Chemicals of Emerging Concern in Roof-harvested Rainwater

Villagómez-Márquez, N1, Montijo, FJ1, Abrell, L1, Buxner, S1, Kilungo, A1,3, Mclain, JE1, Root, R1, Sandoval, F2, Ramirez-Andreotta, MD1,3, Chorover J1
1Department of Soil, Water, and Environmental Science, The University of Arizona, Tucson, Arizona
2Sonora Environmental Research Institute, Tucson, Arizona
3Mel and Enid Zuckerman College of Public Health, The University of Arizona, Tucson, Arizona

ABSTRACT
Today, about 40% of the global population lives in arid and semi-arid environments. In these geographic areas water scarcity concerns are common. Harvesting rain has been used as a water conservation measure, particularly where other water resources are scarce. As water scarcity increases steadily, interest in alternative methods to conserve and collect water also rise. Roof-harvested rainwater is one possible alternative to address the global issue. In arid climates like the Sonoran Desert, rainwater can provide a vital component of water resources. National water quality standards for both potable and non-potable domestic usages are thus far undetermined as roof-harvested rainwater is a new developing practice worldwide. Project Harvest (PH) is a citizen scientist driven program that teaches communities across the state of Arizona the scientific method. Over the course of three years, participants will collect roof-harvested rainwater samples and send them to be analyzed for bacteria, organic and inorganic contaminants at University of Arizona by our team of scientists, in addition to some “DIY” tests at home. Herein the organic chemistry aspect of this project is described including sample preparation, analytical method development, and preliminary results. Project Harvest addresses water conservation and environmental education in underserved communities. PH seeks to fortify informal science learning in underserved communities and help generate water quality guidelines and recommendations for non-potable roof-harvested rainwater domestic use. We aim to investigate the presence of thirty target analyte chemicals in roof-harvested rainwater by applying high-resolution liquid chromatography-tandem mass spectrometry (HR-LC-MS/MS). Roof-harvested rainwater samples were preconcentrated using solid phase extraction (SPE) in preparation for analysis. Chromatographic separations were achieved using a Phenomenex Kinetex (150 x 2.1 mm, 2.6 µm C18 100 Å) maintained at a constant temperature of 25 °C. The mobile phase consisted of 0.1% formic acid in LCMS water (eluent A) and 0.1% formic acid in methanol (eluent B), delivered at a flow rate of 300 ml min⁻¹. The mass spectrometer was operated in positive or negative mode, the spray voltage was 4.0 kV in both modes, and the temperature of the heated capillary was set at 250 °C. Nitrogen was used as the nebulizer and auxiliary gas. Parallel reaction monitoring (PRM) experiments were conducted for pentachlorophenol, glyphosate, nonylphenol, perfluorooctanesulfonic acid, perfluorooctanoic acid, and 2,4-dichlorophenoxyacetic acid in the negative mode. PRM experiments were conducted for chlorpyrifos, prometon, atrazine, and simazine in the positive mode. Other parameters were optimized manually by infusion of the standard solution into the LC. Summary of detection and non-detection of target analyte(s) in roof-harvested rainwater samples from four Arizona communities in 2018 will be provided.