# CALIFORNIA STATE SCIENCE FAIR
# 2017 PROJECT SUMMARY

**Name(s)**

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**Project Number**

**S0607**

**Project Title**

## Photocatalytic Reduction of Hexavalent Chromium Using Titanium Dioxide Catalyst with UV-Irradiation

**Abstract**

**Objectives/Goals**

Investigation of the chemical structure of hexavalent chromium through multiple experiments and changing variables regarding the remediation through the use of the catalyst, titanium dioxide. The objective of these experiments is to investigate possible methods of decontaminating drinking water sources that have damaged communities both locally and nationwide. Goal is to find a method in which hexavalent chromium will be reduced in a short amount of time to a safe amount.

**Methods/Materials**

Creating hexavalent chromium samples using potassium chromate, deionized water, phosphate buffer, and silver-doped titanium dioxide catalyst. After experiments, hexavalent chromium levels were tested using 1,5-Diphenylcarbazide and running through a spectrophotometer at 540 nm. All material were provided by a chemical and environmental engineering lab.

**Results**

After absorbance levels of hexavalent chromium were measured through the spectrophotometer, it was found that reduction speed was most effective at an acidic pHas opposed to a neutral pH, and the catalyst was most effective at one percent silver relative to titanium dioxide, as opposed to one-hap percent, two percent, and five percent.

**Conclusions/Discussion**

Reduction rate of hexavalent chromium is most effective at an acidic pH due to the reaction product being soluble trivalent chromium, which dissolves in the catalyst solution and allows for more catalytic sites. At a neutral pH, the reaction product is insoluble chromium(III) hydroxide, which precipitates on the catalyst surface, disrupting the catalytic sites. The one percent silver titanium dioxide catalyst worked best because at lower percents, there was simply not enough catalytic sites generated, and at higher percents, the excess silver recombines the electron hole, or catalytic sites of reduction, effectively reducing the rate of reaction.

**Summary Statement**

An investigation on how to quickly and effectively reduce the toxic carcinogen hexavalent chromium from the public's drinking water.

**Help Received**

Gongde Chen, graduate student at the UCR Chemical and Environmental Engineering Department aided with correct experimental and safety procedures. All materials were provided by the Chemical lab at UCR.