

Introduction to Urban Watershed Geochemistry
Part 3: Measurement of Bulk Soil Physical and Chemical Properties
Lab Exercise #3

1 Introduction

Urban runoff can lead to flooding and water quality problems. In a previous week's field trip to Filbin Creek in North Charleston, we assessed water quality in the Creek. During seasonal flooding events, one can assume that the floodplain soils and sediments receive significant amount of water contamination. Over the next three weeks we will assess the soils for both basic and advanced soil chemical parameters.

The overall objective of this assessment is to determine if the soils in the floodplain are receptors of contamination from flooding of the creek or from road runoff during storm events. The main objectives of today's lab are to assess bulk soil parameters that include soil color, texture, pH, moisture content, and carbon.

2 Required Materials

The following materials and equipment required for each group for today's lab exercise:

1. Mettler-Toledo pH meter
2. Analytical balance
3. Core cutting equipment (Dremel tool w/ saw tip)
4. Munsell color charts
5. Spatulas
6. Al foil
7. Al sampling boats
8. Whirl-Pak bags for soil sample collection
9. Deionized (DI) H₂O in squeeze bottle
10. 25 mL plastic beakers
11. Magnetic stirrers
12. Kim wipes
13. Gloves, safety glasses
14. Sharpie, Lab notebook

3 Tasks to be Performed:

- A. Student group assignments** Break into 4 groups of students. Each group will be tasked with analyses of 6" of one core sample.
- B. Soil Core Analysis** If the soil inside the core slips out of the plastic liner easily, lay it out on the Al foil and clearly label the core sample. If the soil is dense, then the core liner may have to be cut carefully using a Dremel saw or a box cutter. Divide the soil core in sections of 1" thickness. Clearly mark the depth on the Al foil using a permanent marker. After all initial preparation, homogenize each section of the soil sample and bag the sample in a clearly marked Whirl-Pak bag.
- C. Soil Color** Identify color of soil within each section of the soil core using the provided Munsell Charts.
- D. Soil Texture** Following instructions on the accompanying chart identify the soil texture in each section of the soil core.

- E. Soil pH** Determine soil pH by adding 10 mL of DI H_2O to 10 g of soil in a 25 mL beaker and measuring pH with a pH probe. The soil-water solution should be stirred with magnetic stirrer while pH is being measured.
- F. Soil Moisture and Carbon** Prepare several Al boats to put soil samples. On the bottom of each boat, etch the name of the sample to be placed with any blunt pen-like object (make sure you do not tear the boat). Accurately weigh 10 g of soil (M_1) from each section of the soil core and place in the Al-foil container. Make a note of the balance model used. Place these soil samples in the muffle furnace at $105^\circ C$ for 24 h and measure the mass in each sample (M_2) after this period. Then place the samples back in the muffle furnace and increase the temperature to $450^\circ C$ for 6 h and measure the final mass (M_3) in each sample after this period. The difference between M_2 and M_1 is the moisture content, and the difference between M_3 and M_2 is the organic carbon content. Express moisture and organic carbon content as % of initial mass (M_1) of the sample.
- G. Data sharing** Share all your data with me upon completing your analyses. I'll compile all the information and upload the information to OAKS.

4 What to Include in Your Lab Report:

In addition to the primary objectives, be sure to address these points in your discussion:

1. Summarize all data.
2. Discuss each of the measured soil properties in context of the soils handouts posted on OAKS and potentially what they mean about the watershed. Also visit <http://soils.usda.gov/education/resources/college/index.html> for more information.
3. What can you say about the soil properties based on the data that you collected?

The lab report format is identical to earlier lab reports and should include the following components:

1. Title of the exercise, your name, name of partner, and date of lab exercise.
2. Abstract (≈ 150 words)
3. Methods (≈ 300 words)
4. Results (≈ 400 words)
5. Discussion (≈ 400 words)
6. Conclusions (≈ 100 words)
7. References

