Symbol list

The index “i” in the symbol list can represent any of the following compounds:

Indices for i	Meaning
s	Substrate
x	Biomass
p	Product
w	Water
o	Oxygen
c	Carbon dioxide
n	N-Source
h	H^+
Q	Heat
(t)	Time dependent

a	Parameter Herbert-Pirt substrate distribution relation	mol s/mol X	3
A	Total area of all gas bubbles in the whole fermentor	m^2	4
a	Specific gas/liquid interface area per unit of liquid volume	m^2/m^3	4
$A_\perp$	Cross-sectional reactor area	m^2	4
A_c	Cooling surface	m^2	4
b	Parameter Herbert-Pirt substrate distribution relation	mol s/ mol p	3
C	Particles	mol/mol, kg/kg, mol/m^3 etc. (Depends on flow rate)	5
c_i	Concentration of compound i in fermenter	mol i/m^3 broth	2
$c_{i,in}$	Concentration of compound i in the feed solution	mol i/m^3 feed	2
$c_{i,out}$	Concentration of compound i in the broth outflow	mol i/m^3 broth outflow	2
c_o^*, c_c^*	O_2 and CO_2 -solubility in broth	molO_2 or molCO_2 per m^3 broth	4
c_p	Specific heat	J/kg/K	4
D	Reactor diameter	m	4
d_B	Bubble diameter	m	4
e	Total power input	W/kg	4
F	Feed flow mechanical separation	mol/h, kg/h, m^3/h (Depends on concentrations)	5
F_{cw}	Cooling water flow rate	m^3/h	4
F_g	Gas flow rate	m^3/s	2
F_{in}	Volumetric liquid feed inflow into fermenter broth	m^3 feed/h	2
$F_{N,in}$	Molar gas flow rate in	mol/h	2
$F_{N,out}$	Molar gas flow rate out	mol/h	2
F_{out}	Volumetric broth outflow	m^3 broth/h	2
H	Reactor height	m	4

H/D	Aspect ratio	-	4
k	Reaction rate constant	(Depends on kinetics)	5
K	Partitioning coefficient	-	5
K_L	Mass transfer coefficient	m/h	4
K_s	Substrate affinity	mol s/m^3 broth	3
L	Feed phase	mol/h, kg/h, m^3/h (Depends on concentrations)	5
m_s	Parameter Herbert-Pirt substrate distribution relation	$\frac{mol\ S/h}{mol\ x\ present\ in\ the\ fermenter}$	3
N_G	Total molar amount of gas in fermenter (bubbles + headspace)	mol	2
N_i	Total amount of compound i in the fermenter broth (=$V_L c_i$)	mol i	2
N_{mix}	Mixing number	-	4
p	Pressure	Bar	3
p	Pressure	bar	
pH	Measurement of the acidity or basicity	-	2
p_o, p_c	Partial pressure O_2 and CO_2	bar	2
P_s	Power input impeller	W	4
Q	Heat	J	4
q_i	Biomass specific rate	$\frac{mol\ i/h}{mol\ x\ present\ in\ the\ fermenter}$	2
$q_{i,opt}$	Other biomass specific rate's at μ_{opt}	$\frac{mol\ i/h}{mol\ x\ present\ in\ the\ fermenter}$	3
$q_{p,ss}$	Steady state specific production rate	$\frac{mol\ P/h}{mol\ x\ present\ in\ the\ fermenter}$	3
$q_{s,max}$	Maximum substrate uptake rate	$\frac{mol\ S/h}{mol\ x\ present\ in\ the\ fermenter}$	3
$q_{s,ss}$	Steady state specific substrate uptake rate	$\frac{mol\ S/h}{mol\ x\ present\ in\ the\ fermenter}$	3
R_i	Conversion rate of i in the whole fermenter	mol i/h	2
S	Separation factor	-	5
St_{heat}	Stanton number for heat removal	-	4
T	Temperature	K or °C	
t_m	95% mixing time	s	4
$T_{N,i}$	Transfer rate of compound i in the whole fermenter	mol i/h	2
U	Heat transfer rate	kJ/h/(K*m^2)	4
V	Auxiliary phase	mol/h, kg/h, m^3/h (Depends on concentrations)	5
V_g	Volume of all gas bubbles present in the whole fermentor	m^3	4
v_{gs}	Superficial gas velocity	m/s	4
V_L	Broth volume	m^3	2
V_{min}	Most efficient solvent use	mol/h, kg/h, m^3/h (Depends on concentrations)	5
W	Wash stream	mol/h, kg/h, m^3/h (Depends on concentrations)	5
x	Feed phase concentration	mol/mol, kg/kg, mol/m^3 etc. (Depends on flow rate)	5
y	Auxiliary phase concentration	mol/mol, kg/kg, mol/m^3 etc.	5

		(Depends on flow rate)	
y_i	mol fraction of compound i in the gas phase	-	2
$y_{i,in}$	y_i in gas inflow	-	2
$y_{i,out}$	y_i in gas outflow	-	2
y_o, y_c	mol fraction O_2 and CO_2 in bubbles in the fermentor	-	2
αC	Particles with adherent liquid	mol/mol, kg/kg, mol/m^3 etc. (Depends on flow rate)	5
ΔH	Heat	Joule	3
μ	Growth rate (biomass specific)	$\frac{mol\ x/h}{mol\ x\ present\ in\ the\ fermenter}$	2
μ_{opt}	Optimal growth rate	$\frac{mol\ x/h}{mol\ x\ present\ in\ the\ fermenter}$	3
μ_{ss}	Steady state growth rate (during chemostat)	$\frac{mol\ x/h}{mol\ x\ present\ in\ the\ fermenter}$	2
ρ	Density	kg/m^3	
α	Parameter $q_p(\mu)$ function	$\frac{mol\ P/h}{mol\ x\ present\ in\ the\ fermenter}$	3
α_o, α_c	Henry coefficient O_2 and CO_2 solubility	(mol O_2 / m^3 broth)/ O_2	4
β	Parameter $q_p(\mu)$ function	Aerobic: 1/h or $Anerobic$: $\frac{mol\ P/h}{mol\ x\ present\ in\ the\ fermenter}$	3