



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

Name(s) Matthew P. Denton	Project Number J1508
Project Title Efficiency of a Carbon Filter	
Objectives/Goals Adsorption is the process by which activated carbon removes substances from water. Activated carbon is carbon processed to be extremely porous to increase its surface area. The purpose of this experiment is to determine if the amount of total chlorine present in water affects the adsorption efficiency of a carbon filter.	
Abstract Methods/Materials Four different tests were run through previously unused carbon filters. A measured amount of simple household bleach containing sodium hypochlorite was added to tap water to achieve inlet total chlorine concentrations of 5 mg/L, 20 mg/L, 50 mg/L, and 80 mg/l. During the tests, the temperature and flow rate were kept constant. 60 liters of water were run through the filter in each test. The last 250 ml of each two liters filtered was tested with Total Chlorine Test Strips to find the outlet total chlorine concentration. Occasionally, samples were only taken after every 4 liters when the data did not change very quickly.	
Results The data showed that about the same percentage of total chlorine was removed at the beginning of all of the tests, but as the tests went on, there was a much lower percentage of total chlorine removed in the higher chlorine concentrations, especially at 80 mg/L. In other words, total chlorine concentrations were much higher in the tests with higher inlet concentrations as more and more liters of water were filtered. Adsorption isotherms are relations that can be used to predict how much material can be adsorbed by activated carbon. The two constants in the Freundlich isotherm were calculated using the experimental data from the 80 mg/L test. This isotherm curve, using the experimentally derived constants, confirmed the measured data and can now be used to predict the total chlorine removal of other inlet concentrations.	
Conclusions/Discussion The activated carbon filters fails much more quickly as total chlorine concentration increases. This was likely due to quicker saturation of the activated carbon, in which case total chlorine was getting through the filter because less total chlorine could be adsorbed.	
Summary Statement The adsorption efficiency of a carbon filter decreases as the total inlet chlorine concentration increases.	
Help Received My parents helped me lift the large water jug during the experiment, and they proofread my report and helped me with the math of the isotherm.	