Characterization of disinfection-by-product precursors derived from green algae

Lap-Cuong Hua, Jr-Lin Lin, Chihpin Huang

Institute of Environmental Engineering, National Chiao Tung University, Hsinchu 300, Taiwan

Abstract

Algal eutrophication in reservoirs frequently challenges the performance of unit operation for water treatment plants (WTPs) because of the exponential raise in algal cell population. Essentially, algal eutrophication often accompanies with remarkable increases in the concentration of algogenic organic matter (AOM). The AOM is a major important precursor of disinfection-by-products (DBPs) in drinking water treatment. The aim of this study was to propose a comprehensive protocol to isolate intra-cellular (IOM), extra-cellular organic matter (EOM) and cell-surface organic matter (COM) derived from a common blooming green algae *Chlorella vulgaris* (CV), and to characterize the physicochemical properties of these organic substances and the corresponding C-DBPs formation potential, including trihalomethanes (THMs) and haloacetic acids (HAAs). The IOM, EOM and COM samples were collected by a serial filtration-gridding protocol at the stationary phase during algal growth. Then, they were characterized by excitation emission matrix (EEM) and liquid chromatography-organic carbon detector (LC-OCD) as well as the corresponding DPB formation potential was determined by gas chromatography-electron capture detector (GC-ECD). The results showed that IOM chiefly comprised aromatic protein-like substances with lowest C/N ratio, while humic-like substances were predominant in the EOM accompanying with highest C/N ratio. In contrast, the COM mostly consisted of fulvic-like substances and polypeptides with a distinct molecular weight distribution around 10 kDa. The IOM comprised the highest magnitude of THM and HAA precursors, while there are equivalent THM and HAA precursors among EOM and COM.

Keywords: eutrophication, algogenic organic matter, disinfection-by-product, green algae