Geophysical Research Abstracts
Vol. 21, EGU2019-14330, 2019
EGU General Assembly 2019

Characterisation of algal organic matter produced by different species of phytoplankton in relation to water treatment

Lenka Cermakova, Katerina Novotna, and Martin Pivokonsky

Institute of Hydrodynamics of the Czech Academy of Sciences, Pod Patankou 30/5, Prague 6, 166 12, Czech Republic (cermakova@ih.cas.cz)

Algal organic matter (AOM) may comprise an essential part of natural organic matter in surface waters. It is a consequence of eutrophication of aquatic environments followed by a phytoplankton population increase. In reservoirs supplying drinking water treatment plants, seasonally occurring high concentrations of AOM may affect the performance of treatment processes as well as the quality of water (reduction in coagulation efficiency, membrane fouling, precursors of disinfection by-products, etc.). The AOM, including extracellular organic matter (EOM) and cellular organic matter (COM), is composed of a wide spectrum of chemical compounds and the composition is strongly dependent on the species, its growth phase, the age of the culture, and on the culture conditions. However, the AOM character is one of the most important factors influencing the efficiency of AOM removal processes. Thus, the knowledge of AOM composition and characteristics (molecular weight (MW) distribution, charge, hydrophobicity/hydrophilicity, protein content) is necessary for understanding its treatability in water supplies and subsequent optimization of the removal process.
The study is aimed at the characterisation of AOM derived from four species – green alga Chlamydomonas geitleri, diatom Fragilaria crotonensis and cyanobacteria Microcystis aeruginosa and Merismopedia tenuissima at different growth phases. Algal growth was monitored by cell counting, optical density and dissolved organic carbon concentration measurements. EOM released at exponential and stationary growth phases and COM were characterised in terms of peptide/protein and non-peptide content, specific UV absorbance (SUVA), hydrophobicity and MW. The results showed that both EOM and COM were predominantly hydrophilic and had low SUVA. Generally, COM contained higher amounts of peptides/proteins, were more hydrophilic (with about 86% of hydrophilic fraction for all four species) and had lower SUVA than EOM. From the results of MW fraction it was observed that the highest peptide/protein portion of EOM and COM of C.geitleri (91-100%) is contained in 10-30 kDa fraction. Fraction of 10-30 kDa was also dominant in both EOM and COM of F. crotonensis and M. aeruginosa. Proteinaceous COM of M. tenuissima included mainly high-MWs > 100 kDa accounting 86%. Generally, MW distribution of C.geitleri and F. crotonensis was more uniform? than of M. aeruginosa and M. tenuissima. Moreover, the COM and EOM of both the cyanobacteria had wider MW distribution and contained significant portions of higher-MW protein fractions, especially of > 100 kDa. On the contrary, the non-proteinaceous matter showed the same pattern for all the organisms. To conclude, despite AOM of all the observed microorganisms demonstrated some similarities, the composition and characteristics varied with both the species and the growth phase. The results indicate that the monitoring of algal growth as well as its decline is important for successful prediction of AOM composition and it was necessary for its efficient removal during treatment processes.