A Method for Determining the HRT and Operating Conditions of a Circulating Fluidized Bed Bioreactor with Composition Disturbances

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Supporting Information

Table S1 Composition fractions of the influent wastewater in BioWin.

Fraction (abbreviation)	Unit	Default value[a]	Input value[b]		
			P I	P II	P III
Readily biodegradable (F_{bs})	gCOD/g TCOD	0.16	0.179	0.248	0.193
Acetate (F_{ac})	gCOD/g rbCOD	0.15	0.202	0.139	0.126
Non-colloidal slowly biodegradable (F_{xsp})	gCOD/g sbCOD	0.75	0.750	0.750	0.850
Unbiodegradable soluble (F_{us})	gCOD/g TCOD	0.05	0.035	0.039	0.043
Unbiodegradable particulate (F_{up})	gCOD/g TCOD	0.13	0.060	0.060	0.060
Ammonia (F_{na})	gNH_3-N/gTKN	0.66	0.557	0.607	0.470
Particulate organic nitrogen (F_{nox})	gN/g Organic N	0.5	0.500	0.500	0.500
Soluble unbiodegradable TKN (F_{nus})	gN/gTKN	0.02	0.020	0.020	0.020
N:COD ratio for unbiodegradable part. COD (F_{upN})	gN/gCOD	0.035	0.035	0.035	0.035
Phosphate (F_{po4})	gPO_4-P/gTP	0.5	0.449	0.452	0.390

P:COD ratio for influent unbiodegradable part. COD (F_{upP})	gP/gCOD	0.011	0.011	0.011	0.011

[a] Default of municipal wastewater fractions
[b] Calibrated using the experimental data
[1] Fraction of TCOD which is readily biodegradable ((Soluble readily biodegradable complex COD (S_{bsc}) + Soluble readily biodegradable volatile fatty acid COD (S_{bsa})) / TCOD)
[2] Fraction of slowly biodegradable influent COD which is particulate (Slowly biodegradable particulate COD (X_{sp}) / (Slowly biodegradable colloidal COD (X_{sc}) + Slowly biodegradable particulate COD (X_{sp})))
[3] Fraction of TCOD which is soluble Unbiodegradable ($SCOD_{eff}$ / $TCOD_{inf}$)
[4] Fraction of TCOD which is particulate Unbiodegradable (calibrated using the influent specifier associated with the model and equal to (1- F_{bs}-F_{us}))
[5] Fraction of influent TKN which is ammonia
[6] Fraction of influent biodegradable organic nitrogen which is particulate
[7] Fraction of influent TP which is phosphate

Table S2 Calibrated parameters in BioWin.

	Parameter (unit)	Default value	Input value
attachment/detachment approach	Detachment rate in riser (g/m^3d)	-	1.6E+05
	Detachment rate in downer (g/m^3d)	-	4.5E+06
kinetics and stoichiometry approach	Ammonia-Oxidizing Bacteria (AOB)		
	Max. spec. growth rate (1/d)	0.9	0.36
	Substrate (NH_4) half sat. (mgN/L)	0.7	1
	Ordinary Heterotrophic Organisms (OHOs)		
	Max. spec. growth rate (1/d)	3.2	3.9
	Anoxic growth factor (-)	0.5	0.8
biofilm properties approach	MTBL in riser (um)	-	100
	MTBL in downer (um)	-	100