Instantaneous and Cost-Effective Bacterial Counts using Copper Oxide Nanocomposites

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The aim of this project is to develop an instantaneous and cost-effective method to quantify the total amount of bacteria in a water sample using nanotechnology. Current quantification methods are costly and lengthy. Using copper oxide nanoparticles, a more efficient method was developed. Differences in resistance in samples containing mixed bacteria were measured, and then correlated with the number of bacteria. Resistances were expected to increase with bacterial sample size due to interaction with CuO nanoparticles. To create the nanocomposites, polyaniline, a conducting polymer, was mixed with varying concentrations of nanoparticles. Epoxy and paper nanocomposites were created, then tested dry and with liquid solutions. Current was measured using a multimeter, and 27 V were sourced. Resistance was then calculated using Ohm's Law. The 20% CuO epoxy nanocomposite was selected for use in the coliformulator, a prototype designed for field testing. More influent and effluent samples were then tested. The control liquids had fairly constant resistances, while the bacterial samples showed the predicted trend. The method supported the hypothesis that nanotechnology can be used to rapidly quantify bacteria. Equations were developed to determine the final bacterial count in samples. From last year's study, significant improvements were made. The scope of the research was broadened from E. coli to total bacteria. Resistance values decreased from giga-ohms to ohms, making the use of more inexpensive equipment possible and dropping the cost of analysis to $1.76 per sample, potentially allowing large-scale production. Replication of the study would entail more dilutions of wastewater samples, further research on paper nanocomposites, and more unknown samples.

Awards Won:

Second Award of $2,000