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Characterization of Dissolved Organic Matter in Local Marine and Terrestrial Waters
Anna Bearman '16

There are numerous anthropogenic pollutants present in both marine and terrestrial waters.[1] Though many of these chemicals do not absorb light and therefore cannot undergo photolyic degradation on their own, dissolved organic matter (DOM), found alongside pollutants in natural aquatic waters, can act as a catalyst in the attenuating process of contaminants. DOM is a complex mixture of organic compounds derived from decaying plants, animals and microorganisms. Since DOM can absorb light, it can transfer energy to contaminants, allowing them to break into smaller and often less hazardous molecules. The behavior of DOM is largely determined by its functional chemical components, and the character of DOM is constantly changing with the environment. For example, two International Humic Substances Society standards Pony Lake DOM from Antarctica and Suwannee River DOM from Georgia demonstrate very different compositions and characteristics[2]. More important than simply identifying varying functional groups in DOM these standards, however, may be understanding how our local water in the Androscoggin River and Gulf of Maine behaves and attenuates contaminants.

The goal for this project was to first isolate DOM from the Androscoggin River and the Gulf of Maine. DOM was extracted using the Thurman and Malcolm procedure,[3] beginning with collection and filtration of water from the Androscoggin River boat launch and Simpson's Point. The water was then run through a chromatography column, through the method of absorption chromatography the dissolved organic matter sticks to the resin within the column. DOM was then eluted from the column, concentrated, and protonated with an ion exchange column. The resulting concentrated DOM solution was then freeze-dried to obtain the final powdered DOM fraction. Because the quantity of DOM isolated from the Gulf of Maine was too small for characterization, we determined that a new collection method using equipment suited for sampling larger volumes of water will be necessary for future DOM characterization. Instead we focused on collecting samples from the Androscoggin on a weekly basis.

Following isolation, the Androscoggin River DOM was dissolved in Type I water to make 3mg/L DOM samples and then characterized through UV-Vis absorption and 3D fluorescence Excitation-Emission Matrix (EEM) spectroscopy techniques. The data was then processed using the parallel factor analysis (PARAFAC) method.[4] PARAFAC deconvolutes the fluorescence spectra into the distinct fluorescent components present in the complex DOM mixture (Figure 1). This preliminary analysis indicates that Androscoggin River DOM is made up of at least six specific fluorophores. In the future, I will identify the types of molecules responsible for each component signature and attempt to ascertain the relative concentration of each photoactive constituent in the DOM samples. This information will have significant implications for the photochemistry of natural and anthropogenic chemicals in natural waters.

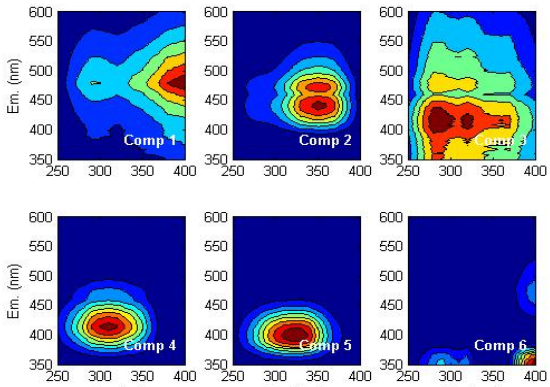

Figure 1. Principal components of Androscoggin River dissolved organic matter as determined by PARAFAC analysis

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[2] Brown, A.; McKnight, D. M.; Chin, Y.-P.; Roberts, E. C.; Uhle, M. *Marine Chemistry* **2004,** *89* (1–4),
[3] Thurman, E. M.; Malcolm, R. L. *Environ Sci Technol* **1981**, *15*, 463.
[4] Murphy, K. R.; Stedmon, C. A.; Graeber, D.; Bro, R. *Anal. Methods* **2013**, *5*, 6557.