

## Undergraduate Research Symposium May 17, 2019 Mary Gates Hall

### Online Proceedings

---

#### POSTER SESSION 1

Balcony, Easel 122

11:00 AM to 1:00 PM

##### **Identifying Species Divergence in the Endemic *Caecidotea* Cave Populations**

*Justin Harris, Senior, Molecular Biology, East Central Coll  
McNair Scholar*

*Mentor: Alisha Howard, Department of Biology, East  
Central University*

*Mentor: Kevin Blackwood, Earth Science, East Central  
University*

The Arbuckle karst system consists of caves, microfractures, and hydrogeologic barriers. Isopods in the genus *Caecidotea* inhabit the pools of water within the groundwater system. Young *Caecidoteas* travel through microfractures, and small populations move from one cave system to the next. Over the time these fractures close, causing the populations of *Caecidotea* to be isolated and potentially drift genetically. The sampled distinct populations have become morphologically distinct, but it is yet to be determined if they also have become genetically distinct species. Genetic classification may also provide a more timely identification of fracture closing. DNA Barcoding using the Cytochrome Oxidase subunit 1 (COX1) gene will provide the percent of divergence in the samples obtained from different populations/locations; however, the chitin-heavy exoskeleton of isopoda could make it difficult to have DNA extractions that are “clean” (without protein) and decent yield. An extraction method was used proteinaseK (protK) and high salt to release the DNA followed by ethanol precipitation to concentrate the extract. For DNA Barcoding, the COX1 gene sequences need a PCR protocol with the robust primers is crucial. We plan to explore various primer sets for the optimal amplification.

#### SESSION 2M

##### **McNAIR SESSION - FROM CHAOS TO ORIGAMI: ADVANCES IN MATH, PHYSICS, CHEMISTRY AND ENGINEERING**

*Session Moderator: Therese Mar, OMAD and Department of  
Environmental and Occupational Health Sciences*

**MGH 288**

3:30 PM to 5:15 PM

\* Note: Titles in order of presentation.

##### **Hydroxyl Radical Scavenging Rate Constants for Solid Phase Mineral Surfaces in Oxidative Treatment Systems** *Constance Green, Senior, Molecular Biology, East Central Coll*

*McNair Scholar*

*Mentor: Klara Rusevova Crincoli, R.S. Kerr Environmental  
Research Center, National Research Council*

*Mentor: Scott Huling, R.S. Kerr Environmental Research  
Center, USEPA*

Advanced oxidation treatment processes involve powerful and indiscriminate radical intermediates, including hydroxyl radicals ( $\bullet\text{OH}$ ) and sulfate radicals ( $\text{SO}_4\text{-}\bullet$ ). Inefficiency in radical-driven treatment systems involves scavenging reactions where radicals react with non-target species in water and solids. Radical scavenging studies have been focused on soluble scavengers in the water and have not assessed radical scavenging by solids which are also present in oxidation treatment systems. The objective of this study was to quantify radical scavenging by solid surfaces.  $\bullet\text{OH}$  were produced in iron (Fe)- and UV-activated hydrogen peroxide (Fe-AHP, UV-AHP) systems where the loss of rhodamine B (RhB) dye served as an indicator of  $\bullet\text{OH}$  activity. The basis used to estimate the  $\bullet\text{OH}$  surface scavenging rate constant ( $k_{\text{S}}$ ) were comparisons of treatment results between simple solids-free oxidation systems and more complex systems containing mineral solids. The solids-free system was based on Fe-AHP and UV-AHP reactions; the solids-amended systems were identical but contained different mineral species. Therefore, differences in the loss of RhB were attributed to  $\bullet\text{OH}$  scavenging by the solid surfaces in the Fe-AHP and UV-AHP treatment systems. Alumina ( $\text{Al}_2\text{O}_3$ ), silica ( $\text{SiO}_2$ ),

and montmorillonite ( $\text{Al}_2\text{H}_2\text{O}_12\text{Si}_4$ ) (MMT) are solid minerals found in soil and aquifers. These minerals were used in this study to assess the solid surface scavenging rate constants. Preliminary results in the Fe-AHP system indicated that  $k_{\text{S}}$  for silica ( $2.85 \times 10^6 \text{ l/m}^2 \times \text{s}$ ) was not statistically distinguishable from alumina ( $3.92 \times 10^6 \text{ l/m}^2 \times \text{s}$ ).  $k_{\text{S}}$  values in the UV-AHP system for silica ( $4.50 \times 10^6 \text{ l/m}^2 \times \text{s}$ ) and alumina ( $7.45 \times 10^6 \text{ l/m}^2 \times \text{s}$ ) were greater than estimates in the Fe-AHP system and may be due to pH.  $k_{\text{S,MMT}}$  ( $\leq 4.22 \times 10^5 \text{ l/m}^2 \times \text{s}$ ) was much less than  $k_{\text{S}}$  for silica and alumina indicating  $k_{\text{S}}$  is mineral-specific. A critical analysis suggests that radical scavenging by solid surfaces in aquifer systems is orders of magnitude greater than scavengers in the water.