CALIFORNIA SCIENCE & ENGINEERING FAIR
2018 PROJECT SUMMARY

Name(s)

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Project Number

38564

Project Title

Inhibiting Escherichia coli

Abstract

Objectives/Goals

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.

Methods/Materials

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.

Results

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.

Conclusions/Discussion

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.

Summary Statement

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.

Help Received

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.