

Improvement of DOC removal by multi-stage AOP-biological treatment

Abstract

The single and multi-stages advanced oxidation process (AOP)-biological treatments were evaluated to apply for drinking water treatment, especially for the water containing less susceptible dissolved organic carbon (DOC) to ozone, comparing with the ozonation-biological treatment. Minaga reservoir water and the secondary effluent from a Municipal wastewater treatment plant were used as dissolved organic matter (DOM) solutions. DOC removals after 60 min AOP-biological treatment were 62% and 41% in the Minaga reservoir water and the secondary effluent, respectively, whereas those in the ozonation-biological treatment only 40% and 15% of DOC were removed, respectively. The result indicated that the single-stage AOP-biological treatment could improve DOC removal in comparison with the single-stage ozonation-biological treatment. This is because the AOP mineralized both biodegradable dissolved organic carbon (BDOC) produced in the early stage of oxidation and non-biodegradable dissolved organic carbon (NBDOC), whereas only BDOC was mineralized by further ozonation and NBDOC was not oxidized in the ozonation-biological treatment. The multi-stage treatment could not improve DOC removal in comparison with the single-stage treatment in the ozonation-biological treatment for the secondary effluent containing less susceptible DOC to ozone. However, the multi-stage AOP-biological treatment significantly reduced DOC and achieved 71% of DOC removal by 4 times repetition of 15 min oxidation, whereas DOC removal was 41% in the single-stage AOP-biological treatment for the same oxidation time. The improvement of DOC removal by the multi-stage AOP-biological treatment was due to BDOC removal as a radical scavenger by subsequent biological treatment in the early stage of oxidation and direct mineralization in the latter stage of oxidation.

Keywords; Advanced oxidation process; Biodegradable dissolved organic carbon; Biological treatment; Multi-stage treatment; Ozonation