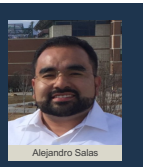
Sequestration of arsenic by cattail in drainage canal

Unit process wetlands and riparian zones

Re-Inventing the Nation's Urban Water Infrastructure (ReNUWIt)



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Background

Arsenic is a naturally occurring mineral found widely in the environment throughout the United States and other parts of the world. Arsenic is found in ground water, surface water and soils and in inorganic form is considered toxic to humans. Exposure to arsenic can lead to cancer and affects major organs like lungs, kidneys, and the liver. This study investigates the interaction between cattails (*T. Latifolia*; **Fig. 1**) and the natural environment. Samples of plant, soil, surface water, and ground water were collected from cattails growing in a drainage canal located at the Reinventing Nation's Urban Water Infrastructure (ReNUWIt) testbed, Sunland Park, NM **(Fig. 7)** and tested for presence of arsenic. The drainage canal at the study location intercepts groundwater flow in addition to occasional flood runoff and intercepted irrigation drainage water. The canal conveys water to the Rio Grande at the city of El Paso, TX.

Methodology

- Surface water, soil, and plant material (stem, roots and rhizomes) samples were collected on monthly basis from the drainage canal (**Fig. 1 & Fig. 7)**. Groundwater samples were collected from 7 piezometers adjacent to the canal to study ground water effects.
- Surface water samples were collected at entry point, points along the drainage canal, and at an exit point.
- The overall health of plants were assessed visually.
- pH, EC, Salinity and total dissolved solids of water samples were measured in the field.
- Cattails from the canal were uprooted and stem, root, and rhizome samples were taken for analysis in the laboratory. **(Fig. 2 & Fig. 3).**
- Plant material and soil samples were placed in 70% nitric acid and 30% hydrochloric acid and then digested using the Multiwave3000®-microwave **(Fig. 5)**. This process dissolves the material into an aqueous acidic solution. Samples are then transferred and prepared for analysis **(Fig. 4).**
- The samples were analyzed using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) **(Fig. 6)** at Freeport-McMoran laboratory, NMSU.

Data Acquisition Process

Figure 1. *T. Latifolia* at ReNUWIt testbed site.

Figure 2. Removal of *T. Latifolia*.

Figure 3. Separation of *T. Latifolia*.

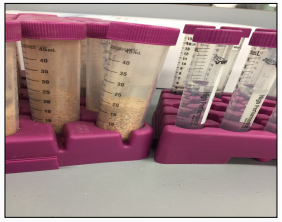

Figure 4. Plant material digested.

Figure 5. Multiwave 300®-microwave.

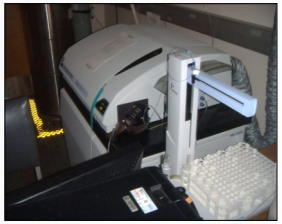

Figure 6. ICP-MS Instrument.

Figure 7: *T. Latifolia* colony at ReNUWIt Sunland Park, NM testbed.

Preliminary Results

The range of arsenic concentrations measured from the site are listed in **Table 1**. According to EPA standards for drinking water, the Maximum Contaminant Levels (MCL) of arsenic is 0.01 ppm (10 ppb). A larger concentration of arsenic was detected in plant rhizomes than in drainage water, soil, and in groundwater. Arsenic in stem portion of the plant was not detected. Concentrations in soil were higher than in surface and ground water.

Table 1. Arsenic concentrations measured.

Sample type	Concentration Measured (ppb)
Cattail Roots	ND-8200
Cattail Rhizome	2700-51300
Cattail Stem	None detected
Soil	640-3600
Groundwater	10-15
Surface water	1-20

Conclusions

Preliminary results show arsenic concentrations found within the cattail plant. Plant tissue samples were collected when the plants were dormant. However, more data is needed to assess the effectiveness of arsenic when the plants are active during the growing season. More data collection is anticipated during the growing season of 2018.

Next Steps

- Continue to collect samples of plant tissue when the plants are active.
- Continue to collect soil and water samples and test for arsenic and anions, cations, DO, pH, temperature, TOC, etc.
- Analyze data and write a report of the findings.

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