ABSTRACT

Drinking water treatment is facing an adverse impact of algae especially when they extensively decay and release cellular organic matter (COM). As the character and consequently the removal efficacy of COM depends on the individual species, the thesis compares algal organic matter (AOM) derived from four common phytoplankton species: green alga *Chlamydomonas geitleri*, diatom *Fragilaria crotonensis*, and cyanobacteria *Microcystis aeruginosa* and *Merismopedia tenuissima*. To evaluate the differences between extracellular and cellular organic matter, we monitored the growth of those organisms and compared AOM obtained at different growth phases. As COM is not only difficult to coagulate, but also hinders the coagulation of other substances, the thesis investigates the effect of simultaneous coagulation of COM with other impurities present in surface waters: kaolin, humic substances (HS) or cyanobacterial cells of *M. tenuissima*. Coagulation behaviour was studied by the jar tests performed with single components and their mixtures with and without a coagulant (ferric or aluminium sulphate). Special emphasis was paid to proteinaceous COM of *M. aeruginosa*; to enhance the removability of proteinaceous matter we implemented pre-oxidation.

Coagulation effectively removed turbidity (up to 99%) either of clay or algae origin at pH approx. 6-8 for ferric and 7-8.5 for aluminium coagulant. On the other hand, both humic and algal organic matter showed lower maximum removals (up to 65% for HS, 60-85% for proteinaceous COM of *M. aeruginosa*, and 43-53% for *M. tenuissima* COM, expressed as dissolved organic carbon (DOC)) at pH below neutral (approx. 4-6 for Fe and 5-6.5 for Al). In the case of mixtures, COM favoured coagulation although it modified the pH optimum for turbidity removal and hence the coagulation mechanisms. While both single cells and kaolin adsorbed preferably onto Al/Fe-oxide-hydroxides at about neutral pH, the COM-cell and proteinaceous COM-kaolin mixtures underwent charge neutralisation by Al/Fe-hydroxopolymers within the moderately acidic pH range more or less overlapping with that for single COM. Additionally, COM induced flocculation of those impurities even in the absence of a coagulant at acidic pH (approx. <4.5). It seems plausible that as a flocculant aid particularly high-molecular weights (MWs) (>10 kDa) involved in the adsorption processes and entailed inter-particle bridging of destabilised molecules and particles. In turn, high portions of low-MWs (<10 kDa) and predominantly hydrophilic nature most likely produced relatively low COM removals. Besides, at a narrow pH range about 6.2 for Fe and 6.8 for Al, coagulation was disrupted due to the formation of organo-metal complexes. However, this interference can be prevented by pH optimisation or by pre-oxidation with the benefit of heightened removals of proteinaceous COM by 5-12% compared to coagulation alone.