SCIENCE FAIR NEWS

On April 9, 2015, the team of Rebecca Spearot and Michael Mutnan represented our section as Special Judges at the 60th Colorado Science and Engineering Fair. We are proud to announce the AICHE Rocky Mountain Section 1st and 2nd Place Projects. These students are awarded a monetary prize, certificate and an invitation to attend our April 21st meeting. The winners are:

JUNIOR DIVISION

1st Place - $100.00 prize

Project Title: Candy Chromatography

Individual/Team Leader's Name: Jocelyn Sanchez

School & City: Corwin International Magnet School, Pueblo

Sponsor's Name: Jeanette Ackerman

Category: Chemistry

Abstract— I have always had an interest in chromatography, which is a laboratory technique that separates compound mixtures. Chromatography consists of two stages, the mobile phrase and the stationary phrase. These phrases are the movement from compound liquid (mobile) to separated liquid (stationary). Using chromatography, I attempted to separate the mixtures of colors in Skittles and M&M's. According to www.cspinet.org, "Skittles Original had 33.3 mg of dye per serving" While it stated that "M&M's Milk Chocolate had 29.5 mg per serving." Based on these numbers, it appeared that Skittles had the most dye. But, I found that they have more of one color, instead of the most colors. After the stationary phrase, the red and green were tied for the most colors (2), but during the mobile phrase the yellow Skittles dye had two colors and M&M's one. My data did not support my hypothesis. Skittles beat M&M's by one dye color. Skittles dye has more colors than M&M's dye. I actually did have to make an important improvement to my experiment. When using a coffee filter the results were little to nothing, so I had to use paper towels, the results were better, I also attempted to modify the recommended salt water solution but it was ineffective. So, I had to do the recommended two cup solution three different times to receive the right results. In this experiment, I learned that Skittles uses more colors to make their candy more colorful than M&M's although Skittles uses more dye by mg.

2nd Place -$75.00 prize

Project Title: Frac Fluid Friction: Does Sand Grain Size Affect the Viscosity of Hydraulic Fracturing Fluid?

Individual/Team Leader's Name: Finn Stowers

School & City: St. Columba Catholic School, Durango

Sponsor's Name: Bridget Stowers

Category: Engineering

Abstract— The purpose of this experiment was to see if sand grain size had an effect on the viscosity of hydraulic fracturing fluid. I hypothesized that the sand with the largest grain size would increase the viscosity of the fracturing fluid.

For the experiment, I made hydraulic fracturing fluid using water, guar gum, which is a gellant, boric acid as the cross-linker, and baking soda to keep the pH neutral. I ran three trials for three different types of sand. I used coarse, medium and fine grained sand. My control was the fracturing fluid without sand. I dropped a sphere into a graduated cylinder containing the frac fluid mixed with sand. I calculated the velocity of each, then used that data to calculate the viscosity.

My results did not support my hypothesis. The play sand with the smallest grains had the highest viscosity which was 35.7 kg/m·s. The masonry sand with the medium sized sand grains was 24.9 kg/m·s, and the concrete sand with the largest grain size was 21.0 kg/m·s. The control was 19.05 kg/m·s.

My results led me to believe that as the sand grain size decreased the viscosity increased. This is because there was less space between the smaller grains in the frac fluid. There is more friction with the sphere and so the viscosity increased. There is more space between the larger sized grains and there is less friction. This caused the viscosity to decrease.

SENIOR DIVISION

1st Place - $100.00 prize

Project Title: Growth and Testing of New Cocrystals, Part 2

Individual/Team Leader's Name: Sofia Antal

School & City: Cherry Creek High School, Greenwood Village

Sponsor's Name: Stephen Smith

Category: Chemistry

Abstract— Climate change has been a topic of discussion among experts and the public for several years. One of the primary contributors to increased global temperatures is air pollution. Carbon dioxide produced by factories, cars, and power plants all of which negatively impact the environment. CO2 is produced through the combustion of carbon rich fuels such as coal or oil. Due to the continuous increase of air pollution, it is vital to further develop gas capture methods. It is well recorded that CO2 reacts with amines. While several studies have been published regarding the kinetics of CO2 and amine reactions, there is no literature cataloging the solid products. The purpose of this project was to evaluate the ability of CO2 to react and form crystals and cocrystals with various amines. Among the materials tested were amines reported to react with CO2 in literature. Different methods of single crystal growth and co-crystal formation were tried. A variety of methods for dissolution were tested as well. Crystal structure of starting amine piperazine and crystalline structures of reaction products with CO2 have been characterized and discussed. Crystallization and cocrystallization may be useful as a future method of storing CO2 in a solid state to reduce air pollution.

2nd Place - $75.00 prize

Project Title: Testing the Water: A Review of Various Acid Mine Drainage Remediation Options

Individual/Team Leader's Name: Liam Foster

School & City: Animas High School, Durango

Sponsor's Name: Steve Smith

Category: Environmental Sciences

Abstract— After 3,000 feet of tunnels were excavated deep into the side of Bonita Peak, the Red & Bonita mine shut down due to the ore's inability to sustain the operation. Ever since, the abandoned tunnel and tailings have been discharging a toxic mix of dissolved lead, cadmium, zinc, and manganese, among others, while metal sulfide minerals exposed continue to oxidize, producing sulfuric acid. One may suspect this is a worst case scenario, but similar ecological disasters occur everywhere there is mining. According to the Animas River Stakeholders Group, a 1,000 gpm. treatment plant on Cement Creek could lower the level of zinc in the Animas by 81%.

This project is a review of several acid mine drainage remediation options, based off of water from the Red & Bonita mine. The methods tested were adding ammonia or sodium hydroxide to raise pH, the addition of sodium phosphate as a precipitating agent, and a pH supplement following the (sodium) phosphate tests. After testing was completed (does not include more recent research), it was determined that the phosphate with a pH supplement to 9.24 was an order of magnitude more effective at removing metal than the other tests, precipitating 0.24 g. of metal out of 166 ml. of water. The most efficient method was ammonia, with the use of phosphate as runner-up. The least costly method was utilizing ammonia, with phosphate, again, as runner-up. Therefore, my testing shows that sodium phosphate with a pH supplement was the best fit.

CONGRATULATIONS TO THEM ALL!!!