Fingerprinting dissolved organic carbon in waters

Xing Ji

Dissolved organic carbon (DOC) has been confirmed a significant role in the global carbon cycle. It is of ecological significance in understanding the overall biogeochemical processes within aquatic environments from many perspectives, such as regulating nutrient availability for microbial and phytoplankton communities, affecting the transport and toxicity of metals, as well as the overall food web structure. By the strong effect of climate change, recent studies in northern latitudes have reported a strong increase of DOC concentration within the last decade. This has raised interest in the potential influence of the change in quality of DOC. In my thesis, I analyzed the variability in the DOC from fifteen small streams in the Krycklan catchment located in Umeå, Sweden, from April 2011 to March 2012. In addition to measuring DOC concentrations, I also calculated five spectral indexes from results of UV-visible absorbance spectra (SUVA and A254/A365) and fluorescence spectra (fluorescence index, humification index and freshness index). For the prediction of DOC quality, I attempted to link spectral characteristics of DOC with different land cover types (forest vs. wetland) and stream water discharge.

The results clearly showed that wetland dominated sites export more DOC to stream systems than forest dominated sites. There were also large differences in the quality of the DOC, not only between different sites but also at the same site during different times of the year. For instance, forested sites had more newly produced DOC with lower aromatic content than wetland sites, while wetland sites exported older DOC coming from plant detritus and soil.

In order to demonstrate the impact of surrounding soils on stream DOC quality, soil water samples were also analyzed once in three transects located 4, 12 and 22 meters away from the stream. As the results shown, from the uplands to the stream, the concentration of DOC only slightly increased, but was sufficient to change the DOC quality to the stream significantly.

As the last part of my thesis, I grouped the performances of these five spectral indexes for indicating water discharge and different land cover type to give an overall ranking for the future uses. From my ranking assessment, A254/A365 and the freshness index (β/α) were recommended as the two best predictors for tracing the overall quality changes of DOC in my study region.

Degree project in Biology, Master of Science (2 years), 2012
Examensarbete i biologi 45 hp till magisterexamen, Uppsala universitet, 2012
Biology Education Center and Department of Limnology
Supervisor: *Dolly Kothawala*