

## Chemists Celebrate Earth Week 2019: CONCRETE WORKSHOP

On April 23 & 25 2019, **OC ACS Environmental and Younger Chemist Committees** came together with the ACS student affiliate chapter, *Chemistry and Biochemistry Club (CBC)* from California State University Fullerton (CSUF) to hold a concrete workshop in celebration of Earth Week on CSUF campus. This goal of this program was to create awareness about the serious environmental impacts of traditional cement and concrete production, including its contribution to approximately 5% of CO<sub>2</sub> emissions from human activities globally. Even though standard concrete is familiar to most people, very few are aware of these facts. Additionally, we wanted to teach people about the recent development of the permeable concrete pavement technology and its benefits on storm water control. The targeted audience was Orange County college students and staff, ACS members, and the chemical and technical community.

The April 23 event featured speaker Ava Moussavi, Assistant Engineer – Water Quality Compliance II from Riverside County Flood Control & Water Conservation District (RCFC&WCD). Ava discussed sustainable Concrete, Chemistry of Concrete, Stormwater Drainage, and Pervious Concrete, and the research and testing the RCFC&WCD has done with pervious concrete test beds on their site. Furthermore, each attendee was able to see and touch an array of pervious concrete samples and gravel types provided by Ava from the RCFC&WCD. Attendance for this part of the workshop had a mixture of ACS members, local students and staff from local colleges. The total number of attendees was 15 (including five volunteers).

Afterwards each participant was able to make their own sample size permeable concrete piece. This experiment involved mixing a 1:3 ratio of Portland cement to gravel with 50 mL of water for 3 minutes. We utilized two boxes to maintain the porosity as the concrete dried, one filled with sand, and one with had holes cut out of the bottom. The one with holes was filled with the fresh concrete mixture and was stacked on top of the sand-filled one. Once participants set this up, they were able to decorate the concrete with a variety of colorful marbles, stones, and glass pieces. This part of the event had 8 participants and a couple of spectators, and an additional 4 volunteers.

On April 25, we handed back people's homemade pieces and gave them the opportunity to see how the water drained immediately through the concrete. Everyone's was effective in draining water! Here we spent about two and a half hours doing side-by-side demos showing how flooding looks with normal concrete compared with permeable concrete. We used two 5-gallon buckets to capture water we poured over one large piece of standard concrete in one bucket, and a piece of the hand-made pervious concrete in the other bucket. People who stopped by were wildly surprised by how the water went right through the pervious concrete, and curious to learn more about what it was. We were able to teach onlookers about the chemical processes involved in cement production, and how this creates a 1:1 ratio of each ton of cement to CO<sub>2</sub> released into the environment. Many people were shocked to learn this along with other crucial concrete facts, like how this contributes to approximately 5% of CO<sub>2</sub> emissions from human activities globally, and that pervious concrete can prevent flooding by reducing runoff and mitigate droughts by enhancing water storage in the ground.

This portion of the workshop was very impactful, because we were able to reach out to many people on CSUF campus who had no background related to sustainable concrete, or ACS. One student was very interested in this demo, because he had never heard of pervious concrete, and he and his father do concrete paving jobs here and there. After this event he asked for more information and said he was going to try and incorporate pervious concrete into their work! Another student who participated was a part of the Model United Nations club at CSUF. He said that learning about pervious concrete, and cement production's effect on the environment, was information that he could apply towards environmental law and advocacy in the Model UN club. The total participants for this part of the workshop was 25, with an additional 6 volunteers.

Unfortunately, this event was very close to the end of the semester, and with finals and projects due there were not enough people who could make the RCFC&WCD tour.

Overall, this event gave the community the opportunity to learn about the chemistry of concrete production and pervious concrete from a local expert in the field, make samples of permeable concrete with their own hands, and see pervious concrete at work on a small scale. This event made it possible for participants to make the connection between what is simply under their feet, to the damages its production causes to the earth. Additionally, by taking home their own concrete samples, they were able to keep a souvenir of their experience, what they learned, and become part of the environmental solution.

Afterwards each participant had the opportunity to make their own sample-size permeable concrete piece.



This involved mixing a 1:3 ratio of Portland cement to gravel with 50 mL of water for 3 minutes.

After everyone put their concrete in box to dry and decorate. The results were great!



On April 25, we handed back people's homemade pieces and gave them the opportunity to see how the water drained through the concrete! Everyone's piece was effective in draining water!

We also did a side-by-side demo showing how flooding looks with normal concrete compared with pervious concrete. Many people walking by took a moment to see the demo and learn about the 1:1 ratio each ton of cement releases of CO<sub>2</sub>. Many people were shocked to learn this fact along with others and were wildly surprised by how the water went right through the pervious concrete!

