



**CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY**

Name(s) Caroline L. Daniher	Project Number 36283
Project Title How an Alum Flocculant Improves the Efficiency of a Ceramic Filter to Purify Water	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Imagine there was a natural disaster affecting your water source, or you lived in an area where clean water was questionable. What would you do? One thing you can do is filter your own water, but this may take a long time especially if the water is extremely turbid. I am asking whether using a flocculant improves the efficiency of a porous ceramic filter to purify turbid water. I am also looking at whether a flocculant improves the water quality after filtration. Completing this experiment will hopefully prove that a flocculant can improve the efficiency of a porous ceramic filter to purify water and the quality of filtered water.</p> <p>Methods/Materials I used ceramic filters, alum, dirt, water, and a nephelometer. First, I made all the turbid waters with different amounts of dirt. Then, I flocculated half of them using a 10% alum ($KAl(SO_4)_2 \cdot 12H_2O$) solution. Finally, I filtered both the flocculated and non-flocculated waters in porous ceramic filters. I recorded the amount of water filtered at timed intervals. Turbidity of the water was measured before and after filtration with a nephelometer.</p> <p>Results My results show how much more efficient the porous ceramic filters were in filtering the flocculated waters compared to the non-flocculated waters. By flocculating the water, the filtration rates improved between 45% and 238%. For example, the 800g of dirt water sample filtered at a rate of 0.89 ml/minute and after flocculation it filtered at 3.03 ml/minute. This is a 238% increase. The more turbid the water was, the more effective the flocculant improved filtration rates. The nephelometer measurements showed that flocculation improved the water quality both before and after filtration. The Nephelometric Turbidity Units (NTU) were about the same as drinking water after filtration.</p> <p>Conclusions/Discussion This was a useful study on the flocculant alum. Since alum is a positively charged compound, it bound easily with the negatively charged suspended particles in the water. This caused the dirt particles to have a larger diameter and settle at the bottom. The flocculated water could then filter more quickly through the ceramic filter resulting in higher filtration rates. Flocculation also led to improved quality (lower NTU) before and after filtration. In conclusion, alum is very useful as a pretreatment before water filtration.</p>	
Summary Statement I used an alum flocculant as a pretreatment to purify water and this resulted in faster filtration rates through the ceramic filter and improved water quality.	
Help Received My mom purchased the materials and taught me how to use a drill. My dad helped me make the graphs. A neighbor lent me the nephelometer and taught me how to use it.	