

Replenishment of the Reference Suwannee River Natural Organic Matter (NOM)

Final Report on a Proposal to

International Humic Substances Society
(Dr. Paul Bloom, Chairman, Samples Collection)

by E. Michael Perdue
Department of Chemistry
Ball State University
Muncie, IN 47304

December 24, 2012

In the time period of May 3, 2012 – May 15, 2012, a scientific team, working under the auspices of the IHSS, collected a new batch of reference Suwannee River NOM (2R101N) from the Suwannee River in southeastern Georgia, U.S.A. The sample was collected at the southernmost dam on the Suwannee River sill, which is the sampling location from which the first NOM sample (1R101N) was collected in 1999 by an IHSS team that included Mike Perdue, Lili Ding, Jim Alberts, and Monika Takacs.

The scientific team for the current work included:

Name	Affiliation
Mike Perdue	Ball State University
Nelson Green	Georgia Tech / Ball State University
Dan McInnis	University of Notre Dame
Norbert Hertkorn	Helmholtz Zentrum – Munich
Michael Gonsior	University of Maryland

The project was made possible by the generous support of:

- IHSS, which provided \$32,292 to cover materials and supplies, travel expenses, and partial salary for Nelson Green.
- Ball State University, which agreed to accept a reduced rate of 24% for indirect costs.
- Okefenokee National Wildlife Refuge – Folkston, GA U.S.A. (Ms. Sara Aicher), which allowed the scientific team to work at the sampling site (the *field site*) on the Suwannee River sill in southeastern Georgia, U.S.A. and which allowed the scientific team full use of a house near the field site, both as a residence and as a *field lab*.
- Dr. Patricia Maurice at the University of Notre Dame, who loaned IHSS her RealSoft PROS/2S reverse osmosis system and ancillary equipment, thus enabling us to operate two such systems simultaneously at the field site.

The overall project consisted of three distinct phases:

- Phase 1 : Preparation for the field work – this phase of the work was conducted in Mike Perdue’s laboratory at Ball State University in April, 2012. The work included restoration and testing of the RealSoft PROS/2S reverse osmosis system that was loaned to IHSS by Patricia Maurice at the University of Notre Dame.
- Phase 2 : Field work – this phase of the work was conducted at the field site and field lab between May 3, 2012 and May 15, 2012.
- Phase 3 : Concentrated solutions of Suwannee River NOM were desalted using an H^+ -saturated cation exchange resin in Mike Perdue’s laboratory at Ball State University and transferred to 25-L carboys. The desalted sample (1004 L) was freeze-dried at Van Drunen Farms in Momence, IL on October 19–24, 2012. Once the sample was returned to Mike Perdue’s laboratory, all carboys were rinsed to recover residual NOM, and the polyethylene sheet liners used in the freeze-drying trays were rinsed to recover additional adsorbed NOM. The rinse solutions were freeze-dried to recover additional NOM, which was added to the main freeze-dried sample. All freeze-dried NOM was sieved through a 100-mesh sieve to remove minor bulk contaminants, especially beads of cation exchange resin and small pieces of polyethylene sheet liners, and to homogenize the dry sample. The sieved particles and the sieving equipment were also rinsed with water to re-dissolve any NOM in a small volume of water, which was freeze-dried. That product was also blended into the final sample.

Some summary statistics for this project are tabulated here:

Description	Value(s)
Average TOC Concentration	6885 $\mu\text{mol/L}$
Average pH	3.68
Average Conductivity	179.2 $\mu\text{S/cm}$
Average Water Temperature	25 $^{\circ}\text{C}$
Volume of Water Processed by Reverse Osmosis	36,887 L
Mass of Organic Carbon Processed by Reverse Osmosis	3101 g C
Mass of Organic Carbon in Concentrated NOM	2921 g C
Mass of Organic Carbon in Concentrated, Desalted NOM	2810 g C
Mass of Organic Carbon in Freeze-Dried NOM	2611 g C
Mass of Organic Carbon in NOM Given to Team Members	122 g C
Mass of Organic Carbon in NOM Given to IHSS	2489 g C

In the preceding table, masses of organic carbon are used, rather than the mass of NOM. This choice was made because the mass of a sample of NOM is considerably increased by ash content and by adsorption of water from ambient air. The organic carbon in the concentrated NOM sample represents a yield of 94.2% in the RO concentration step at the field sampling site. This compares favorably with the RO yield of 92.9% that was achieved during collection of the first IHSS sample of Suwannee River NOM in 1999. Additional losses of carbon occurred during desalting by cation

exchange and during the freeze-drying step. The final freeze-dried sample contains 84.2% of carbon from the original water sample.

The final freeze-dried, air-equilibrated sample of Suwannee River NOM has a mass of 6124 grams and contains 2611 grams of carbon. An aliquot of 285 grams of the final sample was distributed to the volunteers who participated in this project, and IHSS received the balance of **5839 g** Suwannee River NOM, which contains **2489 g** of carbon.

The physical size of the new sample of Suwannee River NOM (five gallons) and its projected value to IHSS preclude the use of commercial transportation to transfer the sample to Paul Bloom. At present, the sample is stored safely in Mike Perdue's laboratory, and it will be delivered directly to Paul Bloom at a mutually agreeable time and location.