This research aimed to develop novel analytical technologies to source-track dissolved organic nitrogen (DON) of surface water in agricultural watersheds, in an effort to control elevated DON through watershed management and improve water quality.

Tracking Dissolved Organic Nitrogen in Terrestrial Aquatic Systems Using Fluorescence Excitation and Emission Matrix Spectroscopy

Who cares and why?

The concentration of dissolved organic nitrogen (DON) of surface water in agriculture watersheds have recently been doubled as a result of increased agricultural activities. Elevated DON level in surface water is of great environmental and health concerns, which could potentially lead to impaired water quality and the potential of eutrophication in aquatic ecosystem. In addition, high DON in drinking source water can serve as precursors for the formation of carcinogenic, DON-related disinfection by-products (DBPs, e.g. *N*-Nitrosodimethylamine), consequently threatening public health. Thus developing the source-tracking technology is critically needed for controlling DON in the aquatic ecosystem and improving surface and drinking water quality through watershed management.

This study aimed to apply fluorescence excitation and emission matrix (EEM) spectroscopy in conjunction with ^{15}N solid-state NMR and XPS spectroscopy for characterizing and determining DON chemical signature from various sources in terrestrial aquatic ecosystems.

What has the project done so far?

Surface waters were collected from the selected agriculture watersheds in various ecosystems, including crop field, forestry and grass lands, and urban areas. Results have indicated that there are four fluorophores identified: protein-like, xenobiotic-like, humic-like or fulvic-like fluoro-phore. The three sources of DON could clearly be differentiated by fluorophore composition, suggesting that the DON chemical structure is source-dependent and EEM spectroscopy could be potentially applicable to DON source-tracking. Solid-state NMR and XPS spectroscopy are also an effective tool to determine the chemical composition and structure of aquatic DON from various sources.

Impact Statement

This research will substantially improve our understanding of the structure of nitrogen-containing natural organics and their environmental fate and provide a novel technology to determine DON chemical signature of various sources in terrestrial aquatic ecosystems, which would lead to:

- Rapidly source-track DON technology in aquatic system
- Best watershed management practices for DON control
- Improving surface and drinking water quality.
- Safeguarding human health and ecosystem from elevated DON and associated DBP
- Improve environmental quality and quality of life

What research is needed?

With limited database of DON chemical signatures of various sources, it is difficult to identify the molecular-based signatures of nonpoint and point DON sources. Further studies that include more DON sources and more agriculture watershed are needed to provide comprehensive evaluation and assessment.

Want to know more?

Project Director: Dr. John Yang. Email: yangj@lincolnu.edu, Tel: (573)681-5383

This research was funded by the 1890 Capacity Building Research Grant within USDA's National Institute of Agriculture and Food (NIFA) to Lincoln University of Missouri. The project addresses the NIFA priority area, "Environmental Quality".

Additional link can be found at http://www.umes.edu/ard/Default.aspx?id=46285