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16/ENG01/004

Chemical Engineering ENG 382.

9. $d = \alpha B^t$

$$\log d = \log(\alpha B^t) = \log \alpha + \log B^t$$

$$\log d = \log \alpha + t \log B$$

t (hr)	d	log d	t ²	t log d
0	2	0.3010	0	0
1	5	0.6990	1	0.6990
2	19	1.2788	4	2.5576
3	50	1.6990	9	5.097
4	151	2.1790	16	8.716
5	470	2.6721	25	13.3605
6	1435	3.1569	36	18.9411
7	4512	3.6544	49	25.5808
8	12935	4.1118	64	32.8944
9	41125	4.6141	81	41.52695
10	111021	5.0454	100	50.45405
$\Sigma t = 55$			$\Sigma t^2 = 385$	$\Sigma t \log d = 199.8269$

$$\log d = \log \alpha + t \log B \Rightarrow \Sigma \log d = N \log \alpha + \Sigma t \log B$$

$$t \log d = t \log \alpha + t^2 \log B \Rightarrow \Sigma t \log d = \log \alpha \Sigma t + \log B \Sigma t^2$$

$$\begin{bmatrix} N & \Sigma t \\ \Sigma t & \Sigma t^2 \end{bmatrix} \begin{bmatrix} \log \alpha \\ \log B \end{bmatrix} = \begin{bmatrix} \Sigma \log d \\ \Sigma t \log d \end{bmatrix}$$

$$\begin{bmatrix} 11 & 55 \\ 55 & 385 \end{bmatrix} \begin{bmatrix} \log \alpha \\ \log B \end{bmatrix} = \begin{bmatrix} 29.41133 \\ 199.8269 \end{bmatrix}$$

$$A \quad X \quad B$$

$$X = A^{-1} B$$

$$= \begin{bmatrix} 0.318182 & -0.04545 \\ -0.04545 & 0.009091 \end{bmatrix} \begin{bmatrix} 29.41133 \\ 199.8269 \end{bmatrix}$$

$$\begin{bmatrix} \log \alpha \\ \log B \end{bmatrix} = \begin{bmatrix} 0.27511 \\ 0.479729 \end{bmatrix}$$

$$\log \alpha = 0.27511$$

$$\alpha = \text{anti.log}(0.27511) \\ = 1.8841$$

$$\log \beta = 0.479729$$

$$\beta = \text{anti.log}(0.479729) \\ = 3.0181$$

t(hr)	d(m)	log d	log d sim	log d sim error	log d error
0	2	0.30103	0.27511	-2.398646894	-2.3727273
1	5	0.69897	0.75454	-1.918917515	-1.9747873
2	19	1.278754	1.234569	-1.439188136	-1.3950037
3	50	1.6987	1.714299	-0.9594458758	-0.9747873
4	151	2.178777	2.194028	-0.479729379	-0.4947804
5	470	2.672098	2.673757	0	-0.0016595
6	1435	3.158852	3.153487	0.479729379	0.48309459
7	4512	3.633216	3.633216	0.959458758	0.98061178
8	12936	4.112945	4.112945	1.439188136	1.43804269
9	41125	4.592675	4.592675	1.918917515	1.9403486
10	111021	5.072404	5.072404	2.398646894	2.37164782
				5.0314441725	5.03222501

$$\log d_{sim} = \log \alpha + t \log \beta$$

$$d_{mean} = 0.27511 + 0.75484 + 1.234564 + 1.714299 + 2.194028 + \\ 2.673757 + 3.153487 + 3.633216 + 4.112943 + 4.592675 \\ + 5.072404.$$

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$$= 2.673757.$$

$$\log d_{sim error} = \log d_{sim} - d_{mean}$$

$$\log d_{error} = \log d - d_{mean}$$

$$R = \frac{\sqrt{(\sum \log d_{sim error})^2}}{\sqrt{(\sum \log d_{error})^2}} = \frac{\sqrt{5.031444172^2}}{\sqrt{5.03222501^2}} = 0.9998$$

$$R^2 = 0.999$$

There is a high Correlation between t and d because of the R Value.