Complex septic odour problem in one river source water in China: odour causing compounds identification and control verification in a full-scale advanced treatment plant

Qingyuan Guo [1,2], Kai Yang [1,2], Xia Ping [4], Zhang Dong [4], Jianwei Yu [1,2], Min Yang [2,3]
Corresponding authors & e-mail: Yang Min (yangmin@rcees.ac.cn); Jianwei Yu (jwyu@rcees.ac.cn)

[1] Key Laboratory of Drinking Water Science and Technology, Research Center for Eco-Environmental Sciences, University of Chinese Academy of Sciences, Beijing, 100085, China.
[2] University of Chinese Academy of Sciences, Beijing 100049, People's Republic of China
[3] State Key Laboratory of Environmental Aquatic Chemistry, Research Center for Eco-Environmental Sciences, University of Chinese Academy of Sciences, Beijing, 100085, China.
[4] Shanghai National Engineering Research Center of Urban Water Resources Co., Ltd., Shanghai 200082, China

Abstract:

Identification and control of the trace odourants causing the septic odour in source waters with complex matrixes has long been a big challenge. The Huangpu (HP) River, an important source water for Shanghai, has long been suffering from septic and musty odours, although major odourants have not been identified due to low effective identification of odourants using gas chromatography-olfactometry with mass spectrometry (GC-O/MS), and it is not known if advanced treatment process is effective in the removal of multiple odourants causing different types of odours. In this study, the identification of odourants in HP source water was conducted by combining the data from GC-O/MS and comprehensive two-dimensional gas chromatography with time-of-flight mass spectrometry (GC×GC-TOFMS) using retention indices (RIs). Simultaneously, the removal performance for odours and odourants were evaluated in a Water Treatment Plant (WTP), which was equipped with coagulation, sedimentation, ozonation, biological activated carbon (BAC) filtration, sand filtration, and chlorination in succession and located in the downstream of the Huangpu (HP) River. Finally, all potential odourants corresponding to each of the olfactometry peaks were screened based on the odour characteristics and match similarity using GC×GC-TOFMS. All identified odourants including three septic odourants (bis(2-chloroisopropyl) ether, diethyl disulfide and dimethyl disulfide) and two musty ones (geosmin and 2-MIB) with OAVs above one would be the major odourants responsible for odours. And it was clear that septic odour and associated odourants could be removed effectively through the combination of ozonation and BAC (the advanced treatment process). The result of this study will be helpful for the identification and control of odourants in complicated odour source waters.

Key words: River source water; septic odour; OAVs; ozonation-BAC.