

NaOH量を計算する式

代謝産物をpH6.0に保つために必要なNaOH量の計算
 ヘンダーソン-ハッセルバルハの式で計算できる。
 特定のpHにおける[A-]/[AH]の比は pKa で決まる。

$$AH \rightleftharpoons A^- + H^+$$

$$a \cdot x \quad x \quad 10^{-pH}$$

$$K_a = (x \cdot 10^{-pH}) / (a \cdot x)$$

$$x = a \cdot K_a / (K_a + 10^{-pH})$$

$$K = [A^-][H^+] / [AH]$$

$$pK_a = pH - \log[A^-]/[AH]$$

 解離している[A-]と等量のNaOHが特定のpHに保つために必要。

Glucose		2%	1.50%
酢酸	濃度 a [mol/L]	0.111	0.083333
	pKa=4.76	1.7378E-05	
	pH=5.5	3.16228E-06	
	a*Ka=	1.92896E-06	
	[A-] = a*Ka / (Ka + [H ⁺])	0.093911006	
	必要NaOH量 [g/L]	3.76	
	[A-] = a*10 ^(pH-pKa)	0.60999037	
	[A-] = a*Ka / [H ⁺]	0.60999037	
	x = a*Ka / (Ka + 10 ^{-pH})	0.093911006	
	必要NaOH量 [g/L]	3.76	
乳酸	pH=6	0.000001	
	pKa=3.86	0.000138038	
	160/100	0.1776	

(e) FERMENTATION BALANCES FOR CLOSTRIDIA

mMoles/100 mmoles glucose fermented

Products	mMoles/100 mmoles glucose fermented					
	<i>Clostridium butyricum</i> ^a	<i>Clostridium lacto-acclophilum</i> ^b	<i>Clostridium perfringens</i> ^{a, b}		<i>Clostridium acetobutylicum</i> ^b	<i>Butyrivibrio rafterii</i> ^b
Butyric acid	76	73	9*	34*	4.3	29
Acetic acid	42	28	15	60	14.2	88
Lactic acid	—	—	160	33	—	107
Carbon dioxide	183	190	24	176	221	203.5
Hydrogen	235	182	21	214	135	77.6
Ethanol	—	—	10	26	7.2	—
Butanol	—	—	—	—	50	53.6
Acetone	—	—	—	—	22.4	—
Acetoin	—	—	—	—	6.4	—
Isopropanol	—	—	—	—	—	12.1
Carbon recovered, %	96.0	91.0	98.3	97.1	99.6	96.2
O/R balance	0.97	1.16	0.81	1.05	1.01	1.06

(b) ANAEROBIC DISSIMILATION OF GLUCOSE BY *Aerobacter aerogenes*
 Fermentations run under the same conditions as for *B. polymyxa* (Table I)

Product	pH 5.00*	pH 5.00	pH 5.20	pH 5.60	pH 6.00	pH 6.60	pH 7.00	pH 7.60	pH 8.00
	Millimoles per 100 millimoles of glucose dissimilated								
2,3-Butanediol	40.2	38.7	48.8	47.9	47.5	38.8	10.78	Nil	Nil
Acetoin	2.43	2.46	1.39	2.39	1.58	2.10	3.08	3.85	5.82
Ethanol	56.4	60.5	61.2	56.3	57.4	55.2	57.7	54.7	60.9
Glycerol	4.13	2.22	1.81	3.91	3.34	4.37	5.79	7.72	6.55
Acetone	Nil	Nil	0.53	Nil	0.07	Nil	Nil	Nil	Nil
Butyric acid	1.07	0.59	0.29	0.07	Nil	0.44	0.68	1.79	3.95
Acetic acid	23.7	20.8	3.89	4.23	7.96	12.95	42.3	52.7	52.6
Formic acid	0.50	0.26	0.43	0.36	0.77	0.44	22.5	52.4	119.6
Succinic acid	1.25	1.29	2.17	2.04	1.80	3.08	6.19	4.10	9.29
Lactic acid	3.15	3.49	2.34	2.64	3.35	7.59	25.0	36.5	9.80
Carbon dioxide	188.0	190.5	183.8	171.1	174.0	167.0	106.8	77.4	19.60
Hydrogen	98.9	103.0	69.8	57.6	74.2	80.7	81.4	69.7	10.37
Glucose carbon assimilated	—	37.0	42.5	66.2	65.1	93.0	87.6	53.2	83.1
Fermentation time, hr.	143	142	94	291	141	101	10	91	21
% glucose used	65.5	68.0	99.9	100.0	100.0	100.0	100.0	99.9	93.4
% carbon accounted for	91.1	96.9	97.0	97.9	99.0	101.8	98.6	94.9	95.9
O/R Index	1.10	1.10	1.07	1.06	1.03	1.06	1.00	1.07	1.07

* Duplicate runs were made at pH 5.00 because the sudden increase in acetic acid and hydrogen was unexpected and needed confirmation.