



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2018 PROJECT SUMMARY

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<b>Project Title</b> Inhibiting Escherichia coli	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The objective of my study was to determine the efficacy of 5 antimicrobial substances at inhibiting the growth of Escherichia coli. I also wanted to examine whether combination products were more effective due to synergy.</p> <p><b>Methods/Materials</b> I inoculated 5 agar plates, using sterile procedures, with Escherichia coli K-12 strain and then placed a sterile control disc with no substance and a sterile disc with one of 5 substances on opposite sides of the plate. I also had a separate control plate for every trial. The substances used were 6% bleach, 10% povidone-iodine, 20% vinegar, 2% chlorhexadine gluconate with 70% isopropyl alcohol, and 3.15% chlorhexadine gluconate with 70% isopropyl alcohol. I inverted and incubated the 6 plates at 37 degrees Celsius for 48 hours. I then measured the size of the zone of inhibition around each disc in millimeters and calculated the standard deviation. Based on the measurements of the zones I classified the Escherichia coli response as susceptible, intermediate, or resistant to the substance. These classifications are determined/accepted by the Clinical and Laboratory Standards Institute.</p> <p><b>Results</b> The results demonstrated that 6% bleach was the most effective against E.coli with an average zone of 43.5 mm. Povidone-iodine was the second most effective with an average zone of 16.3 mm. E.coli only showed an intermediate response to the CHG/Alcohol combination substances and the synergy of these substances was not completely effective. 20% vinegar was not able to inhibit the growth of E.coli as it demonstrated resistance in every trial.</p> <p><b>Conclusions/Discussion</b> Escherichia coli is a significant contributor to food borne illness and hospital acquired infections so knowing the most effective antimicrobial can be life-saving. My findings indicate that 6% bleach and other Halogens should be used to prevent E. coli growth on potentially contaminated surfaces. Both bleach and povidone-iodine are Halogen-releasing compounds and appear to have mechanisms of action that inhibit E.coli with the greatest efficacy. Despite vinegar being advocated for as a "non-toxic" disinfectant I determined it was 100% ineffective as an E. coli inhibitor, therefore unreliable in protecting people. A synergistic effect of combination products may not be as advantageous as choosing a class of chemicals with specific mechanisms that target E.coli structure and function.</p>	
<b>Summary Statement</b> I determined, that of 5 substances commonly used in healthcare as antimicrobials, bleach and then povidone-iodine were superior at inhibiting the growth of Escherichia coli.	
<b>Help Received</b> My mom who works in healthcare taught me the principles of sterile technique and the processes to follow. My science teacher Mrs. Van Nice gave me guidance while I determined my procedure and provided feedback for improvement.	