



**CALIFORNIA STATE SCIENCE FAIR  
2009 PROJECT SUMMARY**

<b>Name(s)</b> Madeleine C. Silverstein	<b>Project Number</b> <b>J1128</b>
<b>Project Title</b> <b>Wastewater Challenge: Effects of Inexpensive Filtration Methods on Caffeine Removal</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The objective of my experiment was to determine if an expensive filter would be effective at removing drug residues from wastewater, using caffeine as a model. In this experiment, a UV spectrophotometer was used to test for absorbance at the expected wavelength for caffeine.</p> <p><b>Methods/Materials</b> Approximately 80 test samples were evaluated. Samples of Diet Pepsi were filtered through activated charcoal pellets, zeolite, ceramic, or a Brita filter. In another trial, dilutions of soda were first treated with alum, then filtered through fine sand. Some samples were also filtered through activated charcoal.</p> <p><b>Results</b> In dilutions of 3.3 milligrams of caffeine per 100 milliliters, the absorbance at 274 nanometers was reduced by 20% using activated charcoal and by 25% with zeolite. Treatment with alum alone reduced the "caffeine" (absorbance at 274 nm) by 37%. Adding activated charcoal filtration decreased the "caffeine" (absorbance at 274 nm) a total of 45%.</p> <p><b>Conclusions/Discussion</b> By using flocculation and activated charcoal filtration, it appeared possible to remove nearly half the "caffeine" (as represented by the peak at 274 nanometers) in a test sample. One difficulty with my experiment was that the absorbed UV radiation at 274 nanometers may have represented compounds other than caffeine. For example, there seemed to be another compound present in the Caffeine Free Diet Pepsi that absorbed ultraviolet radiation at 274 nanometers. Still, my results indicated it might be possible to remove harmful substances in wastewater through relatively inexpensive filtering methods.</p>	
<b>Summary Statement</b> The purpose of this project was to determine if a relatively inexpensive filtration method could be used to reduce drug residues in wastewater.	
<b>Help Received</b> Thank you to Byung Lee and Invitrogen for the use of their UV spectrophotometer. Thank you to my mother for her advice and encouragement. Thank you to my science teacher for lending me equipment.	