



CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

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Project Title Reduction of Escherichia coli and Chlorine Levels Using a Simple Water Filtration System

Abstract

Objectives

One-third of the world's population lacks access to safe drinking water and 2.57 million people die annually from contaminated water-related illness. Adoption of currently produced colloidal silver lined clay pot water filters in developing countries has been difficult due to barriers in cost, local access to materials and manufacturing. The goal of this project was to develop a simple water filtration unit (WFU) using materials accessible in developing countries. The hypothesis was if Escherichia coli (E. coli) inoculated water treated with chlorine dioxide is filtered through a WFU consisting of terracotta clay, sawdust, activated charcoal and chitosan (clay+sd+ac+chito), E. coli and chlorine levels will be reduced to meet the U.S. Environmental Protection Agency (EPA) drinking water regulations.

Methods

WFUs were constructed consisting of combinations of terracotta clay, sawdust, activated charcoal, and chitosan. The terracotta clay disks were baked above the combustion point of sawdust at 260 degrees Celsius for one hour. One-half of E. coli inoculated water was treated with chlorine dioxide for four hours before being filtered. Non-chlorine treated and chlorine treated E. coli inoculated water were filtered through three of each WFU type. Chlorine levels before and after filtration were recorded. The number of E. coli colony forming units (CFUs) of filtered water inoculated on Luria Bertani petri dishes was recorded after 24 hours of incubation. Average chlorine levels and percent reduction in E. coli CFUs of filtered water compared to unfiltered water were calculated.

Results

Chlorine treated E. coli inoculated water filtered through the clay+sd+ac+chito WFU was found to have no residual chlorine and a 100% average reduction in E. coli CFUs. A 99.3% average reduction in E. coli CFUs was found in non-chlorine treated E. coli inoculated water filtered through the clay+sd+ac+chito WFU.

Conclusions

The results support the hypothesis with chlorine and E. coli levels meeting EPA drinking water regulations in chlorine treated E. coli inoculated water filtered through the clay+sd+ac+chito WFU. The 99.3% average reduction of E. coli CFUs in non-chlorine treated water filtered through the clay+sd+ac+chito WFU is similar to the percent reduction of E. coli using currently manufactured colloidal silver lined clay pot water filters. In this project, a simple water filtration system constructed with materials accessible in developing countries reduced E. coli and chlorine levels to meet the EPA drinking water regulations.

Summary Statement A simple water filtration system constructed with materials accessible in developing countries reduced E. coli and chlorine levels to meet the U.S. Environmental Protection Agency drinking water regulations.

Help Received My science teacher, Mr. Cantalejo, reviewed my research report and procedures. Dr. Ichuiji assisted in the acquisition and preparation of the E. coli Microkwik Culture and taught me how to inoculate the petri dishes. Both Mr. Cantalejo and Dr. Ichuiji served as adult supervisors and reviewed safety precautions.
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