APPENDIX B 1. DETERMINATION OF KINETIC COEFFICIENTS k, K_s, μ_{max}, Y_{obs} AND K_d FROM LABORATORY DATA.

Data are derived from a high-strenght bench-scale mixed activated sludge reactor without recycle, show the following substrate concentrations.

Table B1.1

Sample no.	S_0 mg/l NH_4^+	S mg/l NH_4^+	ϕ d	Biomass (X) mg VSS/l
1	300	7	3.2	128
2	300	12	2.0	125
3	300	20	1.6	130
4	300	30	1.0	130
5	300	40	1.1	120

Problem Formulation

Determine the saturation coefficient K_s and the constant k for the data presented in Table B1.1.

Solution

Set up a table to determine the coefficients K_s and k using the following transformation of the Monod equation (3.11).

$$\frac{X\phi}{S_0-S} = \frac{K_s}{k}\,\frac{1}{S} + \frac{1}{k} \qquad \text{(B1.1)}$$

Table B1.2

S_0 - S mg/l	Biomass (X) • ϕ mg VSS / d /l	Biomass (X) $\phi/(S_0$ - S) d	1/S $(mg/l)^{-1}$
293	409,6	1,4	0.14
288	250,0	0,9	0,08
280	208,0	0,7	0,05
270	130,0	0,5	0,033
260	132,0	0,5	0,025

Plot the term X • ϕ / S_0 - S versus 1/S, as shown in figure B1.1

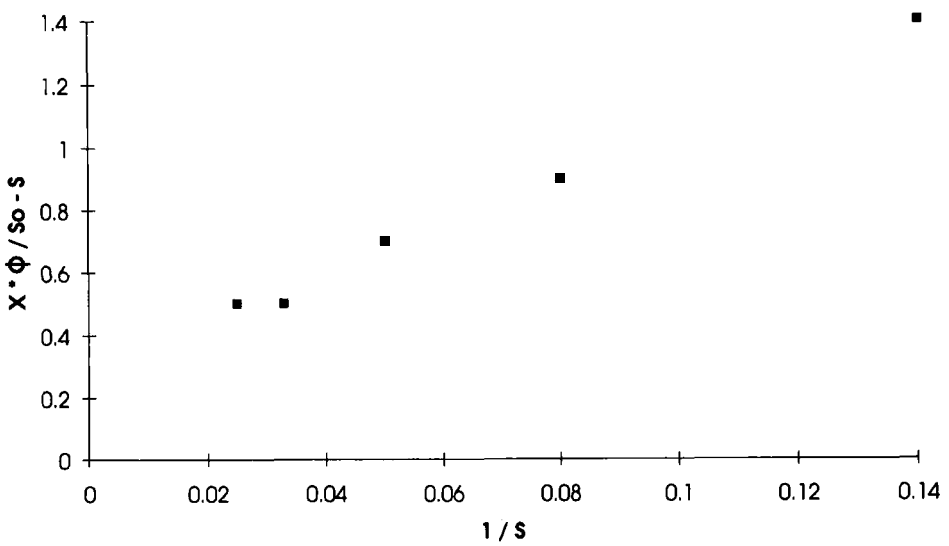

Figure B1.1 Plot of X • ϕ / S_0 - S versus 1 / S.

From equation B1.1 the y intercept equals (1/K).

$$1/k = 0.32 \text{ d}, \; k = 3{,}1 \text{ d}^{-1}$$

From figure B1.1 the slope on the curve equals K_s / k. Knowing k, K_s can be found to be 24,0 mg/l.

Problem Formulation

Determine the coefficient Y_{obs} and the decay rate K_d using the following equation.

$$\frac{1}{\phi_c} = Y_{obs}\frac{S_0 - S}{X\phi} - K_d \qquad \text{(B1.2)}$$

Solution

Plot the term $1/\phi$ versus $(S_0 - S) / \phi \bullet X$.

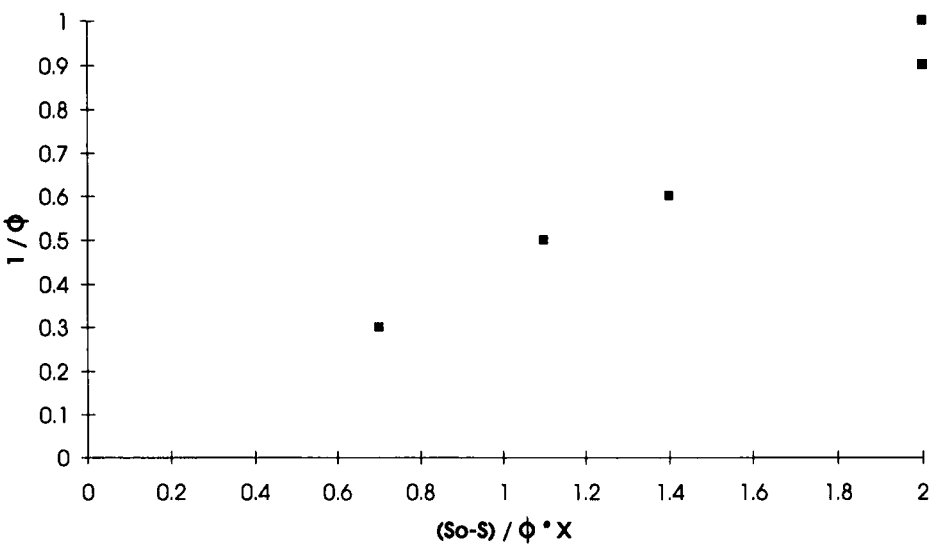

Figure B1.2 $1/\phi$ versus $(S_0 - S) / \phi \bullet X$.

The y intercept on Figure B1.2 equals (- K_d) = 0,05 d^{-1}.

The value of the slope of the curve on Figure B1.2 equals the yield factor Y_{obs}.

$$Y_{obs} = 0{,}35\ d^{-1} / 0{,}70\ d^{-1} = 0{,}5$$

Determine the value of the coefficient μ_{max} using the following equation:

$$\mu_{max} = k \cdot Y_{obs} \qquad \text{(B1.3)}$$

Using this equation μ_{max} is found to be 1,5 d^{-1}.