Desalination and Water Treatment
www.deswater.com
32 (2011) 115–125
August
1944-3994 / 1944-3986 © 2011 Desalination Publications. All rights reserved.
doi: 10.5004/dwt.2011.2686

Modeling urea biodegradation in activated sludge using combined respirometric–titrimetric measurements

Muhammad Azizul Hoque, Vasantha Aravinthan*

Australian Centre for Sustainable Catchments, University of Southern Queensland (USQ), Toowoomba, Queensland, 4350, Australia
Tel. +61 (7) 4631 2299; email: aravintv@usq.edu.au

Received 5 September 2010; Accepted in revised form 14 December 2010

ABSTRACT

Urea biodegradation kinetics determination has been performed in the literature using a two-step nitrification model that was calibrated using on-line respirometric measurements. However, the model neglected the initial hydrolysis step that converts urea to carbon dioxide and ammonia nitrogen, and assumed constant carbon dioxide transfer rate (CTR), though it is inherently a non-linear process which has an impact on the titrimetric modeling. Hence, in this paper, it is aimed to propose a complete two-step nitrification model for urea biodegradation paying attention to urea degradation pathway along with due consideration given for non-linear CTR process occurring in activated sludge system. Experiments were performed in a simple batch reactor equipped with respirometric and titrimetric set-up. Three different initial urea concentrations were added to the reactor for investigating the process kinetics. Proposed model was successfully calibrated with respirometric, titrimetric and combined respirometric–titrimetric measurements; and the estimated parameters were compared for model evaluation. Furthermore, the proposed model was validated with off-line ammonium, nitrite and nitrate measurements. The study revealed that urea was hydrolyzed at a faster rate in liquid phase. The maximum growth rates of the *Nitrosomonas* species and the *Nitrobacter* species were found to be 0.065–0.1 d^{-1} and 0.006–0.008 d^{-1} respectively.

Keywords: Oxygen uptake rate (OUR); Urea biodegradation; Model calibration; Parameter estimation

* Corresponding author.