



**CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY**

Name(s) Cassandra K. Man	Project Number S1016
Project Title The Effect of Visible Light Irradiation on Photocatalyst Mediated Decolorization of Crystal Violet in Wastewater	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Crystal violet is an organic dye that is a serious, yet untreated pollutant in wastewater. Photocatalysis, the acceleration of a reaction involving light through a catalyst, has been investigated as a means to treat crystal violet. The purpose of the experiment was to determine the effect of visible light irradiation on photocatalyst-mediated decolorization of crystal violet for application in water purification. It was hypothesized that exposure to light and zinc oxide photocatalyst will decompose and decrease the concentration of crystal violet in solution.</p> <p>Methods/Materials The experiment required the use of zinc oxide, crystal violet solution, 40W light bulbs, magnetic stirrers, various laboratory glassware, the Spectronic 20D+ Vis-spectrophotometer, and the Ultra-8V Centrifuge. Exposure to light was tested in the study. Three trials of 40 mL 2.5×10^{-5} M crystal violet, with 0.200 grams zinc oxide photocatalyst, were exposed to light. Every 50 min., for a total of 200 min., 10 mL of the suspension was centrifuged and analyzed in a Vis-spectrophotometer for absorption. Two controls of crystal violet solution exposed only to light and crystal violet solution exposed only to zinc oxide were tested for absorption similarly.</p> <p>Results The absorption values of each trial and control were determined through Vis-spectrophotometer analysis, then converted into concentration using Beer's Law. In order to obtain more representative data, average concentrations of the trials were taken from each 50 min. time interval. The average concentration values were plotted against time, and the samples that underwent photocatalysis decomposed to a greater extent after 200 min. than the controls. Based upon the exponential equation obtained from the data, crystal violet is expected to completely decompose at 2500 min.</p> <p>Conclusions/Discussion The concentration of crystal violet solution decreased, signifying decomposition. However, the percentage of decomposition within 200 min. fell short of that obtained using nano-zinc oxide in a 2013 study, showing that zinc oxide, though cheaper, may not be an effective substitute for nano-zinc oxide in purifying wastewater. The concentration of the controls also decreased; hydroxide production through self-ionization of water molecules may have been the cause. These findings warrant a reconsideration of how to most cost-effectively purify wastewater given the various resources needed.</p>	
Summary Statement This project aims to investigate the feasibility, chemically and economically, of photocatalysis to decompose crystal violet dye that is contaminating wastewater supplies.	
Help Received This project utilized equipment (Vis-spectrophotometer and centrifuge) from my high school classroom lab.	