

Independent project/degree project

Title: Investigation the contribution of dissolved organic matter to acidity in Swedish lakes and watercourses by titrations and geochemical modeling

Credits: 30 credits

Level: Master

Subject: Soil Science /Environmental Science

Programme: Soil, Water and Environment, Civilingenjörsprogrammet Miljö- och vatten teknik

Start: January 2026 (if possible)

Background

Dissolved organic matter (DOM) is a natural source of acidification, but it can also bind toxic metals, especially aluminum. The last years research has focused mostly on the concentration of DOM in lakes and watercourses. Little has been focused on how much acidity that one mg of DOM contributes to, i.e. the number of negative functional groups and their acidity. Lately the color has changed of the DOM in Swedish lakes and water courses. If the color change indicates a change of acidity of DOM it is of great value to know for counteracting the negative actions of acidity.

Currently, a large database exists for general water chemistry of Swedish lakes and watercourses. When the laboratory determines alkalinity, it titrates with acid down to pH 5.6. The whole titration curve is recorded, but only the final value is exported and entered into the database. The final value has recently been used to model the acidity of the DOM for a large number of sites during a time interval of the latest 20 years (Bishop&Lackmer, 2025, SLU 2025:08). This modeling shows changes in the acidity of DOM. However, using only one data point, at pH 5.6, can give errors since DOM has a range of different functional acidic groups distributed over the entire natural pH range of pH 4.5-7.5. Adding more of the titration data will improve the acidity calculations.

Issues

The proposed work is part of a FOMA-project running during 2026 with Dr Carin Sjöstedt as project leader and Prof. Kevin Bishop as participant. Titration data from the apparatus at the laboratory at Water and Environment Department will be exported and added to the other water data collected at various sites. If needed, complimentary

alkalinity titrations will be performed on a small subset to test and validate the method. The combined data set will be modeled using the Stockholm Humic Model (SHM) within the Visual MINTEQ-program to study changes of acidity of the DOM in time, space, and compared to other parameters such as color.

Performance

- 1) Literature review
- 2) Export existing data of titrations from the instrument and enter it into the water database
- 3) Tentatively perform additional alkalinity titrations to validate the method
- 4) Running simulations using geochemical modelling (Visual MINTEQ)
- 5) Writing a report
- 6) Oral presentation of results at SLU

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