The Presence of PPCPs in Appalachian Karst Hydrology

Diana Schmidt1 - Steve Ahn2, Emi Miyazaki3, Aaron Napier2, Dr. Madeline Schreiber4, Dr. Kang Xia5

Background

• Pharmaceutical and Personal Care Products (PPCPs) are compounds intended for health, hygiene, or cosmetic use by humans. As contaminants, they enter aquatic environments through wastewater treatment plants, leachate from landfills, and rinse-off from bathing.
• PPCPs are categorized as Contaminants of Emerging Concern by the EPA, meaning that there are no current regulatory standards and can potentially alter or endanger aquatic life.
• Southwest Virginia is situated geologically between the Blue Ridge and Ridge and Valley Geologic Provinces. The area is drained by the Holston and New River watersheds and is a karst region with numerous caves and sinkholes.
• Agricultural runoff and wastewater contamination in these karst systems have been documented in the past.

Objectives

1. Determine the presence of PPCPs in agricultural and urban-impacted karst hydrology.
2. Determine potentially impactful PPCPs in these environments.
3. Compare the number of identifiable PPCPs to Nitrate concentrations per site.

Methods

• 250mL triplicate water samples were collected from the categorized karst hydraulic features during base flow and placed in cold storage.
• The samples underwent vacuum filtration and Solid Phase Extraction (SPE) using Oasis HLB 3cc cartridges
• The samples were analyzed using UPLC/MS/MS analysis (Method 1694, Environmental Protection Agency, 2007).

Results

Figure 1: Study sites and land-use percentages for all sites

- Sites were separated into categories based on surface buffer land-use percentages. (Fig. 1)
- The samples tested positive for 40 of 140 PPCPs.
- Each site tested positive for between 5 and 23 compounds each.
- Three of the identified compounds are known Endocrine Distributing Compounds (EDCs).
- Urban-impacted sites were found to have more PPCP identities than agriculturally-impacted and forested sites. (Fig. 2)
- An indirect correlation between the number of identifiable PPCPs and Nitrate concentrations was determined from sample site averages. (Fig. 3)

Next Steps

1. Determine concentrations of potentially impactful PPCPs in sample sites.
2. Determine variations of EDC concentrations downstream of karst exit-waters.
3. A dye trace study of the hydrology of the study area.

Acknowledgments: Special thanks to VT CSES, Dr. K. Xia, Dr. M. Schreiber, Sheldon Hilaire, Jason Justice, and William Ondroff.
This material is based upon work supported by the National Science Foundation under Grant No. 1609089. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.