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Appendix A.1 Biochemical rate coefficients ($\nu_{i,j}$) and kinetic rate equations (ρ_j) for soluble components ($i = 1 - 12$, $j = 1 - 19$)

j	Component → i / Process ↓	1 S_{su}	2 S_{aa}	3 S_{fa}	4 S_{va}	5 S_{bu}	6 S_{pro}	7 S_{ac}	8 S_{h2}	9 S_{ch4}	10 S_{IC}	11 S_{IN}	12 S_I	Rate (ρ_j, kg COD.m^{-3}.d^{-1})
1	Disintegration												$f_{sI,xc}$	$k_{dis}X_c$
2	Hydrolysis carbohydrates	1												$k_{hyd,ch}X_{ch}$
3	Hydrolysis of proteins		1											$k_{hyd,pr}X_{pr}$
4	Hydrolysis of lipids	$1-f_{fa,li}$		$f_{fa,li}$										$k_{hyd,li}X_{li}$
5	Uptake of sugars	-1				$(1-Y_{su})f_{bu,su}$	$(1-Y_{su})f_{pro,su}$	$(1-Y_{su})f_{ac,su}$	$(1-Y_{su})f_{h2,su}$		$-\sum_{i=9,11-24} C_i\nu_{i,5}$	$-(Y_{su})N_{bac}$		$k_{m,su}\frac{S_{su}}{K_S+S}X_{su}I_1$
6	Uptake of amino acids		-1		$(1-Y_{aa})f_{va,aa}$	$(1-Y_{aa})f_{bu,aa}$	$(1-Y_{aa})f_{pro,aa}$	$(1-Y_{aa})f_{ac,aa}$	$(1-Y_{aa})f_{h2,aa}$		$-\sum_{i=1-9,11-24} C_i\nu_{i,6}$	$N_{aa}-(Y_{aa})N_{bac}$		$k_{m,aa}\frac{S_{aa}}{K_S+S_{aa}}X_{aa}I_1$
7	Uptake of LCFA			-1				$(1-Y_{fa})\,0.7$	$(1-Y_{fa})\,0.3$			$-(Y_{fa})N_{bac}$		$k_{m,fa}\frac{S_{fa}}{K_S+S_{fa}}X_{fa}I_2$
8	Uptake of valerate				-1		$(1-Y_{c4})\,0.54$	$(1-Y_{c4})\,0.31$	$(1-Y_{c4})\,0.15$			$-(Y_{c4})N_{bac}$		$k_{m,c4}\frac{S_{va}}{K_S+S_{va}}X_{c4}\frac{1}{1+S_{bu}/S_{va}}I$
9	Uptake of butyrate					-1		$(1-Y_{c4})\,0.8$	$(1-Y_{c4})\,0.2$			$-(Y_{c4})N_{bac}$		$k_{m,c4}\frac{S_{bu}}{K_S+S_{bu}}X_{c4}\frac{1}{1+S_{va}/S_{bu}}I$
10	Uptake of propionate						-1	$(1-Y_{pro})\,0.57$	$(1-Y_{pro})\,0.43$		$-\sum_{i=1-9,11-24} C_i\nu_{i,10}$	$-(Y_{pro})N_{bac}$		$k_{m,pr}\frac{S_{pro}}{K_S+S_{pro}}X_{pro}I_2$
11	Uptake of acetate							-1		$(1-Y_{ac})$	$-\sum_{i=1-9,11-24} C_i\nu_{i,11}$	$-(Y_{ac})N_{bac}$		$k_{m,ac}\frac{S_{ac}}{K_S+S_{ac}}X_{ac}I_3$
12	Uptake of hydrogen								-1	$(1-Y_{h2})$	$-\sum_{i=1-9,11-24} C_i\nu_{i,12}$	$-(Y_{h2})N_{bac}$		$k_{m,h2}\frac{S_{h2}}{K_S+S_{h2}}X_{h2}I_1$
13	Decay of X_{su}													$k_{dec,Xsu}X_{su}$
14	Decay of X_{aa}													$k_{dec,Xaa}X_{aa}$
15	Decay of X_{fa}													$k_{dec,Xfa}X_{fa}$
16	Decay of X_{c4}													$k_{dec,Xc4}X_{c4}$
17	Decay of X_{pro}													$k_{dec,Xpro}X_{pro}$
18	Decay of X_{ac}													$k_{dec,Xac}X_{ac}$
19	Decay of X_{h2}													$k_{dec,Xh2}X_{h2}$
		Monosaccharides (kgCOD·m^{-3})	Amino acids (kgCOD·m^{-3})	Long chain fatty acids (kgCOD·m^{-3})	Total valerate (kgCOD·m^{-3})	Total butyrate (kgCOD·m^{-3})	Total propionate (kgCOD·m^{-3})	Total acetate (kgCOD·m^{-3})	Hydrogen gas (kgCOD·m^{-3})	Methane gas (kgCOD·m^{-3})	Inorganic carbon (kmole C·m^{-3})	Inorganic nitrogen (kmole N·m^{-3})	Soluble inerts (kgCOD·m^{-3})	Inhibition factors: $I_1 = I_{pH}I_{IN,lim}$; $I_2 = I_{pH}I_{IN,lim}I_{h2}$; $I_3 = I_{pH}I_{IN,lim}I_{NH3,Xac}$

Appendix A.2 Biochemical rate coefficients ($\nu_{i,j}$) and kinetic rate equations (ρ_j) for soluble components ($i = 13 - 24$, $j = 1 - 19$)

j	Component → i / Process ↓	13 X_c	14 X_{ch}	15 X_{pr}	16 X_{li}	17 X_{su}	18 X_{aa}	19 X_{fa}	20 X_{c4}	21 X_{pro}	22 X_{ac}	23 X_{h2}	24 X_I	Rate (ρ_j, kg COD.m^{-3}.d^{-1})
1	Disintegration	-1	$f_{ch,xc}$	$f_{pr,xc}$	$f_{li,xc}$								$f_{xI,xc}$	$k_{dis}X_c$
2	Hydrolysis carbohydrates		-1											$k_{hyd,ch}X_{ch}$
3	Hydrolysis of proteins			-1										$k_{hyd,pr}X_{pr}$
4	Hydrolysis of lipids				-1									$k_{hyd,li}X_{li}$
5	Uptake of sugars					Y_{su}								$k_{m,su}\frac{S_{su}}{K_S+S}X_{su}I_1$
6	Uptake of amino acids						Y_{aa}							$k_{m,aa}\frac{S_{aa}}{K_S+S_{aa}}X_{aa}I_1$
7	Uptake of LCFA							Y_{fa}						$k_{m,fa}\frac{S_{fa}}{K_S+S_{fa}}X_{fa}I_2$
8	Uptake of valerate								Y_{c4}					$k_{m,c4}\frac{S_{va}}{K_S+S_{va}}X_{c4}\frac{1}{1+S_{bu}/S_{va}}I$
9	Uptake of butyrate								Y_{c4}					$k_{m,c4}\frac{S_{bu}}{K_S+S_{bu}}X_{c4}\frac{1}{1+S_{va}/S_{bu}}I$
10	Uptake of propionate									Y_{pro}				$k_{m,pr}\frac{S_{pro}}{K_S+S_{pro}}X_{pro}I_2$
11	Uptake of acetate										Y_{ac}			$k_{m,ac}\frac{S_{ac}}{K_S+S_{ac}}X_{ac}I_3$
12	Uptake of hydrogen											Y_{h2}		$k_{m,h2}\frac{S_{h2}}{K_S+S_{h2}}X_{h2}I_1$
13	Decay of X_{su}	1				-1								$k_{dec,Xsu}X_{su}$
14	Decay of X_{aa}	1					-1							$k_{dec,Xaa}X_{aa}$
15	Decay of X_{fa}	1						-1						$k_{dec,Xfa}X_{fa}$
16	Decay of X_{c4}	1							-1					$k_{dec,Xc4}X_{c4}$
17	Decay of X_{pro}	1								-1				$k_{dec,Xpro}X_{pro}$
18	Decay of X_{ac}	1									-1			$k_{dec,Xac}X_{ac}$
19	Decay of X_{h2}	1										-1		$k_{dec,Xh2}X_{h2}$
		Composites (kgCOD·m^{-3})	Carbohydrates (kgCOD·m^{-3})	Proteins (kgCOD·m^{-3})	Lipids (kgCOD·m^{-3})	Sugar degraders (kgCOD·m^{-3})	Amino acid degraders (kgCOD·m^{-3})	LCFA degraders (kgCOD·m^{-3})	Valerate and butyrate degraders (kgCOD·m^{-3})	Propionate degraders (kgCOD·m^{-3})	Acetate degraders (kgCOD·m^{-3})	Hydrogen degraders (kgCOD·m^{-3})	Particulate inerts (kgCOD·m^{-3})	Inhibition factors: $I_1 = I_{pH}I_{IN,lim}$; $I_2 = I_{pH}I_{IN,lim}I_{h2}$; $I_3 = I_{pH}I_{IN,lim}I_{NH3,Xac}$

Appendix B.1

Kinetic Parameters Used In Aquasim Model, Batstone (1999),Gossete e belser (1982)

Parameter	Value at 35°C	Unit
k_{dis}	0.5	d^{-1}
$k_{hyd,CH}$	10	d^{-1}
$k_{hyd,PR}$	10	d^{-1}
$k_{hyd,LI}$	10	d^{-1}
$k_{dec,(Xaa,Xsu,Xfa,Xc4,Xpro,Xac,Xh2)}$	0.02	d^{-1}
$K_{S,NH3,(Xaa,Xsu,Xfa,Xc4,Xpro,Xac,Xh2)}$	0.0004	$kgCOD/m^3$
$pH_{UL,(acetogenic,acidogenic)}$	5.5	
$pH_{LL,(acetogenic,acidogenic)}$	4	
$k_{m,su}$	30	kgCOD/kgCOD.d
$K_{S,su}$	0.5	$kgCOD/m^3$
Y_{su}	0.10	kgCOD/kgCOD
$k_{m,aa}$	50	kgCOD/kgCOD.d
$K_{S,aa}$	0.3	$kgCOD/m^3$
Y_{aa}	0.08	kgCOD/kgCOD
$k_{m,fa}$	6	kgCOD/kgCOD.d
$K_{S,fa}$	0.4	$kgCOD/m^3$
Y_{fa}	0.06	kgCOD/kgCOD
$K_{I,H2,fa}$	$5x10^{-6}$	$kgCOD/m^3$
$k_{m,c4+}$	20	kgCOD/kgCOD.d
$K_{S,c4+}$	0.3	$kgCOD/m^3$
Y_{c4+}	0.06	kgCOD/kgCOD
$K_{I,H2,c4+}$	$1x10^{-5}$	$kgCOD/m^3$
$k_{m,pro}$	13	kgCOD/kgCOD.d
$K_{S,pro}$	0.3	$kgCOD/m^3$
Y_{pro}	0.04	kgCOD/kgCOD
$K_{I,H2,pro}$	$3.5x10^{-6}$	$kgCOD/m^3$
$k_{m,ac}$	8	kgCOD/kgCOD.d
$K_{S,ac}$	0.15	$kgCOD/m^3$
Y_{ac}	0.05	kgCOD/kgCOD
$pH_{UL,ac}$	7	
$pH_{LL,ac}$	6	
$K_{I,NH3}$	0.0018	$kgCOD/m^3$
$k_{m,h2}$	35	kgCOD/kgCOD.d
$K_{S,h2}$	$2.5x10^{-5}$	$kgCOD/m^3$
Y_{h2}	0.06	kgCOD/kgCOD
$pH_{UL,h2}$	6	
$pH_{LL,h2}$	5	