Maximum growth and decay rates of autotrophic biomass to simulate nitrogen removal at 10°C with municipal activated sludge plants

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Abstract

The present study aims at determining most likely values for the maximum growth rate ($\mu_{A,max}$) and the endogenous decay rate (b_A) of nitrifiers for activated sludge processes treating municipal wastewater operated at low temperature (10°C).

The work used nitrification rate data measured on 10 full-scale plants and 2 pilot plants fed with domestic sewage. This set of data was combined with a modelling and a theoretical approach. The unified values ($\mu_{A,max} = 0.45 \cdot d^{-1}$ and $b_A = 0.13 \cdot d^{-1}$) were obtained at 10°C for the kinetic parameters of the autotrophic biomass in the SRT range 10 to 50 d. In addition, the factors affecting the expected nitrification rate ($r_{v,nit}$) were established by a theoretical approach and confirmed by experimental results. For a given SRT, a linear relationship with the nitrogen volumetric loading rate was shown. The COD/TKN ratio of the influent on the nitrification rate was demonstrated. Finally, an operational tool for the verification of the nitrification rate in the design procedure of activated sludge processes is proposed.

Keywords: nitrification; kinetics; low temperature; autotrophic biomass, maximum growth rate; decay rate