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Differential fluorescence EEMs can be used to assess treatability of DOM during drinking water production

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Fluorescence spectroscopy has been widely used to characterize fluorescent dissolved organic matter (FDOM) in various waters including during drinking water production. Commonly used techniques for data treatment include peak picking, indexes calculated from 2D emission spectra and modelling of fluorescence components using parallel factor analysis (PARAFAC). However, peak picking and indexes only use limited information from the fluorescence EEMs and PARAFAC requires a larger dataset and experience to perform. Because DOM is a major issue in drinking water production, and personnel at water treatment plants usually have limited time for advanced analysis we have developed a simple way of assessing the treatability of DOM in different waters using differential fluorescence. With this approach the removed fraction of FDOM is calculated from samples taken before and after a particular treatment process and the percentage of removed material assessed.

Samples have been collected from four large water treatment plants in Sweden and analyzed for 3Dfluorescence, absorbance and DOC. The selective removal of DOM during e.g. flocculation and slow sand filtration as well as differences in experienced treatability between the treatment plants was described with differential fluorescence.

Chemical flocculation is selective towards FDOM with red-shifted emission across the entire EEM. Red-shift has earlier been connected to condensation (i.e. decrease in H/C) and positively correlated to molecular size indicating that larger, humified molecules are being preferentially removed. During the biological process of slow sand filtration compounds with blue-shifted emission are targeted demonstrating selective removal of more freshly produced, microbial material. Disinfection with UV/NH2Cl and NaOCl was found to only target material with protein-like fluorescence suggesting that FDOM of this nature could be responsible for unwanted consumption of disinfection agent. Targeted removal of this fraction prior to disinfection should optimize the process. Furthermore, the main process at all studied WTPs is flocculation and their experienced treatability could easily be explained through the percentage of FDOM with emission above 450 nm ($p<0.0001$).