CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)

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Project Number

S1512

Project Title

A Survey and ANOVA Analysis of Ultra-Low Concentrations of Bacterial Contamination

Abstract

Objectives/Goals

The objective of our project was to devise a method for the detection and analysis of ultra-low concentrations of bacterial contamination in public places, such as bathrooms and elevators, as well as water sources using a particle counter.

Methods/Materials

Materials: 84 cuvette sample tubes, SIM-FCS software, particle counter, pipettes, SYTO9 bacterial stain, fluorescent beads, cotton swabs.

Procedures: The independent variable was the sample source. The dependent variable was the number of bacteria that the particle counter detected.
There were several major steps that we took to investigate the problem. First, we validated the use of particle counter to measure bacteria by conducting a fluorescent bead serial dilution. Next, we collected samples from various public places such as the mens# and womens# bathrooms, the microwave, a keyboard, an elevator, a water fountain, and samples from several water sites in southern California. There were a total of 28 samples collected, and 3 trials were conducted for each of the samples. Residue on the cotton swabs was transferred to cuvettes filled with 1 mL of water. We measured the number of bacteria detected by the particle counter in each cuvette.

Results

We determined the calibration curve of the particle counter using the fluorescent bead data. We calculated an R^2 coefficient of determination of 0.987, which implies a strong correlation between bead concentration and the particle counter hits.
The highest amount of bacteria detected was from the microwave, and the lowest was from the elevator.

Conclusions/Discussion

ANOVA analysis of the data verified that the groups we measured were statistically different from each other. The R^2 coefficient of determination was able to validate the use of the particle counter as an accurate method to quantify the number of bacteria in public places.
The particle counter was able to quantify bacteria in public places in ultra low concentrations, from 10 to 105 bacteria per sample. We validated that the particle counter can be utilized for commercial applications, such as detecting pathogens indoors in places such as restaurants, hospitals, and clinical environments.

Summary Statement

Our project demonstrates that ANOVA and R^2 coefficient of determination is an effective way to analyze and validate bacterial contamination in ultra low concentrations.

Help Received

Teachers at my school guided me and reviewed my report.