



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) James G. Karroum, II	Project Number S0616
Project Title Photocatalytic Degradation of Dyes Using Metal Oxides In the Presence of UV Light	
Abstract Objectives/Goals In this project I determined which metal oxide photocatalysts are most effective at degrading various organic dyes at different concentrations. My hypothesis was that if metal oxide suspended in a dye solution is exposed to ultraviolet light, then the dye will photocatalytically degrade, indicated by a decrease in concentration; TiO ₂ will be more effective than ZnO as a photocatalyst, and the rate of degradation will be higher at greater initial dye concentrations. Methods/Materials My variables were the type of metal oxide, type of dye, and the dye's initial concentration. I prepared eight suspensions of metal oxide in dye solution, at different dye concentrations: metal oxides were either TiO ₂ or ZnO, dyes were either methylene blue or methyl orange, and dye concentrations were either equivalent to one drop of 1% solution per 100 mL, or two drops. I created every possible combination of these three variables. I then exposed the mixtures to ultraviolet light for two hours, and every thirty minutes extracted a specific amount, separating solid from solution using a centrifuge. Results After measuring and plotting absorbance of solutions using a spectrophotometer, I observed that concentrations of dye solutions generally decreased with time, supported by visual evidence of color loss. Solutions in the presence of TiO ₂ and ZnO degraded at comparable rates, but in most instances ZnO was more effective. Conclusions/Discussion Most of my hypothesis was proven correct: the presence of metal oxides allowed ultraviolet light to degrade the dyes. Contrary to my hypothesis, ZnO was the more effective photocatalyst in most scenarios due to its greater rate of change of absorbance compared to TiO ₂ . Another part of my hypothesis was proven right in that increased initial concentrations correlated with increased degradation rates.	
Summary Statement I determined which metal oxide photocatalysts are most effective at degrading various organic dyes at different concentrations.	
Help Received My past chemistry teacher showed me how to use a spectrophotometer and a centrifuge, and answered questions I had about lab precautions.	