1) 17/08 - 2010

AEROB ODLING

BIOMASSA X $CH_{1,83}O_{0,54}N_{0,11}$ $M_X = 23,87$

SUBSTRAT S $C_2H_3O_{1/2}$ $M_S = 23,0$

N N $HNO_3$

$X = 1,05\ g/l = \frac{1,05}{23,87} = 0,044\ cmol/l$

$(S^0 - S) = (75 - 2,65)\cdot 10^{-3}\ mol/l = 0,1447\ cmol/l$

$Y_{X/S} = \frac{0,044}{0,1447} = 0,304$ cmol/cmol

KOLBALANS $Y_{S/S} = Y_{X/S} + Y_{CO_2/S} \Rightarrow$

$Y_{CO_2/S} = 0,696$

RGB $Y_{O_2/S}\,\gamma_{O_2} = -\gamma_S Y_{S/S} + \gamma_{X/S} Y_{X/S}$

$\gamma_S = 6$

$\gamma_X = 4 + 1,83 - 2\cdot 0,54 - \frac{0,1}{1}(0 + 1 - 2\cdot 3) = 5,25$

$\Rightarrow Y_{O_2/S}\gamma_{O_2} = 0,304\cdot 5,25 - 1\cdot 6 \Rightarrow Y_{O_2/S} = 1,101$

$Y_{NNO_3/S} = 0,1\cdot Y_{X/S} = 0,0304$

$RQ = \frac{Y_{CO_2/S}}{Y_{O_2/S}} = \frac{0,696}{1,101} = 0,632$

H ALT O BALANS GER $Y_{H_2O/S}$

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UPPGIFT 2/

$$N = N^0 e^{-k_d t}$$

VI VET $\quad 1{,}3 \cdot 10^9 = 1{,}7 \cdot 10^{12}\, e^{-k_d(85) \cdot 30}$

$$\Rightarrow k_d(85) = 0{,}239$$

PSS $\quad k_d(100) = 0{,}439$

VI VET $\quad k_d = k_d^0 e^{-E_d/RT}$

$E_d$ FÅS UR ...

$$\ln \frac{0{,}439}{0{,}239} = -\frac{E_d}{R}\left[\frac{1}{373{,}15} - \frac{1}{358{,}15}\right] \Rightarrow$$

$1{,}122 \cdot 10^{-4}$

$$E_d = 45{,}05 \ \frac{kJ}{mol}$$

$$0{,}608 = \frac{E_d}{8{,}314} \cdot 1{,}122 \cdot 10^{-4}$$

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DRT$_{100}$ = $\quad N = N^0 e^{-k_d t}$

$k_d(100) = 0{,}439$

$$\ln\left(\frac{N}{N^0}\right)^{-1} = \ln 2 = k_d t \Rightarrow t = 1{,}58 \text{ min}$$

DRT$_{380K}$ $\quad \frac{k_{d\,380}}{k_{d\,373{,}15}} = e^{-\frac{45{,}05 \cdot 10^3}{8{,}314}\left[\frac{1}{380{,}00} - \frac{1}{373{,}15}\right]}$

$= 1{,}3 \Rightarrow \quad k_d^{380} = 0{,}57$

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$\ln 2 = 0{,}57 \cdot t \Rightarrow t = 1{,}215 \text{ min}$

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KEMOSTAT

$\frac{N}{N^0} = \frac{1}{(1+k\tau)}$

$\tau = 15k$

$k(100) = 0{,}439 \text{ min}^{-1}$

$= \frac{0{,}439}{(60)^{-1}} \text{ tim} = 26{,}34 \text{ h}^{-1}$

$\frac{N}{N^0} = \frac{1}{\left(1 + \frac{0{,}439}{(60)^{-1}} \cdot 15\right)} = 2{,}52 \cdot 10^{-3}$

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TUB

$N = N^0 e^{-k_d t}$ $(\tau)$

$N = N^0 e^{-26{,}34 \cdot 15} \approx 0$

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3) $A \rightarrow B + C$

$$F_A = F_A^\circ (1-X)$$

$$F_B = F_C = F_A^\circ X$$

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$$F_{TOT} = F_A^\circ (X+1)$$

$$r = k \cdot C_A = k \cdot \frac{P}{RT} \frac{F_A}{F_{TOT}} = k \frac{P}{RT} \frac{(1-X)}{(1+X)}$$

$$\frac{V}{F_A^\circ} = \int_0^{0,95} \frac{dX_A}{r} = \frac{RT}{kP} \int_0^{0,95} \frac{(1+X)}{(1-X)} dX = \left[ -2\ln(-X) - X \right]_0^{0,95}$$

$$5,04$$

$$\left[ \frac{(1+X)}{(1-X)} = \frac{2-(1-X)}{(1-X)} = \right]$$

$$\Rightarrow V = \frac{F_A^\circ RT}{kP} [I] = 0,18 \ m^3$$

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b)

$$\left.\begin{aligned} F_A &= F_A^\circ (1-X) \\ F_B &= F_C = F_A^\circ X \\ F_I &= F_I^\circ \end{aligned}\right\} F_{TOT} = F_A^\circ (1+X) + F_I^\circ$$

$$C_A = \frac{(1-X) \cdot F_A^\circ}{F_A^\circ (1+X) + F_I^\circ} \frac{P}{RT}$$

4)

| t | C(t) | E(t) | tE(t) | $t^2C(t)$ | $e^{-kt}$ | $e^{-kt}E$ |
|---|---|---|---|---|---|---|
| 100 | 0 | $2,33 \cdot 10^{-4}$ | 0,046 | 9,3 | 0,59 | |
| 200 | 20 | | | | 0,35 | |
| 300 | 40 | 4,65 | | | 0,21 | |
| 400 | 80 | 9,3 | 0,372 | | | |
| 600 | | $44 \cdot 10^{-4}$ | 2,65 | | | |
| 1000 | 0 | 0 | 0 | | 0,0055 | |
| | 860 | 0,01 | 3,78 | 3526 | 1,158 | |

$k = 0,$

$$\frac{\langle C \rangle}{C^\circ} = \int_0^\infty e^{-kt} \cdot E(t)\, dt \qquad \text{Satır}$$

$$N = \frac{\langle t \rangle^2}{\delta^2} = \frac{(577,9)^2}{18697,94} = 17,86 \approx 17$$

$$\frac{\langle C_A \rangle}{C^\circ} = \frac{f}{1+kt^N} = \frac{1}{\left(1 + 0,0037 \cdot \frac{577}{17,86}\right)^{17,86}}$$

$$= 0,133$$

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| tid | conc | E(t) | t*E(t) | t2*E(t) | exp(-kt) | exp(-kt)*E |
|---|---|---|---|---|---|---|
| 100 | 0 | 0 | 0 | 0 | 0,690734 | 0 |
| 200 | 20 | 0,000233 | 0,046512 | 9,302326 | 0,477114 | 0,00011096 |
| 300 | 40 | 0,000465 | 0,139535 | 41,86047 | 0,329559 | 0,00015328 |
| 400 | 80 | 0,00093 | 0,372093 | 148,8372 | 0,227638 | 0,00021176 |
| 500 | 130 | 0,001512 | 0,755814 | 377,907 | 0,157237 | 0,00023768 |
| 600 | 380 | 0,004419 | 2,651163 | 1590,698 | 0,108609 | 0,0004799 |
| 700 | 140 | 0,001628 | 1,139535 | 797,6744 | 0,07502 | 0,00012213 |
| 800 | 50 | 0,000581 | 0,465116 | 372,093 | 0,051819 | 3,0127E-05 |
| 900 | 20 | 0,000233 | 0,209302 | 188,3721 | 0,035793 | 8,324E-06 |
| 1000 | 0 | 0 | 0 | 0 | 0,024724 | 0 |
| | 860 | 0,01 | 5,77907 | 3526,744 | 1,820518 | 0,00135416 |
| | 86000 | | | | | |

| | | | |
|---|---|---|---|
| k= | 0,0037 | ktau= | 2,13825581 |
| tau= | 577,907 | | |
| varians= | 18697,94 | | |
| N= | 17,86167 | | 0 |
| | | | -0,00156721 |
| Dea/vL= | 0,028824 | | |
| | 0,027993 | | |
| x tank= | 0,867298 | | |
| x disp= | | ur diagram | |
| x segreg= | 0,864584 | | |

SLUTEN MÄTSTRÄCKA

$\tau = 577{,}91$

$\delta_i^2 = 18697{,}9$ $\qquad K\tau = 2{,}14$

$N = 1786$

$D_{emul} = 0{,}028$

$1 - \chi \approx 0{,}15 \Rightarrow \underline{\chi = 0{,}85}$

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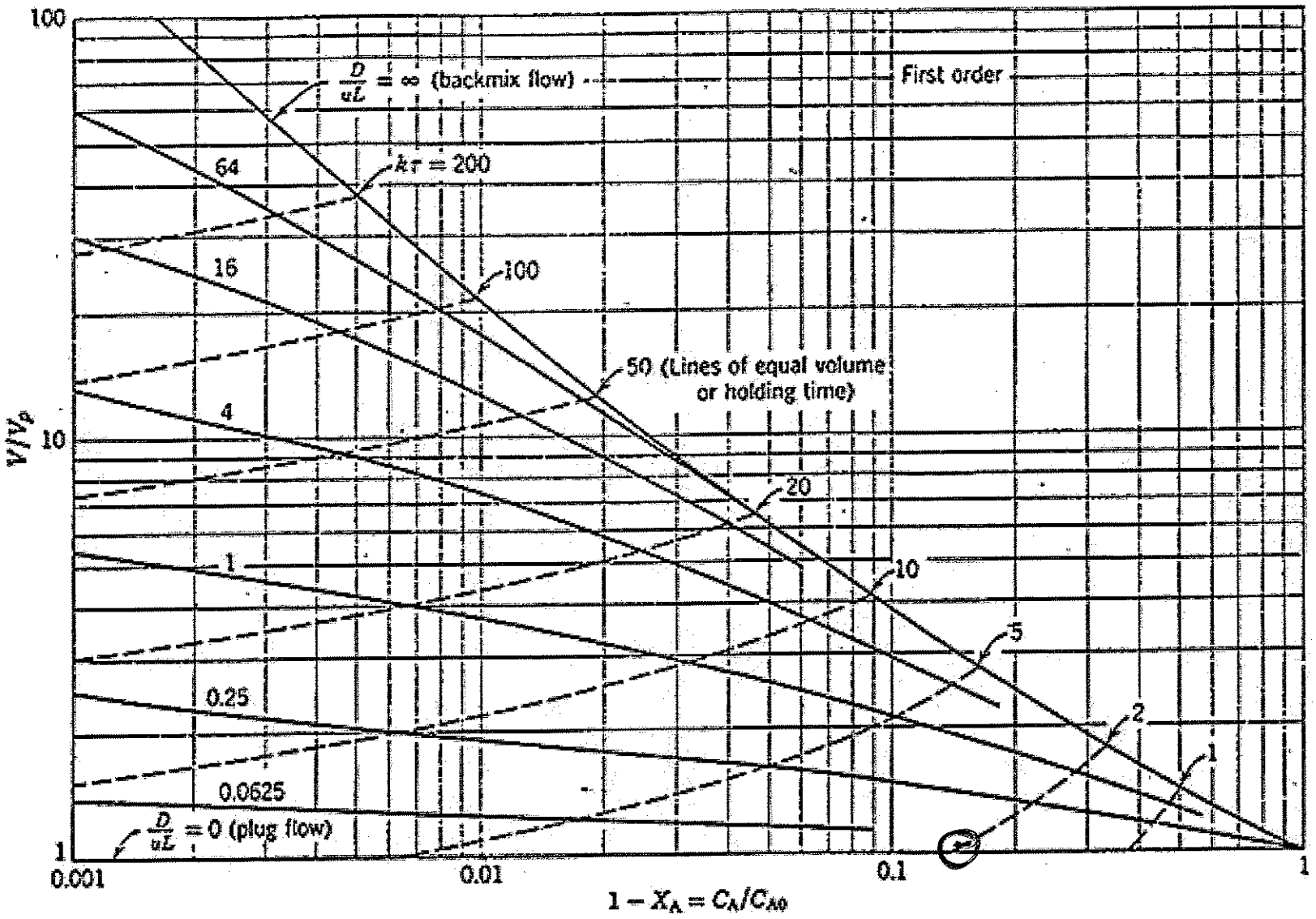
$\chi$ (SEGRE) UR TABELL.

$$\langle \underline{C} \rangle = \int_0^\infty C(t) E(t)\, dt = C \int_0^\infty e^{-(\mu t)} E(t)\, dt.$$

$\Rightarrow \quad \chi_{SEG} = 0{,}864$


100
10
1
0.001
0.01
0.1
1
$V/V_p$
$1 - X_A = C_A/C_{A0}$
$\frac{D}{uL} = \infty$ (backmix flow)
First order
$k\tau = 200$
64
16
100
50 (Lines of equal volume or holding time)
4
20
1
10
5
0.25
2
1
0.0625
$\frac{D}{uL} = 0$ (plug flow)

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$Y_{X/S}$ (0-10)

(10) $X = 12$, $V = 11\ l$ | $X_{10} = 132\ g$

(0) $\frac{X}{V} = 1{,}9\ g/l$, $V = 1{,}0\ l$ | $X_0 = 1\ g$

$S(0) = 2 \cdot 1 = 2g$

$S(10) = 0$

$S(\text{tot}) = 1 \cdot 60 \cdot 10 = 600$

$S = \underline{602}\ g$

$Y_{X/S} = \underline{0{,}22}$

$S_{10} = 0$

$S_5 = 3815 \cdot 6 = 231$

$S(5-10) = 5 \cdot 60 = 300$

$S_{TOT} = 531\ g$

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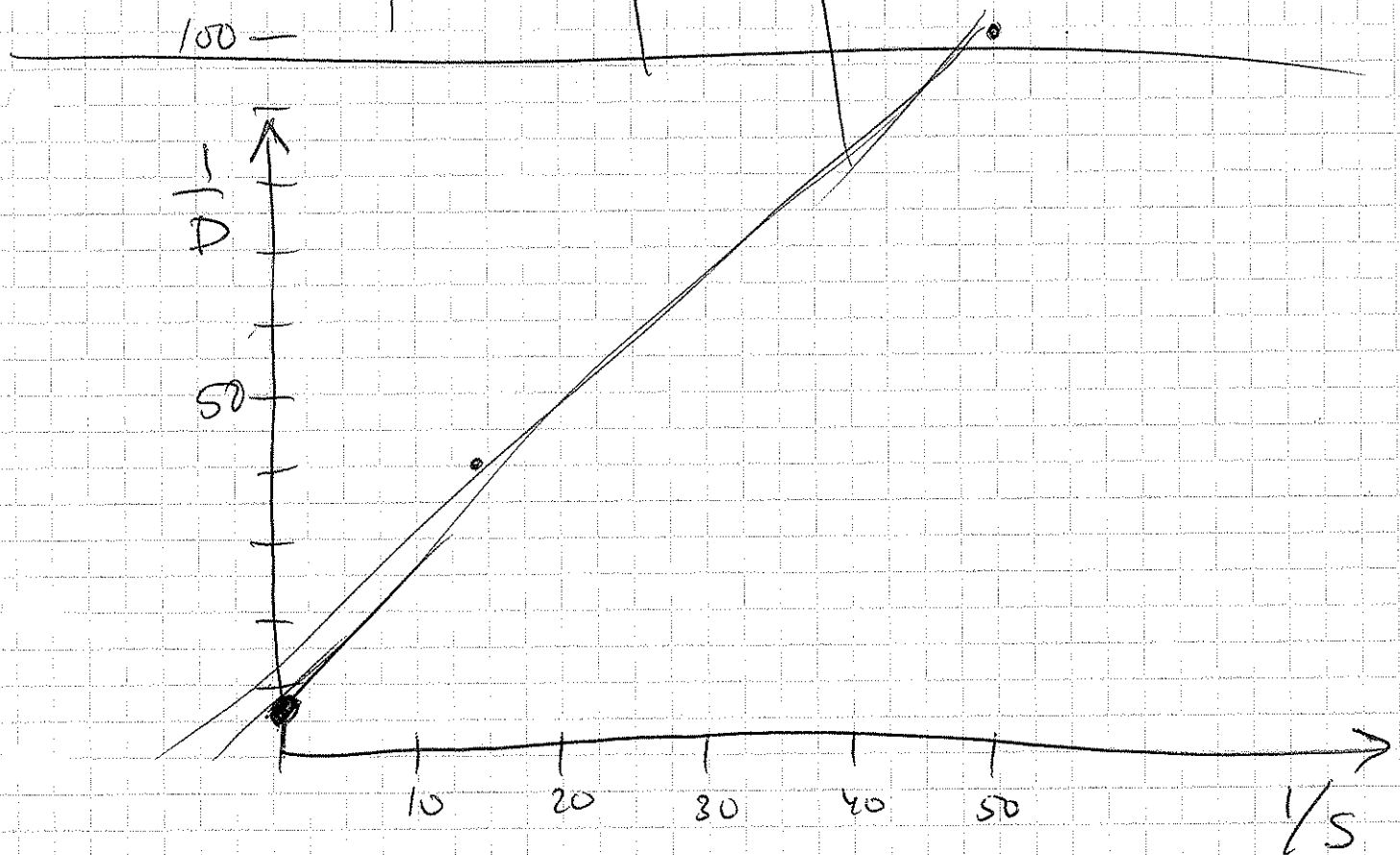
(6)

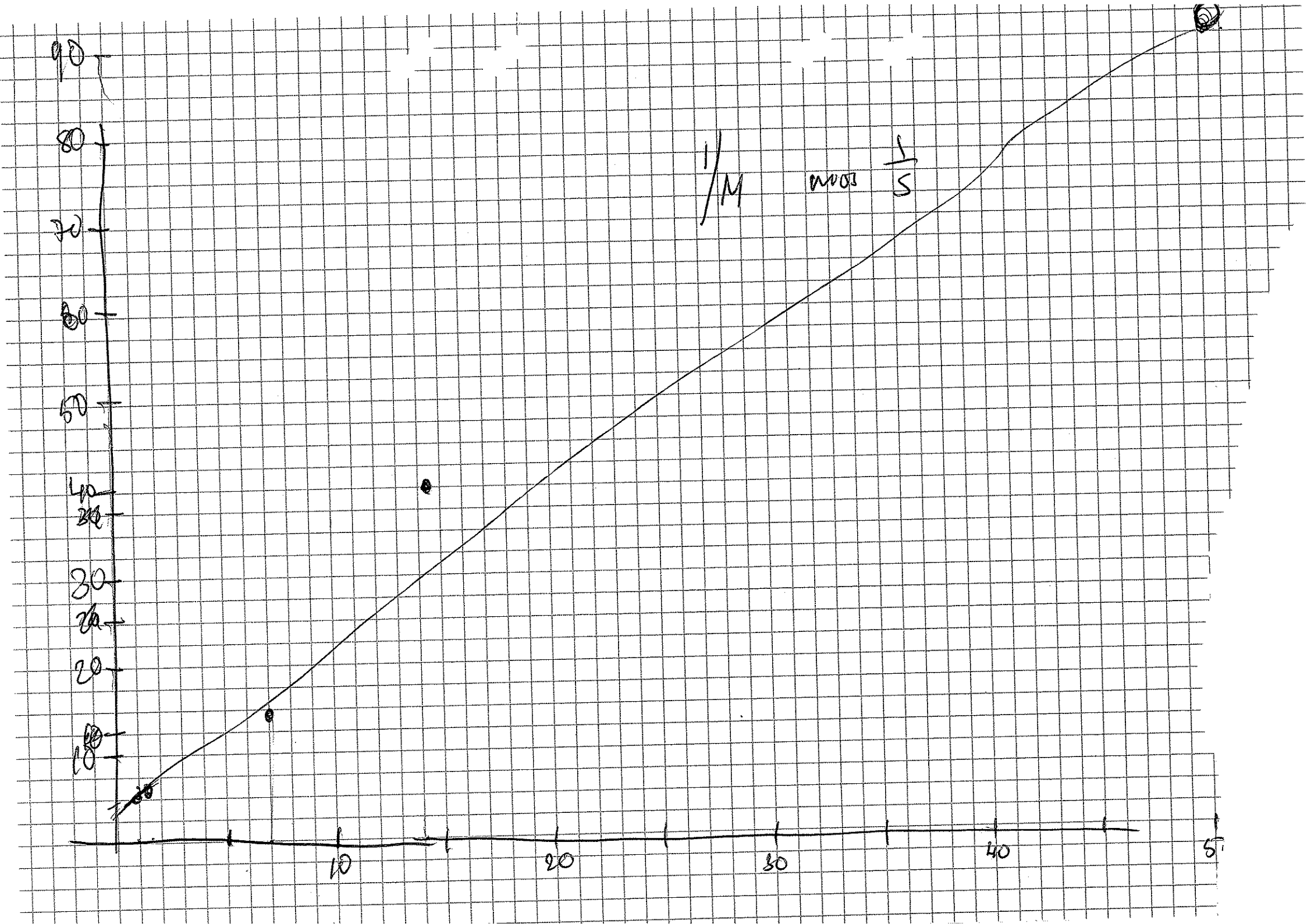
| D | S | 1/D | 1/S |
|---|---|---|---|
| 0,01 | 0,02 | 100 | 50 |
| 0,025 | 0,07 | 40 | 14,3 |
| 0,07 | 0,14 | 44,3 | 7,14 |
| 0,16 | 0,71 | 6,25 | 1,41 |
| 0,183 | 1,09 | 5,46 | 0,92 |
| 0,205 | 1.51 | 4,87 | 0,66 |




$$\mu = \mu_{max} \frac{S}{K_S + S}$$

$$\frac{1}{D} = \frac{1}{\mu_{max}} \left( \frac{K_S + S}{S} \right) = \frac{1}{\mu_{max}} K_S \left( \frac{1}{S} \right) + \frac{1}{\mu_{max}}$$

$$\mu_{max} \approx \frac{1}{7} = 0,14 \qquad \frac{K_S}{\mu_{max}} = \frac{100}{50} = 2 \Rightarrow K_S = 0,286$$


90
80
70
60
50
40
30
20
10
1/M mol 1/s
10
20
30
40
5