CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Sean J. Panado

Project Number

J1510

Project Title

Chlorine Kills: The Cell Density of E. coli in which Tap Water's Chlorine Can No Longer Kill

Abstract

Objectives/Goals

Before water is released from the supply reservoirs as pure, potable, finished water, it must be filtered and disinfected. Chlorination, using the reactive element chlorine, is a common method of treatment. In sufficient doses, chlorine kills microorganisms, including E. coli, within thirty minutes. Contamination of some strains of E. coli can cause serious food poisoning and sometimes death. My objective in this project is to determine the cell density at which chlorine loses its ability to kill Escherichia coli at 100%.

Methods/Materials

Three different types of water were tested: sterile distilled water, my school#s tap water, and a college lab#s tap water. A total of six trials were performed. Per trial, each type of water contained their own series of eight dilutions. Proceeding with the serial dilutions, I allowed the chlorine time to react. Then, I used the spread plate technique to spread each diluent onto a nutrient agar plate. After finding the original cell density, I converted it into exponential form. From there, I multiplied that number by the sample volume in which E. coli stopped growing on the tap water#s nutrient agar plates. I conducted the same for the last plate in which the E. coli grew. I divided the number of colonies on the last nutrient agar plate with growth by the number of colonies that would have grown if there was no chlorine in the water. I converted the result into a percent. This percent is how much E. coli survived.

Results

I have successfully formulated a reliable procedure that shows the range in which chlorine loses its ability to kill E. coli. I also realized the importance of high chlorine content within your tap water. If your tap water#s chlorine content is low, its antimicrobial effect on E. coli could almost be equivalent to that of sterile distilled water.

Conclusions/Discussion

The results and procedure can be used by water authority agencies. My results suggest that the minimum amount of residual chlorine content should be raised. The low requirement may lead to illnesses from infection due to the inefficient killing effect.

Summary Statement

I determined the range in which my school#s tap water can no longer effectively kill E. coli, and also, that the Free Residual Chlorine minimum standard of 0.2 mg/L should be re-evaluated.

Help Received

Supervised by Dr. Michael Leboffe; use of San Diego City College laboratory and equipment