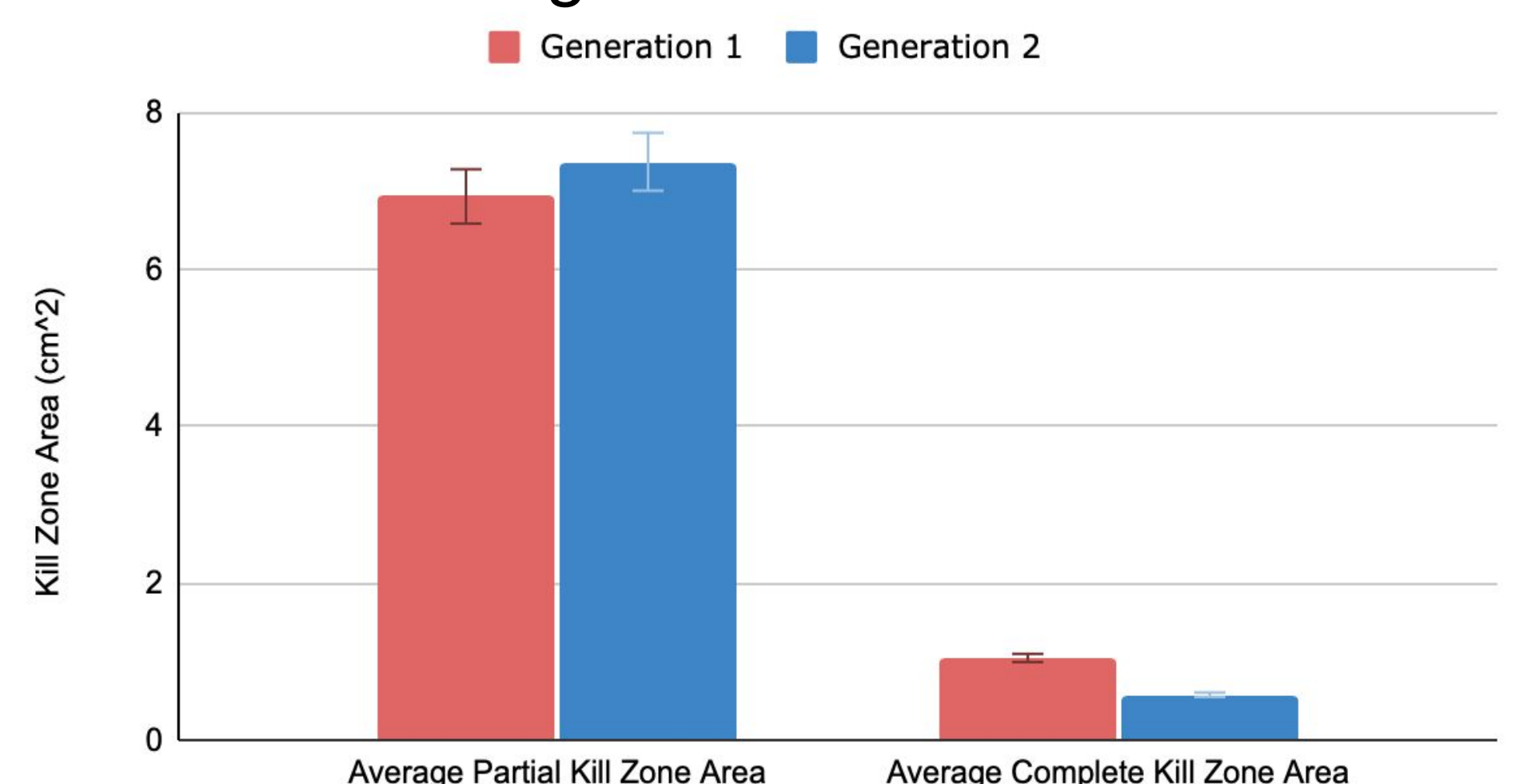


Image 3: Bar chart showing the average partial and complete kill zone areas (cm²)

Conclusions

- As indicated by the Student's t-test, a statistically significant difference between the first and second generations was observed.
- Further experiments and techniques are required to provide a more concrete understanding of the effects of argon CAP on bacterial resistance of *E. coli*.