Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2021.26864

216 (2021) 170–178
March

Using three-dimensional fluorescence excitation–emission matrix spectroscopy with regional integration analysis to determine properties of extracellular polymeric substances in nitrifying sludge at different C/N ratios

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Received 11 June 2020; Accepted 27 November 2020

ABSTRACT

The influences of the carbon/nitrogen ratio (C/N) on extracellular polymeric substances (EPS) of activated sludge were investigated in four laboratory-scale sequencing batch reactors using three-dimensional excitation–emission matrix (3D-EEM) with fluorescence regional integration (FRI). When the C/N ratio increased from 0 to 15, the polysaccharide (PS), protein (PN), and nuclei acid (NA) contents of tightly bound EPS (TB-EPS) increased, the PS, PN, and NA contents in LB-EPS at the C/N ratio of 0 obviously higher than the C/N ratio of 5, 10, and 15. According to FRI, the C/N ratio had a significant impact on Regions III, IV, and V of EPS, Region V (34%~63%) was the dominant fraction in both types of EPS fractions and TB-EPS and LB-EPS contained similar functional groups, furthermore, the percent fluorescence response ($P_{i,n}$) of humic acid in TB-EPS was dramatically lower than LB-EPS. Meanwhile, a significant decrease of soluble microbial by-product of EPS after nitrification was obtained.

Keywords: Activated sludge; C/N ratio; Extracellular polymeric substance; Three-dimensional excitation–emission matrix; Fluorescence regional integration

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