



**CALIFORNIA STATE SCIENCE FAIR  
2002 PROJECT SUMMARY**

<b>Name(s)</b> <b>Angela Beach; Kenneth Takeoka</b>	<b>Project Number</b> <b>S1302</b>
<b>Project Title</b> <b>Shedding Light on the E. coli Dilemma</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> To determine non-toxic methods of neutralizing harmful bacteria, such as Escherichia coli, by using titanium dioxide (TiO<sub>2</sub>) as a photocatalyst.</p> <p><b>Methods/Materials</b> After creating dilutions of Titanium dioxide of 0.000M (control solution) 0.0025M, 0.0050M, 0.0075M solutions, put equal amounts in test tubes. Put one loopful (0.1 mL) of E. coli into each and expose to 24 hours of continuous light. After completing the exposure, extract 0.1 mL from test tubes and spread across evenly on agar-filled petri dishes. Incubate for 48 hours and count number of colony forming units (CFU). Record data and use Analysis of Variance (ANOVA) F-Test to prove differences between control and experimental groups. 500ml water bottles, two liter container, 500 grams of TiO<sub>2</sub>, electronic scale, 250 mL graduated cylinders, 10 mL graduated cylinders, test tube stand, test tubes, incubator, slant tubes with E. coli K-12 strain, inoculating loop/tube, Bunsen burner, Sylvania "Grow-Lux" fluorescent light, trypticase soy agar filled petri plates, distilled water, eye goggles, pairs of non-latex gloves, masks, periodic table of elements, TI-89 calculator, bottle of Clorox bleach, plastic wrap, and microscope.</p> <p><b>Results</b> Null hypothesis = there is no difference between the two groups' Alternative hypothesis = there is a difference between the two groups. Control/Group A (0.0025M TiO<sub>2</sub>)- accept alt. hyp.; Control/Group B (0.0050M TiO<sub>2</sub>)- accept alt. hyp.; Control/Group C (0.0075M TiO<sub>2</sub>)- accept alt. hyp. Group A/Group B- accept Null hyp.; Group A/Group C- accept alt. hyp.; Group B/Group C- accept alt. hyp. Average number of colony forming units: Control- 155.3 CFUs; Group A- 52.4 CFUs; Group B- 38.6 CFUs; Group C- 8.3 CFUs.</p> <p><b>Conclusions/Discussion</b> The ANOVA F-Test proves that differences between control group and variable groups. Between control group and Group A, E. coli exposed to 0.0025M TiO<sub>2</sub> solution, there was an average of 66.3% decrease in formation of CFUs. Between control group and Group B, E. coli exposed to 0.0050M TiO<sub>2</sub> solutions, there was an average of 75.1% decrease in formation of CFUs. Between control group and Group C, E. coli exposed to 0.0075M TiO<sub>2</sub> solution, there was 94.7% decrease in the formation of CFUs. The ANOVA F-Test did not reveal a difference between the number of CFUs in variable groups A and B. However, Group A had 6.3 times more CFUs than Group C, and Group B had 4.7 times more CFUs than Group C.</p>	
<b>Summary Statement</b> Titanium dioxide can be used to neutralize E. coli in the presence of light and water.	
<b>Help Received</b> None	