

COD AND NITROGEN STOICHIOMETRIC AND KINETIC MATRIX FOR GROWTH AND DECAY

Components								Rates
Process	Soluble COD S_S (mg/L COD)	Soluble NH_4 -N S_{NH} (mg/L N)	Soluble NO_3 -N S_{NO} (mg/L N)	Dissolved O_2 , S_O (mg/L O_2)	Heterotrophic biomass, X_{BH} (mg/L COD)	Autotrophic (Nitrifying) Biomass, X_{BA} (mg/L COD)	Debris, X_D (mg/L COD)	ρ_j
Aerobic Heterotrophic Growth	$-1/Y_H$	$i_{NXB}^{(1)}$		$-\frac{(1 - Y_H)}{Y_H^{(2)}}$	1	na	na	$\mu_H^{(4)} X_{BH}$
Aerobic Growth of Autotrophs (Nitrification)	na	$-1/Y_A i_{NXB}^{(1)}$	$-1/Y_A$	$-\frac{(4.57 - Y_A)}{Y_A^{(3)}}$	na	1	na	$\mu_A^{(5)} X_{BA}$
Decay and Lysis of Heterotrophs	$1-f_D^{(6)}$	$i_{NXB} - f_D i_{NXD}^{(1,6)}$		na	-1	na	$f_D^{(6)}$	$b_H X_{BH}^{(7)}$
Decay and Lysis of Autotrophs	$1-f_D^{(6)}$	$i_{NXB} - f_D i_{NXD}^{(1,6)}$		na	na	-1	$f_D^{(6)}$	$b_A X_{BA}^{(8)}$

⁽¹⁾ i_{NXB} = g-N/g-cell-COD and i_{NXD} = g-N/g-debris-COD

⁽²⁾ Y_H = g-heterotroph cell-COD/g-COD consumed

⁽³⁾ Y_A = g-autotroph cell-COD consumed/g- NH_4 -N consumed

$$^{(4)} \mu_H = \hat{\mu}_H \left(\frac{S_S}{K_S + S_S} \right) \left(\frac{S_O}{K_O + S_O} \right) (d^{-1})$$

$$^{(5)} \mu_A = \hat{\mu}_A \left(\frac{S_{NH}}{K_{NH} + S_{NH}} \right) \left(\frac{S_O}{K_O + S_O} \right) (d^{-1})$$

⁽⁶⁾ f_D = g debris-COD produced/g biomass-COD decayed

⁽⁷⁾ b_H = specific decay rate for heterotrophs (d^{-1})

⁽⁸⁾ b_A = specific decay rate for nitrifying autotrophs (d^{-1})